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Understanding Teachers: Sorting, Productivity, and Attrition in the Public School System

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UNDERSTANDING TEACHERS: SORTING, PRODUCTIVITY, AND ATTRITION IN THE PUBLIC
SCHOOL SYSTEM

by

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A thesis submitted to the
Faculty of the Graduate School of the
University of Colorado in partial fulfillment
of the requirement for the degree of

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This thesis entitled:
Understanding Teachers: Sorting, Productivity, and Attrition in the Public School System
By Lauren Marie Calimeris

has been approved for the Department of Economics

Professor Jeffrey Zax, Chair

Professor Terra McKinnish

Date: _____

The final copy of this thesis has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.

Calimeris, Lauren Marie (Ph.D., Economics)

Understanding Teachers: Sorting, Productivity, and Attrition in the Public School System

Thesis directed by Professor Jeffrey Zax

This dissertation is composed of three studies on public school teachers using data from the Schools and Staffing Survey and the Teacher Follow-Up Survey.

The first chapter combines restricted-use data from the 2007-2008 SASS and a disaggregated measure of teacher quality based on undergraduate institutional quality to determine where high quality teachers choose to teach. Higher quality teachers are more likely to teach at charter schools versus public schools than are lower quality teachers. Among the youngest cohort of teachers, those who graduated from the Most Competitive colleges are 11 percentage points more likely to choose a charter school than their lower quality counterparts. These findings suggest that traditional public schools may be at a growing disadvantage in attracting teachers who graduate from the best universities.

The second chapter investigates how teacher job satisfaction affects productivity as measured by the high school graduation rate and college enrollment rate. It uses an instrumental variables (IV) approach to purge the model of the endogeneity of satisfaction. The findings suggest teacher job satisfaction has a long-lasting effect on student outcomes. In particular, a one standard deviation increase in teacher job satisfaction increases the college enrollment rate by roughly 2.3-2.4 percentage points.

The third chapter examines attrition and retention rates among teachers in charter and traditional public schools. It finds that among new teachers, teaching at a charter increases the odds of leaving teaching by a factor of 2.13. Among new teachers who voluntarily leave or move, teaching at a charter increases the probability of leaving by a factor of 3.04. Charter status does not affect attrition among all teachers. The results also indicate that the average marginal effect of graduating from a top ranked college reduces the probability of moving schools among all teachers, though college competitiveness does not marginally affect the mobility decisions of new teachers.

Dedication

To my parents, who instilled in me a love of learning, who taught me the value of education, and who believed in me.

And to my fiancé, Daniel, whose endless patience and faith in me gave me the strength to persevere.

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Any remaining errors are my own.

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CHAPTER 1

CHOOSING WHERE TO TEACH: THE EFFECT OF TEACHER QUALITY ON THE CHARTER VERSUS PUBLIC SCHOOL DECISION

1.1 INTRODUCTION

Since their inception in 1992, charter schools have grown to operate over 5,000 schools in 39 states and the District of Columbia (Center for Education Reform 2010). Charters are a free alternative choice for parents. They are publicly funded and have more autonomy and greater accountability than traditional public schools (henceforth, public or traditional schools). Charters may have different academic focuses or may target different student populations.

Opponents to the charter school movement believe that charters may drain resources from traditional schools (Dillon 2010). Teachers are a key input into the education production function (see for example, Aaronson et al. 2002, Ferguson 1991, Ferguson and Ladd 1996, Goldhaber 2002, Goldhaber et al. 1999, Hanushek et al. 1999, Hanushek and Rivkin 2003, Hanushek 1992, Hanushek 1971, Rivkin et al. 2005, Rockoff 2004), with teacher quality associated with 7% of the variance in student achievement gains (Rivkin et al. 2005). One way to address if charters drain resources is to investigate where quality teachers are more abundant, at charter or public schools? Also, teachers may have faced different choice sets depending upon when they graduated from college, before or after the introduction of charter schools in the early- to mid-1990s. Depending upon when a teacher graduated from college, is there a difference in the probability of teaching at a charter versus a public school for different quality teachers?

This chapter's main contribution is the investigation of sorting decisions among different quality teachers and different cohorts of teachers using data from the 2007-2008 Schools and Staffing Survey (SASS). This paper also makes two secondary methodological contributions. It demonstrates that when proxying for

teacher quality using the teacher's undergraduate college's competitiveness, the competitiveness should be measured at the time of enrollment as college competitiveness is not constant over time. In addition, teacher quality should be measured as precisely as possible because aggregate quality classifications obscure distinctions in the choices made by teachers of different underlying quality.

This chapter is organized as follows: Section 1.2 gives the background of teacher quality proxy, and section 1.3 describes college competitiveness. Section 1.4 discusses teacher quality. Section 1.5 illustrates perceived and real differences in charter and public schools. Section 1.6 details the estimation strategy. Section 1.7 discusses the study findings. Finally, section 1.8 concludes.

1.2 TEACHER QUALITY BACKGROUND

Measuring teacher quality is extremely difficult. Most characteristics of effective teachers such as passion, enthusiasm, work ethic, and people skills, are not easily measurable. Even so, studies have tried to find quantitative and observable ways of measuring quality. Licensure, testing, certification, and advanced degrees are considered observable measures of quality but are not consistently associated with improvements in student outcomes or teacher quality (Angrist and Guryan 2008, Angrist and Guryan 2004, Berliner 2005).

On the other hand, studies have found that a teacher's innate ability and intelligence are associated with positive gains in student outcomes. They have established measures of intelligence, including the teacher's SAT/ACT scores or college competitiveness as good indicators of effectiveness (Angrist and Guryan 2004, Coleman et al. 1966, Ehrenberg and Brewer 1994). The competitiveness of a teacher's college is a common proxy for measuring teacher quality (Bacolod 2007a, Ballou 1996, Ballou and Podgursky 1997, Ballou and Podgursky 1995, Baker and Dickerson 2006, Boyd et al. 2010, Boyd et al. 2003, Carruthers 2009, Clotfelter et al. 2006, Ehrenberg and Brewer 1994, Figlio 1997, Podgursky et al. 2004)¹. The majority of these studies utilize the rankings from Barron's Profiles of American Colleges, which categorizes undergraduate institutions

¹ Some studies use the average SAT/ACT score of where the teacher attended college instead of the college's competitiveness rank. See, for example, Figlio (2002), Hoxby and Leigh (2004), and Podgursky et al. (2004).

into one of 6 tiers: Most Competitive, Highly Competitive, Very Competitive, Competitive, Less Competitive, and Non Competitive. Other studies use similar rankings, such as the UCLA Higher Education Research Institute's ranking (Bacolod 1997a) or a measure by Lovejoy (Figlio 1997).

Most studies implementing college competitiveness as a proxy for teacher quality create aggregates of the original six Barron's categories, though the aggregations are not consistent. For example, Baker and Dickerson (2006) and Lankford et al. (2002) consider teacher quality to be dichotomous, aggregating the top two tiers together and all other ranks together. Carruthers (2009) also treats quality to be dichotomous, though she aggregates all teachers graduating from the top four tiers together. Meanwhile, Clotfelter et al. (2006) create three aggregations: teachers from the top three tiers form the top group, those from competitive colleges are the middle group, and those from the lowest two tiers comprise the final group. Ehrenberg and Brewer (1994), who provide the evidence that increases in teacher quality, as measured by the Barron's ranking, does significantly improve students' outcomes, do not aggregate quality ranks, nor does Hoxby (2002).

While aggregating quality categories is common, most studies do not explain why they do it. Some studies aggregate because their samples, especially among the higher ranks, are small (Podgursky et al. 2004), as individuals who attend more competitive colleges or who have higher standardized test scores are less likely to be teachers (Ballou 1996, Hanushek and Pace 1995). Studies do not address if aggregations are masking effects of finer quality levels on their outcomes.

1.3 COLLEGE RANKINGS

Most studies proxying for quality with college rankings use a single year, or a reference year, of rankings. Most do not choose the reference year corresponding to when their teachers attended college. Few even mention their reference year. Of those that do, some studies choose a year that is the closest to when their median teachers attended (Hoxby 2002) or entered (Carruthers 2009) college. The reference year chosen could affect results if competitiveness changes over time, as teachers could be assigned an incorrect quality

measure, something most studies ignore. If competitiveness changes, measurement error would lead to attenuation bias in study results.

This study uses the college rankings from Barron's Profiles of American Colleges, which ranks all four year institutions which offer bachelor's degrees if they are fully accredited or are recognized as candidates for accreditation. Ranks are based on incoming freshmen characteristics, such as high school class rank, SAT/ACT scores, GPA, and acceptance rate, from the academic year prior to the publication year. For example, the 1996 rankings are based on the characteristics of the entering freshmen of the 1995-1996 academic year. The first year of publication was 1964, and the Profiles are revised biennially.

This study compiled a dataset of rankings for the publication years 1970, 1984, 1986, 1992, 1994, 1996, 1998, 2000, and 2002. These years correspond to when the teachers of most interest in the SASS entered college. Charter schools first opened in 1992, with the bulk of states passing charter laws between 1993-1998². Teachers graduating after 1992 will have had the charter option in their choice set at the onset of employment. Accordingly, the ranking dataset consists of rankings since the inception of charters along with a subset of previous rankings. Earlier rankings allow competitiveness to be tracked over time to determine if it changes. More earlier years were not included as established teachers will have little incentive to leave their schools, while newer teachers have more perceived flexibility and are of the most interest to this study.

This study identified the Barron's ranked colleges IPEDS codes from the National Center of Education Statistics (NCES) for use in merging the rankings to the SASS data. It dropped specialized colleges (e.g., religious or arts schools), those that closed or merged, colleges with multiple campuses that are not uniquely identifiable in both datasets, and foreign colleges from the analysis.

Simple correlations of the rankings illustrate that they do shift. The correlation in ranks from 1970 and 2002 is 0.64. Among the highest two ranks (as of 2002), the correlation is 0.55. Thus, there is movement in the rankings for all levels of colleges, and it is greater among the best.

² Two states passed laws in 1991 and 1992. Six passed laws in 1993, three in 1994, eight in 1995, seven in 1996, four in 1997, five in 1998, two in 1999, one in 2001, two in 2002, and one in 2003 (Center for Education Reform 2010).

Table 1.1 illustrates how the ranks change from 1970 to 2002. Most changes are increases³. Among all universities, nearly 37% have increased in ranking between 1970 and 2002, while 19% have decreased. Roughly 44% did not change over time.

Table 1.1 Frequencies of Differences in University Ranks from 1970 to 2002

	All Universities		Highly, Very High, or Most Competitive in 2002		Very High or Most Competitive in 2002		Highly, Very High, or Most Competitive in 1970		Very High or Most Competitive in 1970	
	N	%	N	%	N	%	N	%	N	%
3 Categories Lower in 2002	2	0.2	0	0.0	0	0.0	2	0.9	2	2.2
2 Categories Lower in 2002	25	2.2	0	0.0	0	0.0	9	3.9	1	1.1
1 Category Lower in 2002	198	17.0	14	3.7	5	3.3	46	19.7	14	15.4
No Difference	512	44.0	99	26.4	39	25.3	99	42.3	39	42.9
1 Category Higher	337	29.0	188	50.1	66	42.9	66	28.2	35	38.5
2 Categories Higher in 2002	86	7.4	71	18.9	41	26.6	12	5.1	0	0.0
3 Categories Higher in 2002	3	0.3	3	0.8	3	2.0	0	0.0	0	0.0
Total	1,163	100	375	100	154	100	234	100	91	100

Among universities ranked in the top three tiers in 2002, 70% have increased in rank since 1970 while roughly four percent decreased. Among the top two ranks, 70% increased compared to three percent that decreased. Increases are not surprising for schools achieving ranks in the top categories in 2002, but the number of tiers jumped indicates that at least 44 universities in the top two tiers in 2002 were not in this group in 1970. These universities, and thus their earlier graduates, may be incorrectly classified both using a reference year and in aggregated groupings due to their large movements.

Columns 7 and 8 in Table 1.1 illustrate what happened to the top universities in 1970. Among the top three tiers, 33% of universities increased in rank while 24% decreased, and 42% remained the same. For the top two tiers, nearly 39% increased, and roughly 19% decreased. The findings suggest that some top ranked universities may have jumped aggregated groupings.

Table 1.1 demonstrates that college rankings are dynamic. Using a reference year may lead to erroneous inferences. Furthermore, the number of tiers that colleges may change over time suggests that

³ One could argue that competitiveness changes over time are simply due to increases in the demand for higher education and do not actually reflect increases in university quality; however, the Barron's rankings are based on a stringent set of characteristics that remains stable over time. Thus, school quality may be increasing as schools are able to accept a lower percentage of applicants with higher test scores, class ranks, and GPAs.

aggregating the quality measures will not solve the misclassification problem. These findings support the idea of tracing college rank back to when the teacher entered college.

1.4 TEACHER QUALITY

The SASS is administered every four years and is a stratified probability proportional to size sample of school teachers across the United States designed to be representative of the nation. It is composed of a series of questionnaires, including school and teacher questionnaires. The teacher survey contains information on teacher demographics (e.g., age, race, sex) and education, including the name of his undergraduate institution and its IPEDS code, his majors, degrees obtained, and his graduation years.

The IPEDS code matches the SASS teachers and the college rank dataset. Teacher "matched ranking" is the Barron's ranking of the teacher's college published in the year of or the year subsequent to his enrollment. For example, a teacher who entered college in 1983 or in 1984 received the 1984 rank, while one who entered college in 1985 or in 1986 received the 1986 ranking. The matched rankings represent the college-based teacher quality measure. This paper excluded teachers who entered college in a year whose ranks were not included in the ranking dataset⁴.

In the 2007-2008 SASS, 18,100⁵ teachers match with their institution's ranking when the teacher entered college. Of these, 17,290 were full or part time regular teachers⁶. Only the 14,030 teachers who attended college in a state with charter laws as of 2007 are included in the primary analysis. Teachers prefer to teach close to where they grew up or to where they went to college (Boyd et al. 2003, 2005). As such, this paper assumes teachers who were educated in non-charter states do not perceive themselves to face the same

⁴ This study is therefore losing cohorts of teachers, not individual teachers. Furthermore, the cohorts that are dropped from the analysis are generally older. These cohorts likely will have already established tenure at their schools and are therefore of little interest to this study. The few earlier cohorts included in the analysis illustrate this point.

⁵ For confidentiality, all sample sizes are rounded to the nearest 10.

⁶ This paper excluded long- and short-term substitutes and teacher aides from the analysis.

choice as teachers who were not. It assumes that the cost of finding a charter job is different for these teachers than for those educated in charter states⁷.

To highlight the importance of the matched ranking measure, this study also uses a reference year teacher quality measure to illustrate differences in the two measures. The 2002 ranks are the reference year ranking. This year was chosen as it corresponds to the teachers who most recently attended college (e.g., teachers who graduated from college in 2006 entered in 2002, and those who graduated in 2007 entered in 2003), allowing for the largest matched sample of teachers post charter introduction.

Table 1.2 presents the frequencies of college rankings in different subgroups of teachers, using both the matched ranking and the 2002 ranking. It illustrates how the two methods of assigning ranks result in different distributions of college-based quality. The differences grow as the reference year is further from the true entrance year. Table 1.2 also shows how the frequencies differ between public and charter teachers.

The 2002 ranks overstate the number of teachers from better colleges for both public and charter teachers. This is expected, given the upward trend in ranks over time. The discrepancies are even more pronounced as the teacher's actual college entrance year is further from the reference year. Among teachers who entered college prior to 1980, the matched ranking measure finds 0.8% of traditional teachers hail from Most Competitive colleges and 2.5% from Highly Competitive colleges. The 2002 measure classifies 2.5% of these same teachers from Most Competitive and 8.3% from Highly Competitive colleges. The matched ranking finds roughly 11% of teachers are from Very Competitive colleges compared to 18% using the 2002 ranking.

For charter teachers entering college between 1980-1989, the matched ranking indicates that none are in the top two tiers, while the 2002 ranking indicates there are a few, though the small number rounds to zero. For traditional teachers, the matched ranking classifies 3.6% in the top two, compared to 7.7% using the 2002 ranking. The discrepancies illustrate that volatility in competitiveness is translated to the teacher

⁷ All analyses have been carried out using all states, including charter and non-charter states, as well as using only teachers teaching in charter states. The general results hold for all analyses.

Table 1.2 Frequencies of College Competitiveness among Teachers in Matched Sample

	Teachers Entering College before 1980							
	Matched Ranking				2002 Ranking			
	Charter		Traditional		Charter		Traditional	
	N	%	N	%	N	%	N	%
Non Competitive	0	0.0	40	3.3	0	0.0	30	2.5
Less Competitive	10	50.0	370	30.6	10	50.0	250	20.7
Competitive	10	50.0	640	52.9	10	50.0	590	48.8
Very Competitive	0	0.0	130	10.7	0	0.0	220	18.2
Highly Competitive	0	0.0	30	2.5	0	0.0	100	8.3
Most Competitive	0	0.0	10	0.8	0	0.0	30	2.5
Total	20	100	1,210	100	20	100	1,210	100
	Teachers Entering College between 1980-1989							
	Matched Ranking				2002 Ranking			
	Charter		Traditional		Charter		Traditional	
	N	%	N	%	N	%	N	%
Non Competitive	10	16.7	250	11.3	0	0.0	110	5.0
Less Competitive	10	16.7	550	24.9	10	16.7	450	20.4
Competitive	30	50.0	1050	47.5	30	50.0	1070	48.4
Very Competitive	10	16.7	280	12.7	20	33.3	410	18.6
Highly Competitive	0	0.0	60	2.7	0	0.0	120	5.4
Most Competitive	0	0.0	20	0.9	0	0.0	50	2.3
Total	60	100	2,210	100	60	100	2,210	100
	Teachers Entering College between 1990-1999							
	Matched Ranking				2002 Ranking			
	Charter		Traditional		Charter		Traditional	
	N	%	N	%	N	%	N	%
Non Competitive	30	7.69	640	8.7	20	5.1	400	5.4
Less Competitive	70	17.9	1320	17.9	70	17.9	1390	18.8
Competitive	160	41.0	3730	50.5	170	43.6	3690	49.9
Very Competitive	90	23.1	1220	16.5	90	23.1	1360	18.4
Highly Competitive	30	7.7	410	5.5	30	7.7	410	5.5
Most Competitive	10	2.6	80	1.1	20	5.1	140	1.9
Total	390	100	7,390	100	390	100	7,390	100
	Teachers Entering College between 2000-2002							
	Matched Ranking				2002 Ranking			
	Charter		Traditional		Charter		Traditional	
	N	%	N	%	N	%	N	%
Non Competitive	10	5.9	170	6.6	10	5.9	140	5.4
Less Competitive	20	11.8	480	18.7	20	11.8	460	17.9
Competitive	80	47.1	1260	49.0	80	47.1	1320	51.4
Very Competitive	40	23.5	470	18.3	40	23.5	450	17.5
Highly Competitive	10	5.9	150	5.8	10	5.9	150	5.8
Most Competitive	10	5.9	40	1.6	10	5.9	40	1.6
Total	170	100	2,570	100	170	100	2,570	100

Note: Teachers are regular full- or part-time teachers educated in charter states only. Sample sizes rounded to nearest 10 for confidentiality purposes. Samples may not add up due to rounding.

population. The reference year rankings are distorting, and results based on this measure are likely to be biased.

Table 1.2 also illuminates how few teachers are from the top colleges, which is consistent with Hoxby's 2002 findings. The matched ranking indicates 6.1% of all teachers are in the top two tiers. For teachers entering college before 1980, no charter teachers hail from Most Competitive colleges while 10 (0.8%) traditional teachers do. For those entering in the 1980s, none of the 60 charter teachers are in the top two tiers, while 80 of the 2,210 traditional teachers are. The percentage of teachers in these ranks is increasing over time for both groups.

Table 1.3 expands on Table 1.2 by illustrating how many categories a teacher's college rank differs between the two assignment methods for different subgroups. While roughly 61% of all teachers are ranked the same, nearly 25% of public teachers are ranked higher using the 2002 ranking than the matched ranking. Roughly 17% are ranked lower in 2002. Among charter teachers, 22% are ranked higher, and 13% are ranked lower.

Table 1.3 also reiterates how using a reference year is more distorting the further away it is from the actual entrance year. For those who entered college after 1999, 94% of charter and 89% of public teachers are ranked the same between the two methods. For those entering in the 1990s, only 59% and 57% of charter and public teachers are. This percentage drops to 50% and 48% for charter and public teachers entering in the 1980s. For those entering before 1980, 50% of charter teachers have the same ranking while 46% of public teachers do.

The evidence presented illustrates that college ranks change over time, and these changes are reflected in the teacher population. There is a difference in rankings between public and charter school teachers, and this difference appears greater the older the teacher. Older teachers from better colleges are traditional school teachers, while there is a greater percentage of Most and Highly Competitive alumni in charters versus public schools among the younger teachers. Since teacher quality is based on college ranks, teacher quality distributions differ depending upon how the rankings are assigned to the teacher. The greater

the difference in the reference year and when the teacher actually entered college, the greater the misrepresentation. Furthermore, the misrepresentation differs for charter and public teachers.

Table 1.3 Frequencies of Differences in Rankings between the Matched Rankings & 2002 Rankings

	2000s College Entrants				1990-1999 College Entrants			
	Charter		Traditional		Charter		Traditional	
	N	%	N	%	N	%	N	%
3 Categories Lower in 2002	0	0.0	0	0.0	0	0.0	0	0.0
2 Categories Lower in 2002	0	0.0	0	0.0	0	0.0	100	1.4
1 Category Lower in 2002	0	0.0	120	4.7	70	17.9	1240	16.8
No Difference	160	94.1	2280	88.7	230	59.0	4240	57.4
1 Category Higher in 2002	10	5.9	150	5.8	80	20.5	1500	20.3
2 Categories Higher in 2002	0	0.0	20 ^a	0.8	10	2.6	280	3.8
3 Categories Higher in 2002	0	0.0	0	0.0	0	0.0	30	0.4
Total	170	100	2,570	100	390	100	7,390	100
	1980-1989 College Entrants				pre-1980 College Entrants			
	Charter		Traditional		Charter		Traditional	
	N	%	N	%	N	%	N	%
3 Categories Lower in 2002	0	0.0	0	0.0	0	0.0	0	0.0
2 Categories Lower in 2002	0	0.0	20	0.9	0	0.0	20	1.7
1 Category Lower in 2002	10	16.7	300	13.6	0	0.0	170	14.0
No Difference	30	50.0	1050	47.5	10	50.0	550	45.5
1 Category Higher in 2002	20	33.3	670	30.3	10	50.0	350	28.9
2 Categories Higher in 2002	10	16.7	170	7.7	0	0.0	130	10.7
3 Categories Higher in 2002	0	0.0	10	0.5	0	0.0	10	0.8
Total	60	100	2,210	100	20	100	1,210	100

Note: Sample sizes rounded to nearest 10 for confidentiality purposes. Columns may not add up due to rounding.

^a Estimate refers to 2 or 3 categories higher in 2002

These results suggest that teacher quality should be measured by the rank of their undergraduate college at the time of their enrollment in order to avoid the mismeasurement biases which might arise if ranks are assigned from a single reference year. The analysis below pursues this suggestion and quantifies the extent of these biases.

1.5 TEACHER PERCEPTIONS OF CHARTER & PUBLIC SCHOOLS

Proponents of charter schools claim that teachers choose charters because they can avoid the bureaucracy associated with traditional schools. Charters are also attractive as they focus on student needs and outcomes (Center for Education Reform 2010). Dye and Antle (1984) suggest that if productivity is correlated with preferences for nonpecuniary job aspects, then different types of workers might systematically sort across jobs, even in the absence of a monetary productivity premium. Accordingly, different quality teachers may be attracted to different school types due to associated nonpecuniary attributes. For charters, these attributes may include a shorter schedule, fewer hours, or more autonomy in the classroom. Teachers sort and workplace characteristics matter, with higher quality teachers less likely to teach at urban (Ehrenberg and Brewer 1994, Figlio 2002, Figlio 1997) or poorer schools (Bacolod 2007b, Lankford et al. 2002). Charter or public school bundles also may enter into preferences.

The SASS contains questions on school characteristics, teacher pay, and teachers' perspectives of their school. The mean values of the responses for charter and public teachers are presented in Tables 4 and 6. The tables also indicate if the differences in the responses are significant.

Table 1.4 details summary statistics on basic workplace characteristics. On average, charter teachers report having longer contracts than public school teachers. They have more required hours and teaching hours per week. Charter teachers are significantly less likely to be in a union. They also earn significantly less money, on average, than traditional teachers. Since pay can vary with experience, teacher reported average pay by tenure is presented in Table 1.5.

The top half of Table 1.5 reports base pay and actual earnings by total experience. Charter teachers' average base pay is significantly lower than public teachers' for all except for those with 1-3, 10-14, 20-24, or over 30 years of experience. Average total earnings are significantly less for charter teachers, though the significance varies for those with over 20 years of experience.

Table 1.4. Differences between Charter and Public School Teachers Workplace Characteristics

	Charter Mean	n	Public Mean	n	Difference	t-stat	N
School Characteristics							
Contract Days	199	640	189	13390	10	8.92	14030
Hours per Week Required	39.1	640	37.9	13390	1.2	6.39	14030
Hours of Teaching per Week Required	30.6	640	29.6	13390	1.0	4.25	14030
Union Status (=1)	0.26	640	0.71	13390	-0.45	-1.83	14030
Pay Base	\$38,379	640	\$42,913	13390	-\$4,534	-9.43	14030
Annual Earnings	\$39,989	640	\$45,235	13390	-\$5,246	-10.32	14030

Note: Sample sizes rounded to nearest 10 for confidentiality purposes.

The bottom half of Table 1.5 reports base pay and annual earnings based on tenure at the teachers' current schools. For their first 9 years of experience, charter teachers' base pay is significantly lower than public school teachers' base pay. For teachers with 10 or more years of tenure at a school, the significance disappears. For the most tenured, charter teachers report slightly higher pay, though the difference is insignificant. The trends are similar for total earnings.

If charter schools are to attract higher quality teachers despite lower salaries and longer school days and years, then other aspects of charter school employment must be more attractive than in traditional schools. The SASS contains questions regarding how much control teachers believe they have on certain aspects of their teaching. Answers range from 1-4, with a value of 1 corresponding to "No control" and 4 corresponding to "A great deal of control". Table 1.6 presents the mean responses for charter and public school teachers and indicates if any differences are significant.

Table 1.5. Differences between Charter and Public School Base & Total Pay

	Base Pay						
	Charter Mean	n	Public Mean	n	Difference	t-stat	N
Years of Experience							
1-3 years	\$36,009	270	\$36,228	3520	-\$220	-0.45	3790
4-5 years	\$37,105	140	\$39,178	2020	-\$2,073	-2.80	2150
6-9 years	\$40,284	150	\$42,662	3360	-\$2,379	-2.85	3510
10-14 years	\$43,814	50	\$46,263	2063	-\$2,449	-1.37	2110
15-19 years	\$42,449	20	\$51,542	1190	-\$9,093	-3.18	1220
20-24 years	\$44,976	10	\$52,652	450	-\$7,677	-1.55	460
25-30 years	\$38,768	10	\$53,835	180	-\$15,067	-2.17	190
30 plus years	\$55,784	10	\$56,668	610	-\$884	-0.17	620
All	\$38,379	640	\$42,913	13390	-\$4,534	-9.43	14030
Total Earnings							
1-3 years	\$37,412	270	\$38,276	2050	-\$864	-1.65	3790
4-5 years	\$38,829	140	\$41,570	1890	-\$2,741	-3.30	2150
6-9 years	\$41,984	150	\$45,036	3330	-\$3,052	-3.36	3510
10-14 years	\$45,413	50	\$48,853	2240	-\$3,441	-1.84	2110
15-19 years	\$44,969	20	\$53,926	1220	-\$8,956	-2.98	1220
20-24 years	\$47,084	10	\$54,888	240	-\$7,804	-1.52	460
25-30 years	\$41,208	10	\$56,307	80	-\$15,099	-2.05	190
30 plus years	\$57,192	10	\$59,057	900	-\$1,864	-0.34	620
All	\$39,989	640	\$45,235	13390	-\$5,246	-10.32	14030
Years at Current School							
Base Pay							
1-3 years	\$37,304	450	\$39,072	6340	-\$1,768	-3.75	6790
4-5 years	\$37,965	100	\$41,842	2110	-\$3,876	-3.85	2220
6-9 years	\$42,062	70	\$45,437	2590	-\$3,376	-2.40	2660
10-14 years	\$48,472	10	\$48,898	1190	-\$427	-0.11	1210
15-19 years	\$59,030	0	\$52,573	600	\$6,457	0.79	610
Total Earnings							
1-3 years	\$38,734	450	\$41,214	6340	-\$2,480	-4.95	6790
4-5 years	\$40,065	100	\$44,278	2110	-\$4,214	-3.86	2220
6-9 years	\$43,913	70	\$47,938	2590	-\$4,025	-2.68	2660
10-14 years	\$50,288	10	\$51,475	1190	-\$1,187	-0.30	1210
15-19 years	\$64,662	0	\$54,864	600	\$9,798	1.15	610

Note: Sample sizes rounded to nearest 10 for confidentiality purposes. Columns and rows may not add up due to rounding.

Table 1.6. Differences between Charter and Public School Teachers' Beliefs about Workplace Characteristics

	Charter		Public		Difference	t-stat	N
	Mean	n	Mean	n			
Has Control Over ^a :							
Selecting Instructional Materials	2.90	640	2.75	13390	0.04	3.40	14030
Selecting Course Content	3.00	640	2.80	13390	0.04	4.87	14030
Selecting Teaching Techniques	3.69	640	3.70	13390	0.02	-0.33	14030
Evaluating and Grading Students	3.63	640	3.62	13390	0.03	0.32	14030
Disciplining Students	3.46	640	3.46	13390	0.03	0.29	14030
Determining Amount of Homework	3.60	640	3.73	13390	0.02	-5.43	14030
Agreement ^b :							
Satisfied Salary	2.72	640	2.63	13390	0.09	2.24	14030
Would Leave for More Pay if Possible	3.03	640	3.05	13390	-0.02	-0.58	14030
Satisfied with Teaching at School	1.62	640	1.54	13390	0.09	3.14	14030
Teachers at School are Happy	2.05	640	1.96	13390	0.09	2.73	14030
School is Run Well	2.12	640	2.00	13390	0.12	3.60	14030
Not Worth Teaching at Current School	3.22	640	3.25	13390	-0.03	-0.86	14030
Wants to Transfer to Another School	2.83	640	3.04	13390	-0.21	-5.13	14030
Worried about Job Security due to Student Test Performance	2.91	640	2.99	13390	-0.08	-2.12	14030
Administration Supportive	1.62	640	1.62	13390	0.01	0.16	14030
Parents Supportive	2.36	640	2.39	13390	-0.02	-0.68	14030
Principal Enforces School Rules & Supports Teachers	1.63	640	1.63	13390	0.01	0.24	14030
Teachers Enforce School Rules	2.15	640	2.25	13390	-0.10	-2.77	14030
Teachers Share Beliefs about School Mission	1.82	640	1.86	13390	-0.03	-1.16	14030
Principal Communicates School Goals to Teachers	1.57	640	1.63	13390	-0.06	-1.85	14030
Adequate Support for Teaching Special Needs Students	2.32	640	2.22	13390	0.09	2.67	14030
Materials (texts, supplies) Adequate	1.90	640	1.81	13390	0.09	2.71	14030
Duties/Paperwork Interfering	2.46	640	2.17	13390	0.29	7.80	14030
Staff is Cooperative	1.76	640	1.86	13390	-0.10	-3.10	14030
Staff Recognized for Good Work	1.97	640	2.00	13390	-0.03	-0.82	14030
Less Enthusiastic than when Started	2.97	640	2.90	13390	0.07	1.72	14030

^a Teacher reported degree of control (1=No control, 2=Minor control, 3=Moderate control, 4=A great deal of control)

^b Teacher reported degree of agreement (1=Strongly Agree, 2=Somewhat Agree, 3=Somewhat disagree, 4=Strongly disagree)

Note: Sample sizes rounded to nearest 10 for confidentiality purposes.

The top portion of Table 1.6 suggests that on average, charter teachers rate their control over selecting instructional materials and course content higher than public school teachers. They rate their control over determining the amount of homework lower than their public school counterparts.

The SASS also contains questions regarding teacher perceptions. Answers range from 1-4, with a value of 1 corresponding to "Strongly agree" and 4 corresponding to "Strongly disagree". In the bottom of

Table 1.6, a negative (positive) difference means the charter teachers agree (disagree) more with the statement than public school teachers.

Responses indicate that while charter teachers are less satisfied with their salaries than public teachers, they are not more likely to leave for greater pay. They are less satisfied with teaching at the school and do not believe their peers are happy. They worry more about job security due to student performance. They believe the school is not run well, and they report lower satisfaction with the adequacy of teaching materials and support for disabled students than public teachers.

Compared to public school teachers, charter teachers believe that their peers are more likely to enforce school rules. They report that their principals communicate goals more, and they believe the staff is more cooperative. Charter teachers report that other duties and paperwork do not interfere with their teaching. Finally, they report having maintained enthusiasm at a greater rate.

Thus, while charter teachers are paid less, are less satisfied with their schools and more worried about their jobs than public teachers, they are still maintaining their enthusiasm. The support from staff, communication from the principals, and lack of extraneous duties support the suggestion that teachers may be attracted to charters because of nonpecuniary attributes. This paper next investigates whether these preferences are related to quality.

1.6 METHODS

While the process through which a teacher and school choose one another is two-sided, the SASS allows only the observation of the result of the matching process. Baker and Dickerson (2006) use 1999-2000 SASS data and assume that the school determines the match when investigating teacher quality in public, private, and charter schools. They find charters had a larger share of higher quality teachers than public schools. The estimation equation considers college competitiveness the dependent variable and school type an independent variable.

Carruthers (2009) examines North Carolina teachers who switch schools. She finds teachers moving from public to charter schools are less qualified and less likely to have graduated from a competitive college than other movers. She finds that charters do not skim high quality teachers from public schools, though they draw more effective teachers among those switching schools. Like Baker and Dickerson, Carruthers also considers college competitiveness the dependent variable and school type an independent variable.

In both studies, the estimation equation assumes that a future event, school type, predicts a past event, college competitiveness. They suggest where a teacher currently teaches predicts her quality, when in fact, different quality teachers may self-select into the different school types. These studies reverse the causality of the relationship.

This paper takes a different viewpoint and investigates how teacher characteristics, in particular, teacher quality influences and predicts the matching result. Assuming a teacher knows his own skill set, a teacher also knows which school would be suitable for his needs and desires in a workplace. Teachers decide where to apply and how to sort. A high quality teacher may like the autonomy at charter schools, while a lower quality teacher may desire more stringent guidelines and the union protection available at public schools. Teachers are the most informed about their own abilities, desires, and beliefs, and ultimately they decide which position to accept, among those offered.

This study assumes that the highest quality teachers can choose their ideal schools⁸. Schools want to hire the best, and there are not enough top quality teachers to fill all positions. Estimates for the highest quality teachers from Most Competitive colleges represent their preferences of school type. The next highest quality teachers, those from Highly Competitive colleges, will also be able to choose their optimal schools, given the position is still available and has not been filled by the highest quality teacher. The interpretation of the coefficient for these teachers represents a mixture of preferences and availability. As quality declines, the interpretation represents availability more than preferences, as lower quality teachers will not be able to

⁸ Though charter schools are not uniformly distributed across charter states, it is also assumed that teachers are able to relocate to accept employment at a charter if desired.

choose freely between school types. These teachers will be offered what has not been accepted by the higher quality teachers.

The basic model in this paper is represented by the following equation:

$$Charter_i = \alpha_0 + Q_i\beta + S_i\delta + X_i\gamma + \varepsilon \quad (1.1)$$

The dependent variable, *Charter*, is an indicator variable equal to one if teacher *i* teaches at a charter school during the 2007-2008 academic year and is equal to zero if the teacher teaches at a public school. Since the dependent variable is binary, the model is estimated via a probit regression. For each probit, the marginal effects are calculated for a benchmark teacher. The benchmark teacher is a White male of the lowest quality with no graduate degrees, with the average number of years of experience, and who is of the average age for the sample of interest.

The teacher quality measures are contained in the Q vector. To determine if aggregating quality could mask effects of finer distinctions of quality, this paper estimates the equation using two specifications of the Q vector. The first aggregates quality, creating three quality groups. Higher Quality is a dummy variable equal to one if teachers hail from Most or Highly Competitive colleges. Lower Quality is a dummy variable equal to one if teachers are from Very Competitive, Competitive, or Less Competitive colleges. Non Competitive teachers comprise the final group. In the second specification, each ranking is included as a binary variable. This specification is of the most interest, as it clearly illustrates what the effects are for differing levels of quality and indicates if there is a stronger effect for better quality teachers. This paper estimated both specifications using the matched and the 2002 ranking to investigate how a reference year might distort findings.

For all specifications, S_i is a vector of educational attainment variables, including if teacher i obtained either a Master's degree or a Ph.D.⁹ Finally, X_i is a vector of demographic controls, including teacher i 's years of teaching experience, age, gender, and ethnicity.

The model is estimated for all teachers pooled together as an introductory exercise. It is then re-estimated for each cohort to determine if sorting differences exist among the different cohorts.

1.7 REGRESSION RESULTS

1.7.1 2007-2008 SASS Findings

The results of the probit model for the aggregated quality regression are presented in Table 1.7. Column 1 presents the estimates using the matched ranking. Column 2 presents the results for the matched population using the 2002 ranking, while Column 3 estimates the equation for all teachers using the 2002 ranking, including those who do not have a matched ranking measure¹⁰.

The estimates affirm the model is plausible as the coefficients all exhibit the expected signs. With respect to controls, the negative and significant coefficient on Master's degree corresponds to the idea that charter teachers have little incentive to obtain an advanced degree compared to public teachers, who are often required by law to get one while the charter teachers are exempt. The table also indicates that more experienced teachers are less likely to work at a charter, holding constant quality. Since charter schools are a relatively recent development, this result is not surprising. A veteran teacher with job security, who has already established her reputation and learned the ins and outs of her school will have little incentive to leave.

⁹ All teachers have their undergraduate degrees in the analysis, so the comparison is to teachers without any graduate degree.

¹⁰ Teachers without a matched measure are teachers who entered college in a year for which the Barron's rankings are not included in this study.

Table 1.7. Probit Results of Charter School Participation & Teacher Quality, 2007-2008 Regular Teachers, Aggregated Quality

	Matched Quality	2002 Ranks	
		Matched Sample	All FT/PT Teachers
Higher Quality (=1)	0.2679*** (0.0962)	0.2312** (0.0948)	0.1012 (0.0709)
Lower Quality (=1)	0.0831 (0.0726)	0.0344 (0.0891)	-0.0477 (0.0662)
Master's Degree (=1)	-0.1529*** (0.0407)	-0.1576*** (0.0408)	-0.1540*** (0.0314)
PhD (=1)	-0.1688 (0.3389)	-0.1788 (0.3356)	0.2001 (0.1420)
Years of Teaching Experience (decades)	-0.2963*** (0.0483)	-0.3024*** (0.0487)	-0.2833*** (0.0257)
Female (=1)	0.1311*** (0.0428)	0.1336*** (0.0429)	0.0701** (0.0332)
Age (100s yrs)	-0.0461 (0.2607)	-0.0259 (0.2612)	0.2252 (0.1777)
Hispanic (=1)	0.2610*** (0.0725)	0.2662*** (0.0726)	0.3023*** (0.0597)
Black (=1)	0.4982*** (0.0601)	0.5112*** (0.0603)	0.4376*** (0.0482)
Asian (=1)	0.3526*** (0.1279)	0.3429*** (0.1275)	0.3818*** (0.1028)
Pacific Islander (=1)	0.3498* (0.2116)	0.3530* (0.2133)	0.1645 (0.1963)
American Indian (=1)	-0.1011 (0.1273)	-0.0988 (0.1275)	-0.1520 (0.1050)
Constant	-1.6538*** (0.1121)	-1.6457*** (0.1250)	-1.6035*** (0.0905)
Observations	14030	14030	26510

Sample sizes rounded to nearest ten for confidentiality purposes.

Reporting probit estimates

High quality refers to teachers from Most and Highly Competitive colleges

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The positive and significant coefficients on Hispanic, Black, and Asian are unsurprising as charters disproportionately enroll minority students (Frankenberg et al. 2010, Hoxby and Muraka 2009). Given that students learn better from teachers with the same ethnicity (Dee 2004), a teacher who wishes to be the most effective will choose to teach where she shares the ethnicity of the students.

The quality estimates imply that Higher Quality teachers are significantly more likely to work at a charter than their lowest quality counterparts. There is no effect for Lower Quality teachers.

Comparing the results in Column 1 to those in Column 2 to determine if the difference in assigning ranks matters, the reference year produces a lower point estimate with a lower significance on the quality variables than the matched measure¹¹. The discrepancies worsen in Column 3, which incorporates all teachers, including those without a matched ranking. The additional teachers entered college before 1991, further from the reference year. The results represent what other studies using a reference year would have found. The estimate for Higher Quality teachers is less than half of the previous estimates and is insignificant. The studies would have erroneously concluded there was no quality effect, while the matched ranking indicates that there is one.

Table 1.8 reports the marginal effects of the probit presented in Table 1.7. For this population, the benchmark teacher is 36.3 years of age with 9.6 years of teaching experience. The probability of teaching at a charter for this population is 4.6%.

The first column indicates that teachers with Master's degrees are roughly one percentage point (22%) less likely to work at a charter. For each decade of teaching experience a teacher has, he is roughly 1.8 percentage points, or 39%, less likely to work at a charter school. Column 1 also finds that females are nearly 22% more likely to work at a charter school than males.

¹¹ The analyses were also carried out using the 2000 ranks as the reference year for columns 2 and 3, and the results and conclusions hold.

Table 1.8. Marginal Effects of Charter School Participation & Teacher Quality, 2007-2008 Regular Teachers, Aggregated Quality

	Matched Quality	2002 Ranks	
		Matched Sample	All FT/PT Teachers
Higher Quality (=1)	0.0214*** (0.0081)	0.0182*** (0.0067)	0.0083 (0.0055)
Lower Quality (=1)	0.0056 (0.0046)	0.0022 (0.0056)	-0.0034 (0.0049)
Master's Degree (=1)	-0.0082*** (0.0024)	-0.0085*** (0.0026)	-0.0100*** (0.0023)
PhD (=1)	-0.0089 (0.0150)	-0.0095 (0.0149)	0.0179 (0.0152)
Years of Teaching Experience (decades)	-0.0183*** (0.0038)	-0.0191*** (0.0042)	-0.0212*** (0.0032)
Female (=1)	0.0092*** (0.0031)	0.0096*** (0.0033)	0.0056** (0.0027)
Age (100s yrs)	-0.0029 (0.0162)	-0.0016 (0.0165)	0.0168 (0.0135)
Hispanic (=1)	0.0207*** (0.0075)	0.0216*** (0.0079)	0.0297*** (0.0078)
Black (=1)	0.0492*** (0.0102)	0.0520*** (0.0113)	0.0483*** (0.0085)
Asian (=1)	0.0305** (0.0152)	0.0299* (0.0154)	0.0402*** (0.0150)
Pacific Islander (=1)	0.0302 (0.0244)	0.0311 (0.0253)	0.0143 (0.0196)
American Indian (=1)	-0.0057 (0.0066)	-0.0057 (0.0068)	-0.0099 (0.0061)
Observations	14030	14030	26510

Sample sizes rounded to nearest ten for confidentiality purposes.

Reporting probit estimates

High quality refers to teachers from Most and Highly Competitive colleges

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The biggest effect appears to be with respect to a teacher's race. Black teachers are 4.9 percentage points, or 107%, more likely to work at a charter than a White teacher. Hispanic teachers are 2.1 percentage points (46%) more likely, and Asian teachers are 3.1 percentage points (67%) more likely to work at a charter than the White benchmark teacher.

Quantifying the quality effect, the Column 1 finds Higher Quality teachers from Most and Highly Competitive colleges are 2.1 percentage points, or 46%, more likely to work at a charter school than the lowest quality benchmark teacher from a Non Competitive college. Lower Quality teachers are not significantly more likely to work at a charter school than the lowest quality benchmark.

The quality effect does not appear that large compared to other controls. While it is larger in magnitude than the effects of graduate degrees, gender, or years of experience, it is less than half the effect of being Black. The small magnitude of the quality effect may be reflecting the fact that teachers were aggregated into quality groups, something that will be investigated in Table 1.9.

For the reference year marginal effects, Column 2 indicates that Higher Quality teachers are 1.8 percentage points (39%) more likely to teach at a charter school than the benchmark teacher. There is still no effect for Lower Quality teachers. Again, incorporating all teachers in Column 3, the estimate is less than half of that in Column 2 and is insignificant.

While the previous tables illustrate that there is a quality effect, the question remains if finer distinctions of quality matter. Table 1.9 presents the marginal effects for the disaggregated quality estimation. The columns can be interpreted in the same manner as those of Tables 7 and 8.

Table 1.9 indicates that the aggregated quality analysis fails to pick up differences among the finer quality distinctions. Column 1 suggests that teachers from the Most Competitive colleges are 4.4 percentage points, or 96%, more likely to teach at a charter than those from Non Competitive colleges. This estimate reflects the fact that schools desire better teachers, and these teachers are able to choose their ideal school. Thus, the 4.4 percentage point increase reflects these teachers' preferences for charters over traditional schools.

Table 1.9. Marginal Effects of Teacher Quality & Charter School Participation, 2007-2008 Regular Teachers, Disaggregated Quality

	Matched Quality	2002 Ranks	
		Matched Sample	All FT/PT Teachers
Most Competitive College (=1)	0.0442** (0.0189)	0.0401*** (0.0151)	0.0200** (0.0095)
Highly Competitive College (=1)	0.0173** (0.0084)	0.0125 (0.0085)	0.0045 (0.0061)
Very Competitive College (=1)	0.0185*** (0.0061)	0.0162** (0.0067)	0.0060 (0.0050)
Competitive College (=1)	0.0038 (0.0047)	0.0023 (0.0058)	-0.0031 (0.0044)
Less Competitive College (=1)	0.0007 (0.0051)	-0.0003 (0.0061)	-0.0050 (0.0047)
Master's Degree (=1)	-0.0087*** (0.0024)	-0.0091*** (0.0026)	-0.0092*** (0.0021)
PhD (=1)	-0.0093 (0.0147)	-0.0109 (0.0142)	0.0140 (0.0133)
Years of Teaching Experience (decades)	-0.0180*** (0.0038)	-0.0189*** (0.0042)	-0.0186*** (0.0028)
Female (=1)	0.0096*** (0.0031)	0.0098*** (0.0033)	0.0052** (0.0024)
Age (100s yrs)	0.0039 (0.0160)	0.0004 (0.0165)	0.0149 (0.0119)
Hispanic (=1)	0.0207*** (0.0075)	0.0218*** (0.0079)	0.0270*** (0.0072)
Black (=1)	0.0514*** (0.0106)	0.0531*** (0.0115)	0.0445*** (0.0080)
Asian (=1)	0.0282* (0.0147)	0.0272* (0.0148)	0.0340** (0.0133)
Pacific Islander (=1)	0.0311 (0.0250)	0.0311 (0.0254)	0.0126 (0.0176)
American Indian (=1)	-0.0053 (0.0066)	-0.0054 (0.0068)	-0.0084 (0.0055)
Observations	14030	14030	26510

Samples rounded to nearest ten for confidentiality purposes.

Reporting marginal effects for bench mark case

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Highly and Very Competitive college graduates are 1.7 and 1.9 percentage points, or 37% and 41%, more likely to work at a charter than the benchmark teacher. These estimates are a combination of the teachers preferences for charter positions given their availability. As quality declines, the point estimates decline as well, and teachers from Competitive and Less Competitive colleges are not significantly more likely to work at a charter. The insignificant result may reflect the fact that these teachers were not able to choose a charter school, as the positions may have been filled. As such, for these teachers, the estimate reflects availability more than preferences.

Table 1.9 also indicates that using the 2002 ranking continues to produce distorted estimates. The difference is greatest between the two measurements for teachers from Most and Very Competitive colleges. In Column 2, the reference year ranking indicates the Most Competitive graduates are 4.0 percentage points more likely to work at a charter, while Highly Competitive graduates no longer have a quality effect. Teachers from Very Competitive colleges are 1.6 percentage points more likely, while there is no quality effect for teachers from lower ranked schools.

The results suggest the probability of teaching at a charter over a public school generally increases as quality increases. Aggregating quality leads to inaccurate conclusions. Using a reference year is more misleading at the highest quality level, and it may change the significance of the findings.

Thus far, more experienced teachers appear less likely to choose a charter over a public school. Charters may have been perceived as risky ventures or as negative signals when they were first introduced. As such, the attraction to charter schools and the quality effect may be different among different cohorts of teachers depending upon when they started teaching. Table 1.10 presents the marginal effects of the probit regressions for different cohorts to determine if the quality effect varies between them. A cohort is defined as the group of teachers matched to a Barron's publication year. For example, teachers who entered college in 1991 and 1992 are classified in the 1992 cohort. There are nine cohorts corresponding to the nine years of Barron's rankings in this study.

Table 1.10 Marginal Effects Estimates of Teacher Quality & Charter Participation, 2007-2008 Teachers, by Cohort

	Cohort Group								
	1969- 1970 ^a	1983- 1984	1985- 1986	1991-1992	1993-1994	1995-1996	1997-1998	1999-2000	2001-2002
Most Comp College (=1)				0.0385 (0.0555)		0.0527 (0.0634)	0.0954 (0.0673)	0.1107* (0.0630)	0.1153* (0.0658)
Highly Comp College (=1)	0.0022 ^b (0.0081)			0.0246 (0.0239)	0.0016 ^b (0.0255)	-0.0284* (0.0150)	0.0888*** (0.0326)	0.0612** (0.0300)	0.0014 (0.0254)
Very Comp College (=1)	-0.0006 (0.0044)	-0.0084 ^d (0.0174)	-0.0014 ^d (0.0030)	0.0230 (0.0149)	0.0043 (0.0218)	-0.0034 (0.0149)	0.0665*** (0.0217)	0.0381** (0.0189)	0.0228 (0.0223)
Competitive College (=1)	-0.0013 (0.0029)	-0.0038 (0.0158)	-0.0003 ^c (0.0028)	0.0102 (0.0085)	-0.0115 (0.0172)	-0.0126 (0.0132)	0.0258* (0.0143)	0.0143 (0.0147)	0.0142 (0.0189)
Less Comp College (=1)		-0.0054 (0.0165)	-0.0029 (0.0033)	0.0093 (0.0093)	0.0130 (0.0215)	-0.0113 (0.0139)	0.0060 (0.0152)	0.0018 (0.0157)	-0.0034 (0.0198)
Grad. Deg. (MA/PhD) (=1)	0.0038 (0.0049)	0.0031 (0.0103)	0.0002 (0.0020)	-0.0062 (0.0048)	-0.0172* (0.0104)	-0.0178** (0.0089)	-0.0045 (0.0051)	-0.0181** (0.0086)	0.0041 (0.0140)
Yrs Teach Exper (decades)	-0.0021 (0.0022)	-0.0250* (0.0150)	-0.0035 (0.0031)	-0.0239 (0.0165)	-0.0470** (0.0213)	-0.0338 (0.0220)	-0.0343* (0.0200)	-0.0004 (0.0239)	-0.0076 (0.0355)
Female (=1)	0.0077* (0.0044)	0.0087 (0.0125)	0.0279* (0.0147)	0.0104 (0.0071)	0.0019 (0.0107)	0.0416** (0.0166)	-0.0071 (0.0059)	0.0149 (0.0095)	0.0053 (0.0093)
Age (100s yrs)	0.0551 (0.0672)	-0.0053 (0.0972)	-0.0030 (0.0156)	0.0550 (0.0441)	-0.1156 (0.0874)	0.0435 (0.0630)	-0.0356 (0.0556)	-0.0569 (0.0616)	0.0100 (0.0636)
Hispanic (=1)	0.0095 (0.0172)	0.0194 (0.0315)	-0.0029 (0.0032)	0.0090 (0.0121)	0.0043 (0.0218)	0.0329 (0.0285)	0.0400 (0.0262)	0.0179 (0.0184)	0.0428 (0.0271)
Black (=1)	-0.0017 (0.0051)	0.0128 (0.0245)	0.0239 (0.0219)	0.0162 (0.0147)	0.0833** (0.0384)	0.0807** (0.0353)	0.0336 (0.0210)	0.0872** (0.0347)	0.0550 (0.0341)
Asian (=1)	0.1834 (0.2253)		0.0207 (0.0335)	-0.0005 (0.0128)	0.0898 (0.0692)	0.0885 (0.0616)		-0.0029 (0.0191)	0.0230 (0.0413)
Pacific Islander (=1)						0.0926 (0.0944)		0.0109 (0.0519)	0.0651 (0.1153)
American Indian (=1)						0.0034 (0.0221)		-0.0184 (0.0154)	-0.0154 (0.0213)
Other Ethnicity (=1)	0.0076 ^c (0.0170)	0.0079 ^c (0.0341)	0.0129 ^c (0.0168)	-0.0073 ^c (0.0065)	0.0369 ^c (0.0390)		-0.0157 ^e (0.0102)		
Observations	1230	980	1300	1470	1630	1780	1920	1980	1750

^a Reference group is teachers from Less and Non Competitive colleges due to few observations.

^b Estimate is for teachers from Most and Highly Competitive colleges due to few observations for Most Competitive colleges.

^c Other ethnicity includes American Indians and Pacific Islanders.

^d Estimate is for teachers from Most, Highly and Very Competitive colleges due to lack of observations

^e Other ethnicity includes Asians as well as American Indians and Pacific Islanders.

Sample sizes rounded to nearest 10 for confidentiality purposes

Reporting probit estimates.

Robust standard errors in

parentheses.

*** p<0.01, ** p<0.05, * p<0.1

The matched ranking is the sole quality measure in the cohort analysis. Due to the small number of charter teachers in each cohort, this study combines some independent variables because of lack of variation. For example, it combines having a Master's or a Ph.D. into a dummy variable for graduate degrees which is equal to one if the teacher has either an M.A. or a Ph.D. For the 1969-1970 and 1993-1994 cohorts, it combines teachers from Most and Highly Competitive colleges due to a lack of variation in these categories for charter and traditional teachers. For other cohorts, such as 1983-1984 and 1985-1986, it combines teachers from Most, Highly, and Very Competitive colleges. When necessary, this study combines minority groups as "Other Ethnicity" due to the small number of minorities in certain cohorts.

The marginal effects for each cohort presented in Table 1.10 are in reference to a benchmark teacher for that cohort¹². All coefficients on the controls exhibit the expected sign. The quality effect is absent for older teachers, as expected, since these teachers would have already found their ideal school by the time charters were established. The quality effect first appears in 1997, though there is a slight negative effect for teachers from Very Competitive colleges who entered in 1995-1996.

The quality effect is largest for the highest quality and most recent college graduates. Among those who entered college in 2001-2002 and who graduated in 2005-2006, the probability of teaching at a charter is 6.4%. For these teachers, those from Most Competitive colleges are 11.5 percentage points, or 177% (11.5/6.4), more likely to teach at a charter than their benchmark teacher.

For those who entered college in 1999-2000, the probability of teaching at a charter is 7.0%. Those from Most Competitive colleges are 11.1 percentage points, or 159% more likely to teach at a charter, compared to their benchmark. Highly Competitive and Very Competitive college graduates are 6.1 (87%) and 3.8 (54%) percentage points more likely to teach at a charter.

For those entering in 1997-1998, the probability of teaching at a charter is 5.3%. Teachers from Highly Competitive colleges are 8.9 percentage points more likely to teach at a charter than their benchmark. Those from Very Competitive and Competitive colleges are 6.7 and 2.3 percentage points more likely.

¹² Recall the benchmark teacher is a White male of the lowest quality and of average age with the average number of years of experience for that particular cohort.

The results from these three cohorts imply that the quality effect on charter school preferences is stronger in more recent cohorts. In particular, for the two most recent cohorts, teachers from the best colleges have the largest increase in the probability of teaching a charter school. These results are important because if the highest quality teachers in the youngest cohorts are significantly more likely to prefer a charter school, this must be affecting the quality level of public school teachers. Furthermore, as older teachers retire, the quality effect on public schools can become even larger.

1.7.2. Persistence: 2003-2004 SASS Findings

While the SASS does not follow the same teachers across waves, it is designed to be representative. As such, data from the 2003-2004 SASS along with data from the 2007-2008 SASS allow this study to observe many of the same cohorts at two different points in time. The most recent cohort in the later data is not in the 2003-2004 data, as these teachers were just entering college at that time. A cohort analysis¹³ applied to the earlier data explores if the patterns observed in the most recent data persist. This analysis implements the same methodology to identify the matched rankings. The sample of regular teachers educated in charter states who have a matched ranking is 13,340.

The results for the cohort analysis using the earlier data are presented in Table 1.11. The marginal effects are calculated in comparison to a benchmark teacher for each cohort. This study combined quality measures and ethnicities for certain cohorts due to lack of variation in independent variables.

The estimates suggest that the quality effect is nonexistent for teachers who entered college prior to 1991, as was true for the cohort analysis using the 2007-2008 SASS data. For the 1991-1992 cohort, the magnitudes of the quality effect appears the same for both the 2003-2004 and the 2007-2008 analysis. Thus, for older cohorts, decisions appear to be persistent.

¹³ The study replicated all previous analyses using the 2007-2008 data with the 2003-2004 data. The general results hold and are available upon request.

Table 1.11. Marginal Effects Estimates of Teacher Quality & Charter Participation, 2003-2004 Teachers, by Cohort

	Cohort Group							
	1969-1970	1983-1984	1985-1986	1991-1992	1993-1994	1995-1996	1997-1998	1999-2000 ^c
Most Comp College (=1)	-0.0104 (0.0306)	0.1511 (0.1098)		0.0537 (0.0423)	0.0898 (0.0791)	0.0790 (0.0685)	0.1059* (0.0582)	
Highly Comp College (=1)	-0.0022 (0.0278)	0.0217 (0.0152)	0.0012 ^c (0.0032)	0.0244** (0.0115)	0.0515** (0.0215)	0.0572*** (0.0180)	0.0398*** (0.0149)	0.0544 ^c (0.0400)
Very Comp College (=1)		0.0095 (0.0230)		0.0292 (0.0228)	0.0694** (0.0309)	0.0627** (0.0285)	0.0240 (0.0182)	0.0327 (0.0512)
Competitive (=1)	-0.0148 ^a (0.0266)	0.0073 (0.0102)	0.0049 ^a (0.0040)	0.0265*** (0.0091)	0.0357** (0.0149)	0.0312*** (0.0109)	0.0126 (0.0092)	0.0423 (0.0295)
Less Comp College (=1)	-0.0136 (0.0270)	-0.0041 (0.0101)	-0.0006 (0.0022)	0.0131* (0.0079)	0.0215 (0.0167)	0.0243** (0.0124)	0.0169 (0.0118)	-0.0157 (0.0224)
Grad Deg (MA/PhD) (=1)	-0.0074 (0.0126)	-0.0048 (0.0051)	-0.0008 (0.0010)	-0.0035 (0.0026)	-0.0063 (0.0055)	-0.0061 (0.0041)	-0.0062 (0.0062)	
Yrs Teach Exper (decades)	-0.0323 (0.0323)	-0.0123 (0.0107)	-0.0070 (0.0056)	-0.0250 (0.0166)	-0.0429* (0.0245)	-0.0303 (0.0197)	-0.0256 (0.0180)	0.0876 (0.0618)
Female (=1)	-0.0136 (0.0168)	0.0055 (0.0070)	0.0123 (0.0075)	0.0024 (0.0030)	-0.0077 (0.0059)	0.0002 (0.0036)	0.0089 (0.0059)	-0.0051 (0.0139)
Age (100s yrs)	-0.0867 (0.2915)	0.0623 (0.0656)	0.0044 (0.0084)	-0.0064 (0.0177)	0.0376 (0.0400)	0.0129 (0.0270)	0.0401 (0.0337)	0.0546 (0.0931)
Hispanic (=1)	0.1132 (0.1061)	0.0375 (0.0441)	-0.0006 (0.0019)	0.0150 (0.0123)	0.0219 (0.0192)	0.0313 (0.0202)	0.0376* (0.0225)	0.0295 (0.0429)
Black (=1)		0.0141 (0.0254)	0.0022 (0.0040)	0.0398* (0.0220)	0.0257 (0.0181)	0.0535** (0.0254)	0.0691** (0.0303)	0.0176 (0.0328)
Asian (=1)			-0.0013 (0.0020)	0.0030 (0.0068)	0.0006 (0.0129)	-0.0025 (0.0078)	0.0038 (0.0125)	-0.0065 (0.0300)
Pacific Islander (=1)			0.0792 (0.0815)	0.0180 (0.0209)		-0.0038 (0.0140)	-0.0039 (0.0165)	
American Indian (=1)			0.0004 (0.0032)	0.0026 (0.0060)		0.0072 (0.0131)	-0.0036 (0.0101)	
Other Ethnicity (=1)		-0.0001 ^b (0.0082)			-0.0062 ^d (0.0106)			0.0144 ^d (0.0383)
Observations	1820	1270	1560	2090	2050	2190	1860	510

^a Refers to estimate for teachers from Very Competitive and Competitive colleges grouped together due to few observations for Very

^b Other ethnicity includes Asians, Pacific Islanders, and American Indians.

^c Refers to the estimate for teachers from Most and Highly Competitive colleges grouped together due to few observations.

^d Other Ethnicity includes Pacific Islanders and American Indians.

^e Graduate degree was not included due to collinearity.

Sample sizes rounded to nearest 10 for confidentiality purposes

Reporting probit estimates.

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Interestingly, for teachers in the 1993-1994 and 1995-1996 cohorts who graduated between 1997-2000, the 2003-2004 data suggest there was a slight quality effect for Highly Competitive, Very Competitive, and Competitive college graduates. By 2007-2008, the effect seems to have disappeared (Table 1.10). The 1997-1998 cohort's decisions do appear similar in the two analyses, with the magnitudes of the quality effects similar in both datasets. The few observations in the latest cohort of the 2003-2004 data make comparisons across the analyses difficult, though it is apparent the magnitudes of the estimates are increasing with quality.

The estimates in Table 1.11 imply that for the majority of cohorts, the patterns appear to hold over time. The probability of teaching at a charter generally increases with college-based quality. The probabilities for higher quality teachers increase in magnitude the younger the cohort. These findings imply that as cohorts retire, the distribution of teacher quality in public schools may be increasingly skewed towards lower quality teachers as higher quality teachers choose charter schools.

1.8 CONCLUSIONS

This paper uses a disaggregated measure of teacher quality based on the competitiveness of a teacher's college as measured by Barron's Profiles of American Colleges to determine how different quality teachers sort between public and charter schools. The findings reveal that teachers from better colleges are more likely to teach at a charter than at a public school. This probability increases with college competitiveness. The greatest impact is on the youngest and newest teachers, with the highest quality ones being roughly 11 percentage points more likely to teach at a charter over their lowest quality counterparts. Quality effects are nonexistent for older teachers. School choice patterns appear persistent over time given a subsequent analysis using the 2003-2004 SASS data, as the magnitudes of the quality effects for cohorts appear similar between the two datasets.

This paper further investigates how to most appropriately proxy for teacher quality using undergraduate college ranking. It finds that aggregating quality levels can mask effects of finer quality distinctions and lead to erroneous conclusions. Furthermore, since competitiveness and rankings are

dynamic, this paper finds that using a single reference year to measure competitiveness can be misleading and distort results. The distortion consistently underestimates the differences in choosing a charter for each quality distinction. The distortion becomes more pronounced the further the reference year is from when teachers actually entered college.

Few teachers hail from the best institutions. Since teacher quality affects student outcomes, knowing where newer and better quality teachers' preferences lay may illuminate how to attract such teachers. Since these teachers are disproportionately choosing charter schools, public schools must address their shortcomings and ask why these teachers are choosing the charter bundle.

CHAPTER 2

DOES HAPPINESS MATTER? THE EFFECT OF TEACHER JOB SATISFACTION ON PRODUCTIVITY

2.1 INTRODUCTION

For decades, researchers and policymakers have been struggling to reform education and to improve student outcomes. Improving educational attainment increases human capital levels, improves life outcomes, and boosts national productivity. The popular press and studies on educational reform typically focus on policies' effects on student test scores. This focus likely is due to the abundance and availability of standardized test scores resulting from No Child Left Behind. Critics argue that test scores may be racially, culturally, and sexually biased and that there is little evidence linking higher test scores to gains in earnings later in life (Evans and Schwab 1995). Educational outcomes that are linked to positive economic gains and success in the labor market include the graduation and college enrollment rates. The mean earnings of high school dropouts in 2008 was \$21,023, compared to \$31,283 for high school graduates and to \$58,613 for college graduates with a Bachelor's degree (US Census Bureau 2011). Those who graduate from high school are less likely to be unemployed, to be in prison, to need public assistance, or to die at a younger age (Mykerezi 2010).

Estimates of the national average high school graduation rate range from 68.8% (Swanson 2010) to 74.9% (Stillwell 2010) and 77.1% (Heckman and LaFontaine 2010). Immediate enrollment of high school completers in two or four year colleges is roughly 69% nationwide (US Department of Education 2010). Given the importance of these educational outcomes, research must focus on increasing the graduation and college enrollment rates. This study analyzes a new input in the educational production function, teacher job satisfaction, and investigates its effect on high school graduation and college enrollment rates.

Numerous studies have attempted to investigate the determinants of high school graduation while few study college enrollment. Many of these studies analyze factors that are beyond the control of policy makers, such as parental marital status, socioeconomic background, teen pregnancy, drug abuse, or ethnicity

(McElroy 1996). While student characteristics and home life are important determinants of educational outcomes, education reform cannot change these characteristics; however, it can affect other inputs into the education production function, such as teachers. In fact, current debate surrounding education reform focuses around teacher-related issues such as quality, pay, retention, and accountability. By providing quality instruction, teachers influence student outcomes. Research shows that teachers affect test scores, and quality teachers are associated with gains in student earnings later in life (Chetty et al. 2011, Hanushek 2011). Teachers also may influence the graduation and college enrollment rates. While training, qualifications, and classroom experience are all positively associated with gains in student outcomes, policy and economic studies often ignore how the classroom atmosphere and teacher attitudes and emotions affect student learning.

More enthusiastic teachers provide higher quality instruction (Kunter et al. 2008). Happier teachers may foster better relationships with students, enabling students to improve academically (Murray and Lamgren 2005). Just as family support and parental involvement aid in high school graduation, students may also benefit from having better relationships with their teachers as they may feel support, motivation, and encouragement from their teachers (Englund et al. 2008). Teachers with greater job satisfaction may be more motivated, which may increase the intrinsic motivation in students (Day et al. 2000, Moe et al. 2010). Poor relationships with teachers is a main reason rural students drop out of high school (McCaul 1988). This paper found no studies that investigate the effects of teacher job satisfaction on high school graduation and college enrollment rates.

For decades, sociologists, psychologists, and economists have believed that increases in job satisfaction should lead to increases in productivity. Meta-analyses from the 1980s found conflicting results; one found a strong positive correlation between individual job satisfaction and job performance (Petty et al. 1984), while another found only a weak correlation between the two (Iaffaldano and Muchinsky 1985). Studies on the subject dissipated. Recently, however, there has been a reemergence of studies investigating job satisfaction and productivity. Judge et al. (2001) find a moderate correlation between job satisfaction and worker productivity. Meanwhile, Ricketta (2008) reports that job attitudes and satisfaction predict future job performance. Likewise, Oswald and colleagues (2008) designed a randomized trial in which some workers'

happiness increased while others' decreased. Those with increases in happiness were more productive. Building on this literature, Borgogni et al. (2010) study self efficacy, job satisfaction, and job performance on workers in Italy. Their results indicate that job satisfaction positively affects productivity. If there is a positive relationship between job satisfaction and output in other industries, the same may be true in education.

This study contributes to two branches of the literature. First, it contributes to research on job satisfaction and productivity by investigating the education sector. Second, it contributes to the literature on high school graduation and college enrollment rates by analyzing a new input, teacher job satisfaction, along with a rich set of other school-level inputs that are of interest to policy makers, including charter status.

This study uses restricted-use data from the 2007-2008 Schools and Staffing Survey (SASS) to investigate how teacher job satisfaction in the public school system influences the graduation rate and the percentage of graduates who enroll in four year colleges. This study also investigates the extent to which job satisfaction may be increased via nonpecuniary aspects of the job. The extent to which satisfaction is sensitive to changes in these aspects will enable districts to save money while improving educational outcomes.

The findings suggest that a one standard deviation increase in the average level teacher job satisfaction at a school increases the college enrollment rate by roughly 2.3-2.4 percentage points. There is no significant effect of teacher job satisfaction on the high school graduation rate. A supportive and cooperative atmosphere and autonomy in the classroom are the biggest determinants of teacher job satisfaction.

The remainder of this chapter is set up as follows. Section 2.2 describes the current literature, while section 2.3 discusses the empirical strategy. Section 2.4 describes the data. Section 2.5 presents the results. Finally, section 2.6 concludes.

2.2 LITERATURE REVIEW

2.2.1 Education Production Function

Education is difficult to model as the educational process is cumulative. Contributing to the difficulty of modeling it is that many factors that enter into a student's education are not readily measurable, such as innate intelligence, ability, and motivation. Researchers agree that a student's learning is influenced by his familial background and neighborhood (Coleman 1966, Dee 1998, Englund 2008, Hanushek 1986, Hanushek 2003). Students from two parent households fare better than students from one parent households. Students whose parents have high educational attainment have greater attainment than their peers. Researchers are still searching for which school and policy-relevant inputs also affect student outcomes.

Variables such as student-teacher ratios or class size; per pupil expenditures, average expenditures, or teacher salaries; teacher experience and/or education; the percentage of students who are minority; and the percentage of students on free or reduced-price lunches or some combination of the like typically are included in education production models (see for example Lamdin 1996, Ostroff 1992, Wilson 2001). Also common are inputs such as relative teacher pay, the distribution of earnings, and the length of the school year (Bedard 2003, Card and Krueger 1992).

Figlio (1999) points out that "school success stories" have common themes, such as smaller classes, school-based management, good principals, and more money. He finds that decreases in the student-teacher ratio are positively related to gains in student outcomes, as is starting teacher salary. Eide and Showalter (1998) illustrate that school inputs matter differentially for different types of students. In particular, expenditure matters most for the lowest ability students, while the length of the school year matters for those with the greatest abilities.

Differential effects were found in other studies as well. Academically weak students and boys benefit most from reductions in class sizes (Heinsen 2009). Weaker students and those from disadvantaged backgrounds benefit most from smaller schools, and small secondary schools graduate a significantly larger

proportion of their students than do larger ones (Leithwood and Jantzi 2009). School inputs and resources matter differentially for elementary level students as well (Summers and Wolfe 1977). Small schools benefit all students, while disadvantaged students are helped more by certain inputs. Teachers who received their Bachelor's degree from a higher ranked college produce greater student learning than those who attended a lower-ranked college. Lower income students benefit the most from these teachers. Higher achieving students benefit most from teachers with more experience, while those with lower scores are negatively affected by these teachers. High achieving students fare better in larger classes, while low achieving students do worse in these classes. Black students benefit in a less racially diverse setting.

School characteristics that are consistently found to affect student outcomes positively include a reduction in class size (Coates 1998, Heinesen 2009, Krueger 1999), lower student-teacher ratios (Card and Krueger 1992, Figlio 1999, Finn and Achilles 1990, Wilson 2001), and smaller schools (Bedard 2003, Leithwood and Jantzi 2009, Summers and Wolfe 1977). Krueger (1999) further found that the effect of smaller classes also continued affect elementary school children in later years.

Other, less commonly included inputs also affect student outcomes. For example, student attendance is positively and significantly related to standardized test scores in elementary school children (Angrist and Lavy 1999, Lamdin 1996, Rivkin et al. 2005). Hanushek (2003) finds weak support for the notion that simply providing higher salaries or greater overall spending will lead to increased student performance. Coates (1998) finds time in instruction is a key determinant in average test scores. White and Asian students tend to have higher standardized test scores than Black students (Krueger 1999).

The majority of the aforementioned studies are based on test score outcomes among elementary and secondary school students; however, studies investigating high school completion use similar school controls and find similar results. For example, Wilson (2001) finds that the probability of graduation is greater among schools with higher per pupil spending and lower student-teacher ratios. Likewise, smaller schools are beneficial for graduates (Bedard 2003, Leithwood and Jantzi 2009).

When considering the effects that teachers have on student outcomes, economic studies typically include only measures such as educational attainment, licensure, testing, certification status, or years of

teaching experience. In fact, licensure, testing, and certification status are not consistently associated with improvements in student outcomes (Angrist and Guryan 2008, Angrist and Guryan 2004, Berliner 2005). Having a Master's degree has no significant effect on student outcomes (Angrist and Guryan 2008, Angrist and Guryan 2004, Berliner 2005, Figlio 1999, Krueger 1999, Rivkin et al. 2005). Meanwhile, teachers who graduate from higher ranked colleges are more efficacious (Ehrenberg and Brewer 1994, Summers and Wolfe 1977).

Psychologists and education specialists acknowledge that other teacher characteristics may also influence student outcomes. Emotions play a powerful role in teaching and learning (Fried 1995, Goleman 1995). Teacher qualifications, attitudes and instructional practices lead to reading and math gains in first grade (Palardy and Rumberger 2008). Teachers, through their own emotions and motivation, motivate students (Day et al. 2000), and more enthusiastic teachers provide higher quality instruction (Kunter et al. 2008). Murray and Lamgren (2005) find that warm relationships with teachers positively affect GPA. Student teacher relationships and school-based intervention programs also suggest that good relationships with teachers may help students (Anderson et al. 2004, Karcher et al. 2002) and may aid them in acquiring skills to be successful in school (Pianta et al. 2004). One study found that teacher self-efficacy influenced job satisfaction, but job satisfaction did not affect student outcomes (Capara et al. 2006).

2.2.2 Job Satisfaction

Economic, sociological, and psychological theory suggests that happier workers are more productive. Workers who are treated well and satisfied with their jobs will put forth greater effort in line with their employer's objectives. Employers who treat workers poorly will have employees who put forth minimal effort due to the negative emotions of their treatment. Empirical research finds that individuals with greater job satisfaction are more productive (Kube 2010, Mangione and Quinn 1975, Oswald et al. 2008, Patterson et al. 2004). Boehm and Lyubomirsky (2008) conclude that happier people have better career outcomes, and there is a positive correlation between happiness and work performance.

Kalleberg (1977) developed a theory of job satisfaction in which he disaggregates job satisfaction into six main components. He argues that individuals value different aspects of the job differentially. Given different job attributes, workers create a balance of the differing characteristics and obtain one composite, overall satisfaction measure of the job as a whole. He finds the six main components include intrinsic and extrinsic measures, including convenience, finances, relationships with coworkers, career opportunities, and resource adequacy. The intrinsic measures include aspects relating to the how interesting the job is, if the worker develops and uses his abilities, and if the worker is able to see results. The intrinsic factors reflect the worker's desire to be stimulated by the job and to be able to exercise acquired skills at work.

The convenience aspect of the job refers to characteristics such as having good hours, freedoms from conflicting demands, no excessive amounts of work, and enough time to do the work. Financial aspects include the pay, fringe benefits, and job security associated with the job. Relationships with coworkers indicate if the coworkers are friendly, helpful, and supportive of the worker. Career dimensions refer to aspects such as opportunities for promotion and whether the employee receives recognition for her work. Finally, resource adequacy refers to characteristics and aspects of the job that enable the worker to successfully complete his or her tasks. These include attributes such as availability of help, equipment, and information required, as well as having helpful coworkers and adequate supervision.

Other economic studies have attempted to ascertain which job characteristics influence job satisfaction, and much of these findings corroborate Kalleberg's framework. Clark (2001) reports that men value the extrinsic aspects of work, while women value intrinsic aspects. Job security and pay are the biggest predictors of job satisfaction and quit behavior (Clark 2001, Clark 1998, Clark 1997). Work hours and promotion opportunities are the least cited determinants of satisfaction (Clark 1997). Workers value interpersonal relationships followed by job content and high income (Clark 1998).

Furthermore, Borgogni et al. (2010) find that management, colleagues, and workers' immediate supervisors are strong predictors of job satisfaction. Supervisors are a main contributor to job satisfaction as they are the ones who support and value employees, and they make explicit their demands of the employees and distribute rewards to workers.

Gaziogly and Tansel (2006) report that individuals in the education field are less satisfied with their absolute pay, but they are more satisfied with their jobs and sense of achievement. They also find that teacher job satisfaction is positively associated with greater job security and negatively associated with long working hours, larger schools, and union membership.

In the academic setting, school organization influences teacher job satisfaction (Byrk & Driscoll 1988, Little 1982, Rosenholtz 1989, Rutter and Jacobson 1986). Communication between teachers and the principal increases teacher job satisfaction (Bridges and Hallinan 1978, Forsyth and Hoy 1978, Little 1982). Principal leadership, communicative school organization, orderly environment, and average levels of control given to teachers increase teacher efficacy which increases job satisfaction (Lee et al. 1991). Lack of autonomy and emotional exhaustion have a negative influence on job satisfaction (Skaalvik and Skaalvik 2009).

Ostroff (1992) studied the effect teacher job satisfaction on student standardized test scores on the U.S. and Canada. She found that higher job satisfaction was associated with increases in standardized test scores in math, reading, and social sciences among high school students. While she treats satisfaction as exogenous, she acknowledges the possibility of reverse causality. Another recent study found that teacher qualifications, attitudes, and instructional practices were positively associated with achievement gains in math in reading among first graders (Palardy and Rumberger 2008).

This paper therefore contributes to the current literature by investigating job satisfaction and productivity. It further contributes by linking teacher emotions and job satisfaction to student outcomes. It fills a void in the literature by analyzing outcomes of high school students, in particular, the graduation and college enrollment rates.

2.3 EMPIRICAL STRATEGY

The main goal of this paper is to identify the effect of teacher job satisfaction on productivity. A secondary goal includes examining other determinants of high school graduation and college enrollment rates. Therefore, the main equation of interest is the following:

$$O_s = \beta_0 + \beta_1 Sat_s + T_s \theta + C_s \gamma + I_s \tau + D_s \rho + \varepsilon_s \quad (2.1)$$

where O is the outcome of interest, the graduation rate of school s or the percent of graduates from school s who enroll in a four-year college. Sat is the average level of teacher satisfaction at the school. Contained in the vector T are average teacher characteristics, including the average competitiveness level of the teacher's undergraduate institution as ranked by Barron's in the year closest to when the teacher entered college; the average number of years of experience and its square; the percentage whose Bachelor's is in the field of education; the percentage with a Master's Degree; the percentages who have a regular, other (e.g., temporary, waived, emergency), or no state certificate; the percentage who are white, Hispanic, black, or other ethnicities; the percentage of teachers who are female; the average age and its squared term; the average reported log yearly earnings of teachers, the percentage who are unionized; and the percentage who are part time.

The vector C represents student demographic characteristics, including the percentage of students who are limited-English proficient; the percentage who are on an individualized education plan; the percentage who are on free or reduced price lunch; the percentage of students who are white, Hispanic, black, or other ethnicities; the percentage who are male; and the percentage who are migrant. While this study is not able to measure directly parental support and familial background characteristics, including the percentage of students on school lunch and ethnicities may address these issues. Students on reduced-price lunch come from poorer families, where the parents might be less educated and perhaps might not value education as much as better educated parents. Even if they do value education, parents in these families may have to work multiple, low-paying jobs and may not have time to help their children with their homework or to encourage them academically.

I is a vector of school-specific characteristics, including whether or not the school is a charter school, its enrollment and enrollment squared, the student-teacher ratio, and the average daily attendance rate. The average daily attendance rate also may capture familial and neighborhood effects, as schools with lower average daily attendance may be in areas where education is not valued or where parents are not around to encourage their child to go to school. Furthermore, average daily attendance captures if students are more prepared and learning in school.

The vector I also includes interactions of student and teacher ethnicities as well as characteristics such as whether or not the school is for problem children, has admission requirements, has a magnet program, is a Montessori or other specialized instruction school, whether it receives Title 1 benefits, whether it has a special program emphasis, is a special education school, a vocational/technical school, or an alternative school. I also contains information regarding the organizational structure of the school, such as hours per day and hours per day squared, days of school and days of school squared per academic year, if the school has block, loop, or divided scheduling, if the school groups different age groups together, and if the school is on a 12 month schedule. I also includes information regarding the school's urbanicity.

Finally, D represents a vector of state fixed effects. As educational policy varies significantly by state, excluding state effects would lead to omitted variable bias and would cause any effects found to be invalid.

Since the outcome of interest is a school-level variable, this study estimates equation (2.1) using one observation per school (full sample). The teacher characteristics are aggregates (averages) of the teacher responses to the SASS questionnaires. Therefore, this study also estimates equation (2.1) using only schools with at least three respondents to the SASS.

Estimating equation (2.1) by OLS may result in biased estimates, as the average level of teacher satisfaction is endogenous. The endogeneity stems from reverse causality: teachers who work at more successful schools will be happier. As such, an instrumental variable approach is necessary to purge the model of this endogeneity. The instruments for teacher job satisfaction are based on the Kalleberg (1977) framework and the other job satisfaction literature findings. The following equation represents the first stage:

$$Sat_s = \alpha_0 + A_s\delta + T_s\theta + C_s\gamma + I_s\tau + D_s\rho + v_s \quad (2.2)$$

The exogenous instruments are contained in the vector A which represents the average levels of teacher autonomy and attitudes about their schools and teaching. These variables include the variance of teachers' responses to questions regarding their level of agreement with if the staff is recognized for a job well done and if the principal supports teachers. A also contains information regarding the average of teacher's responses to the amount of control they believe they have over selecting their instructional materials and textbooks and disciplining students.

Many of the determinants of teacher satisfaction, such as salary and hours (Clark 2001, Clark 1997), also may influence student outcomes directly. Therefore, this analysis excludes these variables as potential instruments. Using multiple instruments for job satisfaction is advantageous as it overidentifies the system, allowing for the orthogonality assumptions associated with the instruments to be tested formally. Furthermore, as Kalleberg (1977) suggested, individuals value different dimensions of jobs differentially, and they each weight these aspects individually to arrive at a single, composite measure of satisfaction. As such, this estimation strategy further corresponds to Kalleberg's framework.

The teachers' views on if the staff is recognized for good work and on if the principal is supportive of the teachers' work reflect the career dimension of Kalleberg's framework. If teachers feel support for their work and feel that they are not being criticized and unappreciated, they will be happier. Furthermore, actual recognition for good work inspires teachers and makes them happier in their jobs. These variables do not directly influence the graduation rate or college enrollment rate, except through increasing job satisfaction.

The variables relating to the teachers' views of control reflect the intrinsic aspect of Kalleberg's framework. The variables reflecting the control over selecting books and materials and disciplining students do not belong in the second stage. They reflect how the teachers view their control over these aspects of their jobs and do not directly influence the outcomes of interest. Having autonomy and control increases job satisfaction (Skaalvik and Skaalvik 2009), and high satisfaction increases a teacher's motivation (Moe et al. 2010). Thus, increased perceived control may increase satisfaction, resulting in happier and better teachers.

Control over selecting materials does not belong in the main equation, because while having the ability to select materials will aid teachers, teachers still need the skill set to be able to use these resources to be effective teachers. Furthermore, the control variables represent the variance of the teachers' perceptions, so a direct link to outcomes is nonexistent.

The instruments are the variances of these variables as using the average of the variable would imply the average outcome. Using the variance of the instruments suggests increases or decreases in satisfaction overall. In other words, using an average to predict an average may violate orthogonality conditions, whereas variances give an extra degree of exogeneity.

2.4 DATA

The data come from the restricted-use 2007-2008 Schools and Staffing Survey (SASS). The SASS is a stratified probability proportional to size survey that is administered every four years. The SASS is composed of a series of questionnaires at the teacher, school, principal, and district levels. Schools are sampled and surveyed first, and then teachers are sampled from the responding schools. Teachers within schools are surveyed at a rate of at least one and no more than 20 teachers per school, with an average between 3 and 8 teachers sampled per school.

The teacher survey contains a series of questions about the teacher's demographic characteristics (e.g., age, race, gender); educational attainment, including the name of the teacher's undergraduate college, his majors, degrees obtained, years of graduation; years of teaching experience; and certification status. It also contains questions about teacher's perceptions of the school climate and about the teacher's attitudes towards teaching and her school. Respondents answered the questions on a scale of 1-4, and the average school-level response is an aggregation of the teachers' responses. The measure of teacher job satisfaction is based on the question "I am generally satisfied with being a teacher at this school." Responses range from 4 "Strongly

Agree" to 1 "Strongly Disagree." The average level of teacher job satisfaction is 3.46, with a standard deviation of 0.38¹. The minimum school level of satisfaction is 1.4, while the maximum is 4.0.

The school survey contains information regarding the student demographic composition, the numbers of staff and faculty working at the school, information regarding school programs, organization, and structure, and whether the school had any students in grades 9-12. Since the outcomes of interest are the high school graduation rate and the percentage of graduates who enroll in four year institutions, the sample includes only schools that had seniors the year before the survey (e.g., seniors graduating in 2007). The final sample is comprised of 2970² public high schools.

While there is much debate over the proper way to measure the graduation rate (see Heckman & LaFontaine 2010), the graduation rate in this study is the schools' reported rate of the percentage of seniors who graduated. It is roughly 87.8%, with a standard deviation of 21.6. The enrollment rate is the percentage of graduating seniors who enrolled in a four year college. Of those schools with graduating seniors, the average enrollment rate is roughly 45.6% with a standard deviation of 24.7.

2.5 RESULTS

2.5.1 Job Satisfaction

The quality of the identification strategy hinges critically on whether the instruments are important determinants of the level of teacher job satisfaction. Table 2.1 presents the estimates of the first stage (equation 2). In addition to the theoretical arguments above, the first stage regression results indicate that the instruments are valid. The R-squared values of 0.20 and 0.21 for the full sample and the subsample of schools with at least 3 teachers responding indicate that the instruments explain the average satisfaction level adequately. Shea's partial R-squared, which reports the part of satisfaction which is explained by the excluded

¹ The average level of job satisfaction for the subpopulation of schools with at least 3 teachers responding to the SASS is 3.46 with a standard deviation of 0.36.

² All samples sizes are rounded to the nearest 10 for confidentiality purposes. The subsample of schools with at least 3 teachers responding to the SASS is 2740.

instruments, is 0.13 for the full sample and 0.14 for the subsample of schools with at least three teachers responding to the SASS³. Shea's partial R-squared terms suggest that the instruments explain a significant portion of satisfaction.

Table 2.1 First Stage Estimates

	First Stage Results	
	Model I	
	All Schools	3+ Obs/Schl
Variance of Teacher Agreement Staff Recognized for Job Well Done	-0.0730*** (0.0156)	-0.0742*** (0.0162)
Variance of Teacher Agreement Principal Supports Teachers	-0.1696*** (0.0160)	-0.1799*** (0.0156)
Variance of Control over Material	-0.0265** (0.0108)	-0.0316*** (0.0116)
Variance of Control over Discipline	-0.1423*** (0.0223)	-0.1501*** (0.0230)
2nd Stage Controls	Yes	Yes
Constant	2.0679** (1.0371)	1.7142 (1.0737)
Observations	2970	2740
Adjusted R-squared	0.204	0.209

Furthermore, an F test on the excluded instruments results in an F statistic of 44.32 and 80.987 for the two samples, again suggesting that the instruments are not weak and continue to explain a significant portion of satisfaction, even after controlling for the exogenous variables in the main equation. For the college enrollment outcome, the F statistics are 80.8 and 83.3 for all schools and for schools with at least three teachers responding. Finally, Hansen's J statistic, which tests the orthogonality conditions and ensures that the model is overidentified. For the graduation outcome, Hansen's J statistic is 0.13 ($p=0.988$) for the full sample and 1.23 ($p=0.745$), indicating that the model is overidentified. For the college enrollment outcome, Hasen's J statistic is 3.58 ($p=0.311$) and 5.71 ($p=0.126$) for the two samples, confirming the model is overidentified and that the empirical strategy is sound.

³ The college enrollment outcome is for a subsample of schools from the graduation outcome. The adjusted R-squared terms for this outcome for all schools and for schools with at least three teachers responding to the SASS are 0.20 and 0.24, respectively. Shea's partial R-squared is 0.13 and 0.14 for the two samples.

The results of the first stage analysis suggest that the biggest determinants of teacher job satisfaction are a supportive principal and autonomy over disciplining students. Teachers also appear happier if they receive recognition for their hard work. Finally, the results indicate that the identification strategy is sound, the model is over identified, the instruments are not weak, and that the results are valid and consistent.

2.5.2 Graduation Rate

The results of equation (2.1) using the graduation rate outcome are presented in Table 2.2. Columns 1 and 2 provide the OLS estimates for all schools and for schools with at least four teachers responding, respectively. Columns 3 and 4 present the results of the IV estimation.

For the OLS estimation, the results in Column 1 indicate that a one standard deviation increase in the average teacher job satisfaction at a school is associated with an increase in the graduation rate of 0.87 percentage points. As such, the model suggests that happier teachers are more productive. This finding implies that a relationship exists; however, this finding should be interpreted with caution due to the endogeneity of satisfaction.

For the controls, Column 1 suggests that schools whose teachers are more experienced have lower graduation rates. This could reflect that teachers may become stale in their teaching and may have difficulty engaging students the longer they have been teaching.

Schools with greater proportions of black teachers have lower graduation rates, as do schools with greater proportions of black and other minority students; however, interaction effects indicate positive effects. That is, schools with greater proportions of black teachers and students have higher graduation rates. This is consistent with the finding that students learn better from teachers with whom they share their ethnicity (Dee 2004).

Table 2.2. OLS & IV Estimates of Teacher Satisfaction on the Graduation Rate

	OLS		IV	
	All Schools	3+ Obs/Schl	All Schools	3+ Obs/Schl
Average Teacher Satisfaction	2.2696** (1.0392)	2.5309** (1.0295)	1.8728 (3.2898)	1.1984 (2.7703)
Ave College Rank	0.6880 (0.8001)	0.3399 (0.8118)	0.6754 (0.7821)	0.2708 (0.7920)
Average Years of Experience of Teachers	-0.8196** (0.3841)	-0.6611 (0.4190)	-0.8204** (0.3741)	-0.6726* (0.4085)
Average Years of Experience of Teachers Squared	0.0196 (0.0120)	0.0149 (0.0133)	0.0197* (0.0117)	0.0154 (0.0130)
Percent of Teachers Hispanic	0.0152 (0.0427)	-0.0113 (0.0451)	0.0149 (0.0422)	-0.0123 (0.0441)
Percent of Teachers Black	-0.1601* (0.0861)	-0.2081** (0.0879)	-0.1596* (0.0842)	-0.2033** (0.0860)
Percent of Students Hispanic	-0.0748** (0.0380)	-0.0712* (0.0384)	-0.0766** (0.0380)	-0.0786** (0.0383)
Percent of Students Black	-0.0966** (0.0390)	-0.0682* (0.0374)	-0.0977** (0.0394)	-0.0704* (0.0372)
Percent of Students Other Ethnicity (Asian, Am Ind, Oth)	-0.1037* (0.0594)	-0.1244** (0.0608)	-0.1041* (0.0582)	-0.1273** (0.0595)
Charter School (=1)	4.3760 (2.7855)	2.5549 (2.8789)	4.3787 (2.7336)	2.1946 (2.8028)
Average Daily Attendance Rate	0.0609 (0.0407)	0.0858** (0.0420)	0.0621 (0.0395)	0.0807** (0.0409)
Pct Teachers Hispanic*Percent Students Hispanic	-0.0006 (0.0010)	-0.0001 (0.0009)	-0.0006 (0.0010)	-0.0001 (0.0009)
Percent Teachers Black*Percent Students Black	0.0018* (0.0010)	0.0020** (0.0010)	0.0018* (0.0009)	0.0020** (0.0010)
Pct Teachers Other Ethnicity*Pct Students Other Ethnicity	0.0031* (0.0016)	0.0016 (0.0015)	0.0032** (0.0016)	0.0015 (0.0015)
School for Problem Children	-9.9379*** (3.8210)	-5.9303 (4.4212)	-9.9114*** (3.7516)	-6.2920 (4.3265)
Magnet Program (=1)	3.4012** (1.3601)	2.3631* (1.3440)	3.3726** (1.3346)	2.3889* (1.3165)
Special Education School (=1)	-27.8324*** (5.4612)	-28.9247*** (5.9323)	-27.7165*** (5.3427)	-29.1063*** (5.8069)
Vocational/Technical School (=1)	-10.9168*** (3.6744)	-8.5147** (3.7464)	-10.8436*** (3.6475)	-8.3052** (3.6605)
Alternative School (=1)	-18.7583*** (3.3399)	-19.0889*** (3.8991)	-18.7547*** (3.3021)	-18.5543*** (3.7880)
Hours in School Day	10.0330** (4.3011)	13.8321*** (5.2658)	9.9394** (4.2077)	14.2340*** (5.1762)
Hours in School Day Squared	-0.7087** (0.3461)	-0.9944** (0.4176)	-0.7004** (0.3386)	-1.0241** (0.4101)
School Organization: Multiple Age Groups Combined (=1)	-3.0575*** (0.7121)	-3.1697*** (0.7029)	-3.0714*** (0.6940)	-3.0924*** (0.6858)
State Fixed Effects	Yes	Yes	Yes	Yes
Constant	44.1117 (67.9196)	19.2444 (73.4014)	45.2427 (66.8286)	19.3225 (72.0337)
Observations	2970	2740	2970	2740
Adjusted R-squared	0.304	0.286	0.304	0.285

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Other controls include: teacher age and age squared; the log average earnings of teachers, percentage of teachers of another ethnicity (Asian, American Indian, Other), the percentage of teachers who have a BA in Education, a Master's, are certified, are female, unionized, part time; the percentages of students who are limited english proficient, on an individualized education plan, on school lunch, male or migrant; the school's days per year and its square, total enrollment and its square, the student teacher ratio, if it is a Montessori, Title 1, or Special program emphasis school, if it has an admissions requirement, if the school has a block, loop, or 12 month schedule, and its urbanicity.

Schools that are for problem children, are special education, vocational/technical, or alternative schools have lower graduation rates than traditional public schools. Special education schools have lower graduation rates by roughly 28-29 percentage points, while vocational/technical schools have lower graduation rates by 10.9 percentage points for the full sample and 8.5 percentage points for the subsample than traditional public schools. Alternative schools have lower rates by 18.8 to 19.1 percentage points for the two samples. Schools that group children in multiple age groups also have lower graduation rates by roughly 3.1-3.2 percentage points.

Schools with magnet programs have greater graduation rates by nearly 3.4 percentage points than schools without magnet programs. Schools with longer school days have greater graduation rates. This corresponds to the idea that the longer students are instructed, the greater their achievement (Coates 1998). Overall, the general model appears to be valid as the controls exhibit the expected signs.

Column 2 presents the OLS results for the subsample of schools with at least three teachers responding to the SASS. For this subsample, a one standard deviation increase in job satisfaction increases the graduation rate by 0.91 percentage points.

The results for the controls appear similar between the two samples, although there are a few differences. Most notably, schools with greater attendance rates have greater graduation rates. This finding is similar to the idea that attendance helps test scores among elementary students (Angrist and Lavy 1999, Lamdin 1996, Rivkin et al. 2005), therefore, attendance improving graduation rates is logical.

Other notable differences between the two samples are that teacher experience no longer negatively affects the graduation rate. Also, being a school for problem children no longer negatively affect the graduation rate,

Given the endogeneity of satisfaction, the estimates for the OLS estimation are not consistent. To address the endogeneity problem, columns 3 and 4 present the instrumental variables estimates.

Correcting for the endogeneity of satisfaction, the results suggest that teacher job satisfaction does not affect the graduation rate. The results for the controls are similar between the OLS and IV models. Thus, OLS overestimates the effect of teacher satisfaction on the graduation rate. The estimates for the

controls are similar between the OLS and IV estimations, as well as for both samples. They are all of the predicted sign, confirming the plausibility of the model.

2.5.3 College Enrollment Rate

Studies on college enrollment rates typically examine financial aid and the opportunity cost of attending college. They do not focus on what high schools may do to encourage their graduates to attend college. This study fills a void in the literature by investigating which school policies and characteristics are associated with increases in the college enrollment rate.

While increases in teacher job satisfaction do not influence the graduation rate, the question remains as to how job satisfaction may affect students in the longer term. In particular, the question remains as to if teacher job satisfaction affects students' enrollment in four year colleges. Table 2.3 presents the results of the estimation of equation (2.1) for the college enrollment rate outcome. Columns 1 and 2 present the OLS results for the full and subsamples, respectively. Columns 3 and 4 present the IV results for the two samples.

The OLS results are quite similar across the two samples. The estimates imply that a one standard deviation increase in teacher job satisfaction increases the college enrollment rate by roughly 1.4 for the full sample and by 1.5 percentage points for the subsample of schools with at least three teachers responding to the SASS. Thus, the OLS estimates imply teacher job satisfaction may have a lasting effect on student outcomes beyond high school.

Unlike with graduation, a one percent increase in the proportion of teachers with a Bachelor's degree in education is associated with a decrease in the college enrollment rate by roughly 0.05 and 0.06 percentage points for the two samples. No other teacher characteristics affect the college enrollment rate.

With respect to student characteristics, increases in the proportion of students on school lunch are associated with decreases in the college enrollment rate. This may reflect that these students must work full time after graduating from high school to help support their families.

Table 2.3. OLS & IV Estimates of Teacher Satisfaction on the College Enrollment Rate

	OLS		IV	
	All Schools	3+ Obs/Schl	All Schools	3+ Obs/Schl
Average Teacher Satisfaction	3.6487*** (1.0691)	4.2261*** (1.1611)	6.1911** (3.1114)	6.3767* (3.2592)
Ave College Rank	1.2140 (0.9009)	1.0876 (0.9720)	1.2372 (0.8879)	1.1173 (0.9551)
Average Years of Experience of Teachers	0.2048 (0.3984)	0.5165 (0.4454)	0.2551 (0.3911)	0.5676 (0.4379)
Average Years of Experience of Teachers Squared	-0.0018 (0.0117)	-0.0115 (0.0130)	-0.0036 (0.0115)	-0.0137 (0.0127)
Percentage of Teachers with BA in Education	-0.0475** (0.0222)	-0.0631*** (0.0238)	-0.0455** (0.0219)	-0.0618*** (0.0234)
Percent of Students on School Lunch	-0.0012*** (0.0002)	-0.0012*** (0.0002)	-0.0011*** (0.0002)	-0.0012*** (0.0002)
Percent of Students Hispanic	-0.1210*** (0.0409)	-0.1233*** (0.0428)	-0.1146*** (0.0405)	-0.1205*** (0.0424)
Percent of Students Male	-0.0903* (0.0509)	-0.0755 (0.0545)	-0.0875* (0.0499)	-0.0747 (0.0534)
Charter School (=1)	6.1749* (3.3054)	6.1270* (3.6388)	6.9406** (3.2350)	6.8853* (3.5504)
Total Enrollment	0.0040** (0.0020)	0.0033 (0.0021)	0.0040** (0.0020)	0.0033 (0.0021)
Percent of Teachers Black*Percent of Students Black	0.0016* (0.0009)	0.0014 (0.0009)	0.0015* (0.0009)	0.0012 (0.0009)
Specialized Instruction (e.g., Montessori) (=1)	-1.6705* (0.9769)	-1.8934* (1.0149)	-1.6307* (0.9564)	-1.8519* (0.9944)
Special Program Emphasis (=1)	16.3719*** (3.8252)	17.4036*** (3.8617)	15.7924*** (3.7731)	16.8472*** (3.8003)
Special Education School (=1)	-21.9553*** (4.4429)	-21.8469*** (4.9003)	-21.7150*** (4.3743)	-22.2091*** (4.8070)
Vocational/Technical School (=1)	-16.4759*** (3.3662)	-17.5681*** (3.6373)	-16.6588*** (3.3336)	-17.7222*** (3.5715)
Alternative School (=1)	-23.9943*** (2.9857)	-21.1988*** (3.4825)	-25.1687*** (2.9894)	-23.1600*** (3.4532)
School Organization: Multiple Age Groups Combined (=1)	-1.3550 (0.8564)	-1.7130** (0.8719)	-1.3123 (0.8412)	-1.6478* (0.8547)
Urbanicity: City (=1)	2.3744* (1.4200)	2.9174** (1.4856)	2.2378 (1.3932)	2.7914* (1.4554)
Urbanicity: Suburb (=1)	3.9260*** (1.2722)	3.6856*** (1.3174)	3.8255*** (1.2493)	3.5542*** (1.2893)
State Fixed Effects	Yes	Yes	Yes	Yes
Observations	2890	2680	2890	2680
Adjusted R-squared	0.309	0.292	0.308	0.291

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Other controls include: teacher age and age squared; the log average earnings of teachers, percentage of teachers of another ethnicity (Hispanic, Black, or Asian, American Indian, Other), the percentage of teachers who have a Master's, are certified, are female, unionized, part time; the percentages of students who are Black and other ethnicity, limited english proficient, on an individualized education plan, on school lunch, male or migrant; interactions of percentages of students and teachers Hispanic and other ethnicity; the school's days per year and its square, hours per day and its square, enrollment squared, the student teacher ratio, the attendance rate, if it has a Magnet program, is Title 1, if it has an admissions requirement, if the school has a block, loop, or 12 month schedule, and the constant.

A one percentage point increase in the proportion of students who are Hispanic is associated with a decrease in the college enrollment rate by roughly 0.12 percentage points for the two samples. An interaction of the percentage of teachers and students who are black positively affects the enrollment rate, though this effect is small in magnitude and is significant at the 10% level only in the full sample. Finally, a one percentage point increase in the percent of students who are male is associated with a decrease in the graduation rate of nearly 0.9 percentage points, though this effect is significant only in the full sample of schools at the 10% level.

School characteristics and programs also associated with increases in the college enrollment rate. Unlike with the graduation outcome, charter status now has a positive effect on student outcomes. Charter school graduates are roughly 6.17 and 6.13 percentage points more likely to enroll in college than traditional public school graduates in the two samples. Schools with a larger enrollment have a slightly higher college enrollment rate among their graduates, though this effect is quite small and is only significant for the full sample.

Schools with a special program emphasis also have greater enrollment rates by roughly 16.4 and 17.4 percentage points for the full and subsample, respectively. Finally, schools in cities and suburbs have greater college enrollment rates than their rural counterparts. Schools in cities have greater college enrollment rates by 2.4 and 2.9 percentage points for the full and subsamples, respectively. Schools located in suburban areas have greater enrollment rates by 3.93 and 3.69 percentage points.

School characteristics and programs that are associated with negative college enrollment rates include school with specialized instruction programs (e.g., Montessori, etc.) have lower college enrollment rates by roughly 1.7 and 1.9 percentage points for the two samples. Schools that are special education, vocational technical, and alternative schools also have lower college enrollment rates. Special education schools have lower college enrollment rates by nearly 22.0 and 16.5 percentage points. Vocational and technical high schools have lower rates by roughly 16.5 and 17.5 percentage points for the two samples. Students graduating from these schools have little incentive to enroll in college as these students typically graduate with trade skills. Finally, alternative high schools have lower college enrollment rates among their graduates by

nearly 24.0 and 21.2 percentage points for the two samples. All of these schools serve a distinct group of students who are generally less likely to enroll in college for a variety of reasons. Finally, for the sample of schools with at least three teachers responding to the SASS, the results indicate that schools which group multiple ages of students together have lower college enrollment rates of roughly 1.7 percentage points.

As with the graduation outcome, given the endogeneity of satisfaction, OLS estimates are inconsistent. The IV estimates are presented in Columns 3 and 4 for the full and subsamples, respectively.

The results in Columns 3 and 4 in Table 2.3 imply that the OLS estimates underestimate the effect of teacher job satisfaction on the college enrollment rate. The IV results indicate that a one standard deviation increase in teacher job satisfaction is associated with an increase in the college enrollment rate of 2.35 percentage points for the full sample and of 2.28 percentage points for the subsample of schools. Thus, teacher job satisfaction has a lasting and long term effect on student outcomes.

As with the graduation outcome, the IV estimates for the controls are similar to the OLS estimates. The IV estimation also indicates that charter schools have a slightly larger effect on the college enrollment rate than the OLS estimates suggest. Charter school graduates are 6.94 and 6.89 percentage points more likely to enroll in college than traditional public school graduates.

2.6 CONCLUSIONS

Improving student outcomes is a major policy focus of the nation. For decades, researchers have attempted to determine which school inputs affect student outcomes. While most studies focus on changes in test scores, these outcomes are not linked to later life outcomes. High school graduation and college enrollment rates are positively associated with improvements in life outcomes. Furthermore, increases in the high school graduation rate and college enrollment rate will lead to increased national productivity and decreased societal costs.

While much attention has been given to addressing teacher qualifications and teacher effectiveness, thus far research has not focused on teacher attitudes. This paper sheds light on how teacher attitudes affect

student outcomes. It contributes to the literature by investigating the effect of teacher job satisfaction on productivity, as measured by the graduation and college enrollment rates. It finds that an increase of one standard deviation in the average level of teacher job satisfaction at a school has a lasting effect on students as it is associated with an increase in the college enrollment rate of roughly 2.3-2.4 percentage points. It has negligible effects on the graduation rate. The determinants of teacher job satisfaction suggest that improving teacher support and autonomy in their classrooms may help to increase teacher job satisfaction at little monetary cost to schools.

Finally, this study also attempted to determine which policy-relevant school characteristics may influence student outcomes. While charter school status had no significant effect on increasing the graduation rate, charter school graduates were nearly 7 percentage points more likely to enroll in college than their traditional school counterparts.

CHAPTER 3

TEACHER ATTRITION IN CHARTER AND PUBLIC SCHOOLS

3.1 INTRODUCTION

Teacher attrition in the public school system is a subject of much concern among policymakers. It is estimated that the cost of replacing a teacher is roughly 25% of the salary and benefits per teacher (Texas Center for Educational Research 2000). Attrition may be beneficial, if those who are not committed and those who are the least effective are the ones leaving. If, however, higher quality teachers are the ones who are leaving, then attrition becomes a problem. Furthermore, a constant churn of teachers in and out of schools may introduce instability into students' academic careers.

Charter schools are a hybrid of public and private schools in that they are publicly funded but may be exempt from some constraints associated with traditional public schools. Charter teachers are generally younger than traditional public school teachers, and they are less likely to be union members. They are also more likely to be from better ranked colleges. Proponents of the charter school movement believe the autonomy associated with charters may make them attractive workplaces for teachers. Given the fundamental differences between charter and public schools, investigating if there is a difference in attrition may illuminate how to encourage effective **teachers to remain in the profession**.

Attrition includes both teachers who leave the profession as well as those who switch schools. Attrition is higher among newer, younger teachers (Hansen et al. 2004, Inman and Marlow 2004, Miron and Applegate 2007). Roughly 11% of teachers exit in their first year of teaching, while nearly 40% leave within 5 years (Ingersoll 2002). Certified teachers are less likely to leave (Ondrich et al. 2008), and non certified teachers are more likely to leave (Miron and Applegate 2007). Teacher attrition is also high in schools located in urban areas (Lankford et al. 2002) and in schools which serve minority (Feng 2010, Feng 2009, Hanushek et al. 2004, Scafidi et al. 2007) or poorer students (Lankford et al. 2002). Since charter teachers are newer and

younger than traditional teachers, since they are less likely to be certified, and since charters disproportionately serve minority students, the attrition rate may be higher at charter schools. Charter teachers also have more autonomy than traditional public school (TPS) teachers, so attrition may be lower in charters.

With the rise of the charter school movement, recent literature has attempted to examine attrition in charter and public schools. The results are somewhat mixed. In Florida, charter teachers are more likely to leave their schools than TPS teachers, though those that leave are the weaker ones (Harris 2007). Meanwhile, in Wisconsin, the high rates of turnover in charter schools is attributed to the types of teachers hired and charter location as opposed to their charter status (Gross and DeArmond 2010). Among charter teachers in Florida, the less experienced are not more likely to move to another school (Harris 2007). Studies on charters in Wisconsin and Florida may not be generalizable to the nation, as their charter laws are relatively strict and teacher requirements are similar between the two school types. For example, in other states, newer and younger teachers are more likely to leave charters (Miron and Applegate 2007).

Cannata (2010), using a binomial logistic hierarchical linear model, also finds charter teachers leave their schools at a greater rate than TPS teachers. She cites that inexperience and lack of certification are the main drivers of decisions to leave. She finds no difference in the odds of leaving for charter and TPS teachers after controlling for teacher and school characteristics and teacher experiences. Cannata's analysis only investigates teachers who leave teaching, not those who switch schools.

Using data from the 1999-2000 Schools and Staffing Survey (SASS) and the 2000-2001 Teacher Follow up Survey (TFS), Renzulli et al. (2011) estimate a multinomial logit model and find that charter teachers are 3.47 times more likely to leave schools and 2.7 times more likely to leave teaching altogether than TPS teachers. While the authors control for teacher and school characteristics, they do not account for certification nor for qualifications such as the competitiveness of the teacher's undergraduate college. Stuit and Smith (2009) find similar results using the 2003-2004 SASS and TFS. Using a multinomial logit, the authors find that charter teachers are more likely to leave teaching and to move schools than traditional teachers, though their analysis is limited to sixteen states.

This study draws on the previous literature on attrition and retention in schools and attempts to clarify the ambiguity. It investigates how attrition, measured in terms of both leaving teaching altogether and switching schools, differs between charter and public school teachers and among teachers with different qualifications. It further examines how attrition rates vary for all teachers versus new teachers. Furthermore, it investigates differences in attrition among teachers who voluntarily left their schools.

This chapter is organized as follows: Section 3.2 describes the relevant literature. Section 3.3 defines the empirical strategy, and section 3.4 describes the data. Section 3.5 presents the results, while section 3.6 concludes.

3.2 LITERATURE REVIEW

Teachers' mobility decisions are a factor of personal and professional characteristics. These include general demographic and household characteristics, quality and qualifications, financial aspects, and nonpecuniary aspects of teaching.

With respect to personal demographics, Black teachers are more likely to leave teaching while Hispanic teachers are more likely to transfer districts (Feng 2009). Gender's role in the mobility decision is slightly murky. One study suggests that females are more likely to leave (Guarino et al. 2006), while another finds that males are more likely to leave (Harris 2007). Among charter school teachers, gender and race are not significant predictors of the mobility decision (Miron and Applegate 2007).

One of the seemingly most obvious reasons is that teachers may leave their profession due to low pay or to relatively lower pay given outside options. The literature on this aspect is mixed. One study reports that teachers do not leave for higher paying jobs (Scafidi et al. 2006), while others claim that they are less likely to change districts or leave teaching when they are paid relatively more (Feng 2009, Ondrich et al. 2008). Other studies suggest that teachers respond to pay incentives, though the effect is small (Hansen et al. 2004, Hanushek et al. 2004).

Similarly, teachers who may have greater opportunities outside of teaching, such as those from higher-ranked colleges, those with graduate degrees, or those who teach high school, may be more likely to leave. Again, the findings in the literature are slightly mixed. Some studies indicate that teachers with greater qualifications and those who are more effective are less likely to leave (Feng and Sass 2011, Goldhaber et al. 2010, Boyd et al. 2011, Boyd et al. 2008). A host of other studies suggest that teachers graduating from better ranked colleges are more likely to leave teaching earlier (Guarino et al. 2006, Henke et al. 2000, Lankford et al. 2002, Murnane and Olsen 1989, Murnane and Olsen 1990, Podgursky et al. 2004). One study finds that both higher and lower quality teachers are more likely to leave teaching than are average quality teachers (Feng and Sass 2011).

The literature on teachers with advanced degrees is ambiguous as well. Some studies suggest teachers with Master's degrees are more likely to leave (Hensen et al. 2004), while others suggest they are less likely to leave (Feng 2009).

High school teachers are more likely to leave teaching (Guarino et al. 2006, Henke et al. 2001, Ingersoll 2001, Kirby et al. 1999, Miron and Applegate 2007). Female math and science teachers are more likely to leave teaching than female elementary school teachers (Ondrich et al 2008).

School context matters to teachers, as they respond to school and student characteristics, as well as their experiences in their schools. Teachers are more likely to leave low-achieving schools and academically disadvantaged students (Hanushek et al. 2004). This effect is greater for more qualified teachers (Boyd et al 2005, Lankford et al. 2002). Teachers are more likely to leave when they are in higher poverty schools (Harris 2007).

Teachers who leave cite a lack of professionalism, support, and collegiality as reasons for why they may leave (Inman and Marlow 2004). Johnson and Birkeland (2003) also find teachers leave due to lack of clear expectations and unsupportive and cooperative environments.

Charter teachers are less likely to move or leave schools with greater proportion of limited-English proficient (LEP) students, while public school teachers are more likely to leave these schools (Harris 2007).

Male teachers are more likely to move, and inexperienced public school teachers more likely to move than the more experienced (Harris 2007).

Thus, the literature and conclusions on teacher attrition leave an incomplete and complex picture. It appears that newer, younger teachers leave teaching at a greater rate than their more experienced counterparts. Teachers also leave more challenging work environments. Teachers who have greater opportunity costs of teaching may be more likely to leave teaching. What remains unclear is if the attrition rate differs for charter and TPS teachers, and if teacher qualifications, such as the competitiveness of the teacher's undergraduate college, matter.

This study draws on the previous literature and attempts to clarify which teacher, school, and student characteristics enter into the teacher mobility decision. Furthermore, while most studies incorporate teacher demographic characteristics such as age, race, and gender, household characteristics tend to be lacking from the analysis. This study incorporates household characteristics into the mobility decision as a teacher must factor in not only work-related aspects, but also his or her home life and necessities. Finally, this study investigates differences in attrition for different sub-groups of teachers, including new teachers and those who voluntarily left teaching, a characteristic often ignored in the literature¹.

3.3 EMPIRICAL STRATEGY

To investigate factors that determine attrition rates, this study estimates a multinomial logit model to determine the probability that a teacher may leave or move schools. The model is:

$$P(A_i = j|x) = \frac{\exp(x\beta_j)}{(1 + \sum_{h=1}^J \exp(x\beta_h))}, j = 1, 2 \quad (3.1)$$

$$x\beta_j = T_i\alpha + P_i\gamma + S_i\delta$$

¹Feng (2010, 2009) and Feng and Sass (2011) acknowledge that turnover may be a result of school actions, though they cite that in Florida 85-90% of turnover is voluntary. Since their data are from Florida, they therefore include both voluntary and involuntary leavers.

where A is attrition and $j=0$ represents staying in the current school, $j=1$ represents leaving teaching altogether, and $j=2$ represents switching schools. The vector T contains teacher characteristics, the vector P includes information regarding teacher's perceptions of their school and experiences, and S is a vector of school characteristics.

Contained in T are teacher i 's demographic, household, and teacher characteristics. These include the teacher's age, gender, ethnicity, marital status, the competitiveness of the teacher's undergraduate institution, and if the teacher holds a Master's or doctorate degree. *A priori*, this study expects that younger teachers will be more likely to leave or move schools as they will be less likely to be settled and established at their schools.

This study does not have an expectation about the role of gender in the mobility decision, as prior literature was ambiguous. Females may be more likely to leave teaching, especially if they are caretakers of their families. At the same time, they may be less likely to leave due to the convenient schedule of teaching if they are caretakers and have a perceived lack of options.

Married teachers may be more likely to leave as they have the security of their spouse's income and/or may have to leave teaching because of their spouse's job. On the other hand, married teachers may be more likely to leave because their lives are more stable than teachers who have never been married. This study expects that teachers who are divorced or who become divorced or separated are more likely to move schools, as they may have had to move due to their divorce or separation.

With respect to the competitiveness of the teacher's undergraduate institution, this paper anticipates that teachers graduating from higher ranked colleges may be more likely to leave teaching as they have a greater opportunity cost of teaching. Similarly, teachers with graduate degrees may be more likely to leave teaching than those without as they also have greater opportunity costs of teaching.

The household characteristics include the number of children under age five, number of family members, and household income. These characteristics are often ignored in studies on attrition and retention, likely because they are difficult to obtain; however, these characteristics should be included since teachers

make mobility decisions based on their own personal lives and households as well as based on their career experiences.

This study projects that the probability of leaving teaching is increasing in the number of children a teacher has under five years of age. Teachers with young children will require day care for their young children, increasing the cost of teaching. Along the same lines, teachers with larger households may be more likely to leave teaching as they may have to be the caretakers.

This study expects that teachers who are from households in the top tiers of the income distribution will be more likely to leave teaching than those from the middle or lower end of the distribution as these teachers' salaries likely will be a small part of the income and perhaps unnecessary. Meanwhile, teachers from the lower or middle of the income distribution range may be more likely to stay in the profession as these teachers may be significant contributors to their household's well-being.

Teaching characteristics include the number of years of total teaching experience and its square, the number of years the teacher taught at the school and its square, if the teacher is a secondary or primary school teacher, whether the teacher is a union member, if the teacher is part time, the teacher's log yearly earnings, and the teacher's certification status. *A priori* expectations suggest that newer teachers and teachers who are newer to their schools will be more likely to leave teaching or to move schools.

This study anticipates secondary school teachers are more likely to leave teaching than elementary school teachers. It expects that non unionized teachers are also more likely to leave as they do not have union support and may not be as committed to teaching. Part-time teachers also are more likely to leave as they may be teaching part time while they look for a permanent job or because they may have other obligations that make teaching or having a full time job unattractive.

Teachers who earn more will be less likely to leave or move schools. Moving schools may cause teachers to earn less money, depending on the salary structure of the receiving school. Furthermore, teachers who earn more may be at better schools or may have been at their schools longer, also contributing to the decision to stay. Finally, uncertified teachers are expected to leave teaching at greater rates as these teachers have less invested in their teaching careers than certified teachers.

The vector P contains information regarding teachers' perceptions or experiences at their schools. This includes information regarding the teacher's level of satisfaction with his/her job, whether the teacher believes if the school is run well, if the teacher has ever thought about transferring, or if the teacher believes other teachers enforce school rules. This study anticipates that more satisfied teachers will be less likely to leave or move schools. It also expects that teachers will be less likely to leave if they agree that the school is run well. It expects that teachers who have thought about transferring will be more likely to move schools and less likely to leave teaching. Teachers who think about transferring may be dissatisfied with their current schools, but they may be committed to teaching. Finally, this study expects that teachers who agree that other teachers enforce school rules will be more likely to stay since enforcement may reflect a sense of support and community that teachers seek.

Also included in the vector P are variables indicating whether the teacher believes s/he has control over choosing his/her own teaching technique, choosing the materials for class, or over disciplining the students. A priori, this study expects that greater degrees of control will be associated with decreases in the probability of leaving teaching, as teachers may desire autonomy in their classrooms.

Finally, S contains all student and school characteristics. These include an indicator for charter status, the percent of students on an individualized education plan (IEP), the percent who are limited-English proficient (LEP), the percent on school lunch, and the percent of students and the percent of teachers who are Hispanic, Black, White, or Other (Asian, American Indian, or Pacific Islander). A priori expectations suggest that teachers will be more likely to leave schools where they teach greater percentages of students on an IEP, who are LEP, and who are on free or reduced price lunch. Finally, it expects that teachers may be more likely to leave schools with greater proportions of minority students. It expects that Black and Hispanic teachers may be more likely to leave teaching than White teachers.

The vector S also includes the teacher's class size (or average class size if the teacher teaches multiple groups of students) and an indicator for if the school has teachers with no classroom. This study expects that teachers who have larger class sizes may be more likely to move schools than to stay. It also expects that teachers will be more likely to leave schools if there are not enough classrooms for each teacher to have

his/her own, although having too few classrooms may indicate that the teachers are happy and wish to stay at that particular school.

S contains characteristics of the school's organization and mission. These include characteristics such as if it is a school for problem children or if it has admissions requirements, if the classes are taught with an interdisciplinary focus, or if there is team teaching at the school. *A priori* expectations suggest that teachers will be more likely to switch schools if it is a school targeted at problem children. Teachers will be more likely to stay if the school has admissions requirements, as students at these schools must have an increased desire to be at these schools. Finally, teachers will be more likely to switch schools if the school has an interdisciplinary teaching focus or team teaching focus. Although, having an interdisciplinary focus may be part of a school's mission, and if teachers choose their schools based on the mission, they may be more likely to stay due to the interdisciplinary aspect.

Final controls included are indicators for if the school has a twelve month schedule or block scheduling, both of which may be associated with lower retention at that school. Finally, urbanicity, whether it is urban or rural, and state fixed effects also are included. State fixed effects are important in this analysis, as not only do states determine teachers' retirement packages and requirements, but charter laws vary by state. Some states have very lenient charter laws, while others are more strict. Although the laws vary by state, it should also be noted that not all charters within a state are the same and may vary quite significantly from other charters in the state; however, this study treats all charter schools the same.

3.4 DATA

The data come from the restricted-use 2003-2004 Schools and Staffing Survey (SASS) and the 2004-2005 Teacher Follow-up Survey (TFS). The SASS is a stratified probability proportional to size survey that is administered every four years. The SASS is composed of a series of questionnaires at the teacher, school, principal, and district levels. Schools are sampled and surveyed first, and then teachers are sampled from the responding schools. Teachers within schools are surveyed at a rate of at least one and no more than 20

teachers per school, with an average between 3 and 8 teachers sampled per school. The TFS is based on a sub-sample of SASS teacher respondents to track attrition and retention in schools. To help determine what drives attrition, the TFS purposefully oversamples teachers who leave teaching (leavers) and teachers who switch schools (movers).

The teacher survey contains a series of questions about the teacher's demographic characteristics (e.g., age, race, gender); educational attainment, including the name of the teacher's undergraduate college, degrees obtained, years of graduation; years of teaching experience and years of teaching at the current school; and certification status. It also contains questions about teacher's perceptions of the school climate and about the teacher's attitudes towards teaching and his or her school. Answers ranged from 4 "Strongly Agree" to 1 "Strongly Disagree."

To obtain the ranking and competitiveness of the teacher's undergraduate college, this study utilized rankings from Barron's Profiles of American Colleges, which ranks all four year institutions which offer bachelor's degrees if they are fully accredited or are recognized as candidates for accreditation. The rankings are divided into six tiers, Most Competitive, Highly Competitive, Very Competitive, Competitive, Less Competitive, and Non Competitive. This study compiled a dataset of the rankings for the publication years 1970, 1984, 1986, 1992, 1994, 1996, 1998, 2000, and 2002. It identified the Barron's ranked colleges IPEDS codes from the National Center of Education Statistics (NCES) for use in merging the rankings to the SASS data. It dropped specialized colleges (e.g., religious or arts schools), those that closed or merged, colleges with multiple campuses that are not uniquely identifiable in both datasets, and foreign colleges from the analysis. Teachers' colleges competitiveness is identified off of the ranking in the year closest to when the teacher entered college. For example, a teacher who entered college in 1990 received the 1992 ranking.

The school survey contains information regarding the demographic make up of the teachers and students at the school. Student characteristics include the percentages and number of students on IEPs, of students who receive free or reduced price lunch, and of students who are LEP. It also contains information regarding the organization of the school, schedule of the school year, special programs or focuses, and

information on class sizes. Finally, it contains geographic information, including the state and urbanicity of the school.

The Teacher Follow-Up Survey indicates if the teachers remained in their positions between the 2003-2004 and 2004-2005 academic years, if they switched schools (movers), or if they left teaching altogether (leavers). It also contains information regarding why they left, including if it was the result of a school staffing action (e.g., layoff, lack of contract renewal) or other reason (e.g., maternity or leave, retirement). It contains demographic information regarding the teacher's household, such as the number of children under age 5, the number of people in the household, the teacher's marital status, the teacher's marital status the year before, and information regarding the household income.

There were 1,830² former public school teachers and there were 3,500 current public school teachers in the TFS. Teachers without a college identifier or who did not have a school identified in the school survey were dropped from the analysis. The 650 teachers who retired after the 2003-2004 academic year were also excluded from the analysis. The final sample consists of full or part time regular teachers who are not on maternity, paternity, disability leave, or sabbatical. The full sample is 3,500 teachers. Of these teachers, 970 were teachers with three or fewer years of experience who started within 5 years³.

3.5 RESULTS

3.5.1 Descriptive Statistics

Table 3.1 illustrates the differences between leavers and movers versus stayers. Leavers and movers are more likely to be from charter versus traditional public schools. They are more likely to be graduates of

² All samples are rounded to the nearest 10 for confidentiality purposes associated with the restricted-use nature of the data.

³ The SASS defines a new teacher as one with three or fewer years of teaching experience. Many of these teachers started teaching greater than 5 years ago, but still have fewer than 3 years of experience. This study defined new teachers as those with three or fewer years of teaching experience who started within 5 years. This corresponds to the idea that teachers progress along a learning curve in their first few years, and it also corresponds to the idea that teachers leave teaching within their first 5 years.

Less and Non Competitive colleges, but they are less likely to be graduates of Competitive colleges. Generally, they are younger than traditional teachers, and they have more children under the age of 5 years.

Table 3.1. Descriptive Statistics for Leavers and Movers versus Stayers, All Teachers

	Leavers/Movers			Stayers			Difference			
	Mean	Std Err	N	Mean	Std Err	N	Mean	Std Err	t-stat	N
Charter (=1)	0.065	0.008	1970	0.051	0.006	1530	0.015	0.008	1.81	3500
New Teacher (=1)	0.278	0.015	1970	0.273	0.011	1530	0.004	0.015	0.28	3500
Most Competitive College (=1)	0.008	0.003	1970	0.008	0.002	1530	-0.001	0.003	-0.29	3500
Highly Competitive College (=1)	0.044	0.007	1970	0.038	0.005	1530	0.005	0.007	0.76	3500
Very Competitive College (=1)	0.143	0.012	1970	0.144	0.009	1530	0.000	0.012	-0.04	3500
Competitive College (=1)	0.454	0.017	1970	0.511	0.013	1530	-0.058	0.017	-3.40	3500
Less Competitive College (=1)	0.257	0.015	1970	0.230	0.011	1530	0.027	0.015	1.84	3500
Non Competitive College (=1)	0.095	0.009	1970	0.068	0.007	1530	0.027	0.009	2.88	3500
Age (Hundreds yrs)	0.382	0.004	1970	0.407	0.003	1530	-0.025	0.004	-6.43	3500
Female (=1)	0.720	0.015	1970	0.746	0.011	1530	-0.025	0.015	-1.67	3500
Tch Hispanic (=1)	0.041	0.007	1970	0.035	0.005	1530	0.006	0.007	0.92	3500
Tch Black (=1)	0.100	0.010	1970	0.086	0.007	1530	0.014	0.010	1.44	3500
Tch Oth Ethnicity (=1)	0.062	0.008	1970	0.042	0.006	1530	0.019	0.008	2.55	3500
No. Children Under 5	0.396	0.022	1970	0.292	0.017	1530	0.104	0.022	4.69	3500
No. Family Members	2.763	0.046	1970	2.773	0.034	1530	-0.010	0.046	-0.22	3500
Got Married (=1)	0.044	0.007	1970	0.044	0.005	1530	0.000	0.007	-0.01	3500
Got Divorced (=1)	0.018	0.004	1970	0.011	0.003	1530	0.007	0.004	1.62	3500
Married Dec 2003 (=1)	0.646	0.016	1970	0.650	0.012	1530	-0.004	0.016	-0.24	3500
Separated/Divorced Dec 2003 (=1)	0.106	0.011	1970	0.108	0.008	1530	-0.002	0.011	-0.15	3500
Never Married Dec 2003 (=1)	0.239	0.014	1970	0.230	0.011	1530	0.009	0.014	0.60	3500
Household Income <\$35,000 (=1)	0.110	0.010	1970	0.066	0.007	1530	0.044	0.010	4.49	3500
Household Income \$35,000-50,000 (=1)	0.222	0.014	1970	0.181	0.010	1530	0.042	0.014	3.03	3500
Household Income \$50,000-75,000 (=1)	0.197	0.014	1970	0.194	0.010	1530	0.003	0.014	0.23	3500
Household Income \$75,000-100,000 (=1)	0.206	0.014	1970	0.235	0.011	1530	-0.029	0.014	-2.10	3500
Household Income \$100,000+	0.157	0.013	1970	0.194	0.010	1530	-0.038	0.013	-2.92	3500
Years Experience Total	10.105	0.329	1970	12.309	0.247	1530	-2.204	0.329	-6.69	3500
Years Teaching at School	5.313	0.242	1970	7.734	0.181	1530	-2.421	0.242	-10.02	3500
High School (=1)	0.552	0.017	1970	0.488	0.013	1530	0.064	0.017	3.77	3500
Union Member (=1)	0.655	0.016	1970	0.756	0.012	1530	-0.101	0.016	-6.51	3500
Part Time Teacher (=1)	0.082	0.008	1970	0.040	0.006	1530	0.041	0.008	4.98	3500
Log Yearly earnings	10.505	0.011	1970	10.619	0.008	1530	-0.115	0.011	-10.39	3500
Hours per Week	51.545	0.364	1970	52.440	0.273	1530	-0.895	0.364	-2.46	3500
Graduate Degree (=1)	0.397	0.017	1970	0.425	0.013	1530	-0.028	0.017	-1.68	3500
No certificate (=1)	0.045	0.006	1970	0.022	0.005	1530	0.024	0.006	3.79	3500
Other certificate (=1)	0.164	0.012	1970	0.136	0.009	1530	0.028	0.012	2.25	3500
Regular State Certificate (=1)	0.791	0.013	1970	0.842	0.010	1530	-0.051	0.013	-3.86	3500

Table 3.1. Descriptive Statistics for Leavers and Movers versus Stayers, All Teachers (cont).

	Leavers/Movers			Stayers			Difference			N
	Mean	Std Err	N	Mean	Std Err	N	Mean	Std Err	t-stat	
Teacher Satisfied with Teaching at School	3.200	0.027	1970	3.526	0.020	1530	-0.325	0.027	-12.10	3500
Teacher Agreement School Run Well	2.805	0.027	1970	3.005	0.020	1530	-0.199	0.027	-7.33	3500
Teacher Agreement Thought of Transferring	2.309	0.032	1970	1.878	0.024	1530	0.431	0.032	13.46	3500
Teacher Agreement Teachers Enforce Rules	2.857	0.031	1970	2.947	0.023	1530	-0.090	0.031	-2.90	3500
Teacher Control over Teaching Technique	3.604	0.021	1970	3.647	0.016	1530	-0.043	0.021	-2.02	3500
Teacher Control over Materials	2.736	0.035	1970	2.810	0.026	1530	-0.074	0.035	-2.11	3500
Teacher Control over Disciplining Students	3.433	0.023	1970	3.516	0.017	1530	-0.083	0.023	-3.60	3500
Pct Students on Individual Ed Plan	0.421	0.013	1970	0.387	0.009	1530	0.034	0.013	2.65	3500
Pct Students Limited English Proficient	0.153	0.009	1970	0.132	0.007	1530	0.021	0.009	2.25	3500
Ave Class Size	21.944	0.410	1970	22.405	0.307	1530	-0.461	0.410	-1.12	3500
Percent Students on Free Lunch	0.436	0.010	1970	0.407	0.007	1530	0.030	0.010	3.01	3500
School is for Problem Children	0.017	0.004	1970	0.010	0.003	1530	0.007	0.004	1.87	3500
School has Admissions Requirements	0.113	0.011	1970	0.108	0.008	1530	0.005	0.011	0.45	3500
School has Teachers with No Classrooms	0.330	0.016	1970	0.369	0.012	1530	-0.039	0.016	-2.39	3500
Percent Students Hispanic	0.139	0.008	1970	0.144	0.006	1530	-0.006	0.008	-0.76	3500
Percent Students Black	0.203	0.009	1970	0.169	0.007	1530	0.034	0.009	3.69	3500
Percent Students Other Ethnicity	0.073	0.005	1970	0.049	0.004	1530	0.023	0.005	4.69	3500
Percent Teachers Black	0.100	0.006	1970	0.082	0.005	1530	0.018	0.006	2.86	3500
Percent Teachers Hispanic	0.046	0.004	1970	0.051	0.003	1530	-0.006	0.004	-1.25	3500
Percent Teachers Other	0.030	0.003	1970	0.018	0.002	1530	0.012	0.003	3.80	3500
School Schedule Block (=1)	0.418	0.017	1970	0.386	0.013	1530	0.033	0.017	1.95	3500
School 12 Month Schedule (=1)	0.067	0.008	1970	0.037	0.006	1530	0.030	0.008	3.88	3500
School has Interdisciplinary Teaching (=1)	0.398	0.017	1970	0.388	0.012	1530	0.010	0.017	0.58	3500
School has Team Teaching (=1)	0.401	0.017	1970	0.424	0.013	1530	-0.023	0.017	-1.35	3500
Urbanicity: City (=1)	0.301	0.015	1970	0.250	0.011	1530	0.050	0.015	3.30	3500
Urbanicity: Suburb (=1)	0.328	0.016	1970	0.400	0.012	1530	-0.072	0.016	-4.42	3500

They are less likely to be female. They are more likely to be Asian, Pacific Islander, or American Indian (other minority ethnicity). They are more likely to come from households earning under \$50,000 per year and less likely to be from households earning over \$75,000 per year.

Leavers and movers are more inexperienced, and they have been teaching at their schools fewer years than stayers. They are more likely to be high school teachers and part-time teachers, and less likely to be in a union. They earn less money than stayers, and they work roughly one hour less per week. They are less likely to have a graduate degree. They are more likely to be uncertified or holding a temporary, provisionary, or probational teaching certificate and less likely to hold a regular state teaching certificate.

Teachers who leave or move are less satisfied teaching at their schools and do not believe the school is run as well as stayers do. They are more likely to have thought about transferring, and they do not believe that other teachers enforce school rules. They report having less control over determining their teaching techniques, choosing teaching materials, and disciplining students.

Leavers and movers appear to be from more challenging schools. They teach more students who are limited English proficient, who are on an individual education plan, and who are on school lunch. Leavers and movers they are more likely to teach at a school specifically for problem children. They leave schools with greater percentages of Black or other minority students. Their peer teachers are more likely to be Black or other minority ethnicities. They are less likely to be from schools with more teachers than classrooms. They are more likely to leave schools with block scheduling or with a twelve month schedule.

Leavers and movers teach in more urban areas than stayers. They are less likely to teach in suburban areas.

All in all, the descriptive statistics for all the teachers appear to confirm the findings of the literature on teacher attrition and the a priori expectations of this study. That is, leavers and movers tend to have a greater opportunity cost of teaching. They report dissatisfaction with their schools and a general lack of autonomy. Furthermore, they teach in more challenging environments than stayers.

3.5.2 Multinomial Logit Results

Table 3.2 presents the results of the multinomial logit model presented in section 3. Following the analysis by Gross and DeArmond (2010), the model is estimated four times using different controls to illustrate how the study findings may change depending upon the controls included in the model.

The results in Table 3.2 are for all teachers, including new teachers and involuntary leavers. For each specification, the reference category is stay (e.g., stay in same school as last year). The first column represents the difference between leaving and staying and the second column represents the difference between moving (switching schools) and staying.

Table 3.2. Multinomial Logit Estimates of Mobility for All Teachers

	Model I		Model II		Model III		Model IV	
	Leave	Switch	Leave	Switch	Leave	Switch	Leave	Switch
Charter (=1)	0.0827 (0.1993)	-0.2619 (0.1798)	-0.0402 (0.2048)	-0.2667 (0.1820)	-0.0722 (0.2202)	-0.2659 (0.1965)	0.1833 (0.2439)	-0.2154 (0.2098)
Most Competitive College (=1)	0.0829 (0.4640)	-1.1304** (0.5429)	0.0048 (0.4735)	-1.1497** (0.5453)	0.0057 (0.4636)	-1.2425** (0.5870)	-0.0782 (0.4899)	-1.2817** (0.6121)
Highly Competitive College (=1)	-0.0581 (0.2727)	-0.2942 (0.2456)	-0.0554 (0.2723)	-0.2929 (0.2456)	-0.0956 (0.2735)	-0.2803 (0.2572)	0.2160 (0.3093)	-0.0943 (0.2798)
Very Competitive College (=1)	-0.2347 (0.1981)	-0.2065 (0.1789)	-0.2372 (0.1982)	-0.2050 (0.1792)	-0.2252 (0.2047)	-0.1585 (0.1936)	0.0787 (0.2361)	0.0432 (0.2131)
Competitive College (=1)	-0.3722** (0.1693)	-0.3035* (0.1553)	-0.3770** (0.1695)	-0.3025* (0.1554)	-0.4040** (0.1738)	-0.3458** (0.1685)	-0.1431 (0.2008)	-0.1891 (0.1865)
Less Competitive College (=1)	-0.0367 (0.1792)	-0.1505 (0.1659)	-0.0370 (0.1791)	-0.1489 (0.1660)	-0.0324 (0.1836)	-0.1416 (0.1781)	0.1626 (0.2065)	-0.0245 (0.1924)
Graduate Degree (=1)	0.3035*** (0.1047)	0.0873 (0.0946)	0.3089*** (0.1054)	0.0888 (0.0946)	0.3535*** (0.1100)	0.1181 (0.0993)	0.2775** (0.1171)	0.0446 (0.1030)
Years Teaching Total	0.0593** (0.0237)	0.0565*** (0.0211)	0.0646*** (0.0243)	0.0572*** (0.0216)	0.0578** (0.0251)	0.0509** (0.0229)	0.0462* (0.0264)	0.0477** (0.0235)
Years Teaching Total Squared	-0.0012* (0.0067)	-0.0010* (0.0059)	-0.0014** (0.0007)	-0.0010* (0.0006)	-0.0011 (0.0007)	-0.0008 (0.0006)	-0.0010 (0.0007)	-0.0009 (0.0007)
Years Teaching at School	-0.1113*** (0.0231)	-0.1115*** (0.0212)	-0.1114*** (0.0231)	-0.1117*** (0.0213)	-0.1192*** (0.0242)	-0.1221*** (0.0228)	-0.1216*** (0.0253)	-0.1278*** (0.0235)
Years Teaching at School Squared	0.0032*** (0.0008)	0.0116** (0.0076)	0.0032*** (0.0008)	0.0016** (0.0008)	0.0035*** (0.0008)	0.0022*** (0.0008)	0.0036*** (0.0008)	0.0022*** (0.0008)
High School (=1)	0.6156*** (0.0992)	0.0040 (0.0845)	0.6023*** (0.0997)	0.0034 (0.0845)	0.5874*** (0.1171)	-0.0023 (0.1020)	0.6927*** (0.1247)	0.0427 (0.1077)
Union Member (=1)	-0.3095*** (0.1059)	-0.3009*** (0.0942)	-0.3087*** (0.1060)	-0.3011*** (0.0942)	-0.2884*** (0.1080)	-0.2386** (0.0994)	-0.1921 (0.1220)	-0.2492** (0.1113)
Part Time Teacher (=1)	0.4222* (0.2171)	0.0777 (0.2165)	0.4083* (0.2186)	0.0769 (0.2159)	0.4617** (0.2286)	0.2371 (0.2246)	0.6059** (0.2581)	0.3775 (0.2464)
Log Yearly Earnings	-1.1831*** (0.0219)	-0.6494*** (0.1996)	-1.1583*** (0.2199)	-0.6499*** (0.1993)	-1.1242*** (0.2369)	-0.5998*** (0.2163)	-0.4731* (0.2773)	-0.0455 (0.2434)
Age 20-24 yrs (=1)	-0.0523 (0.2573)	-0.3037 (0.2093)	-0.0584 (0.2560)	-0.3047 (0.2090)	0.1031 (0.2565)	-0.2519 (0.2246)	0.0848 (0.2713)	-0.2981 (0.2297)
Age 25-29 yrs (=1)	0.3227 (0.2830)	-0.1119 (0.2191)	0.3392 (0.2811)	-0.1112 (0.2190)	0.3621 (0.2824)	-0.1216 (0.2324)	0.3139 (0.2980)	-0.1729 (0.2382)
Age 30-34 yrs (=1)	0.0407 (0.3322)	-0.0792 (0.2608)	0.4017 (0.3310)	-0.0786 (0.2610)	0.4695 (0.3307)	-0.0166 (0.2737)	0.3831 (0.3482)	-0.0804 (0.2805)
Age 35-39 yrs (=1)	0.4402 (0.3452)	-0.3006 (0.2740)	0.4403 (0.3443)	-0.3018 (0.2739)	0.4943 (0.3456)	-0.2228 (0.2876)	0.3174 (0.3633)	-0.3431 (0.2946)
Age 40-44 yrs (=1)	0.3397 (0.3550)	-0.4974* (0.2813)	0.3333 (0.3545)	-0.4993* (0.2811)	0.4112 (0.3551)	-0.4504 (0.2943)	0.2876 (0.3747)	-0.5331* (0.3017)
Age 45-49 yrs (=1)	0.0862 (0.3617)	-0.3225 (0.2765)	0.0787 (0.3619)	-0.3252 (0.2764)	0.1142 (0.3622)	-0.2283 (0.2906)	-0.0429 (0.3805)	-0.3274 (0.2971)
Age 50-54 yrs (=1)	0.1563 (0.3594)	-0.4275 (0.2777)	0.1472 (0.3591)	-0.4301 (0.2775)	0.2238 (0.3589)	-0.2887 (0.2926)	0.0443 (0.3794)	-0.3934 (0.3015)
Age 55-59 yrs (=1)	0.1175 (0.3674)	-0.7244** (0.2916)	0.1079 (0.3669)	-0.7271** (0.2914)	0.2066 (0.3672)	-0.5691* (0.3061)	-0.0225 (0.3871)	-0.6901** (0.3108)
Age 60-64 yrs (=1)	0.6971 (0.4312)	-0.9111 (0.3948**)	0.6954 (0.4293)	-0.9152** (0.3947)	0.8747** (0.4308)	-0.6180 (0.4138)	0.5231 (0.4487)	-0.8476** (0.4138)
Female (=1)	-0.2717** (0.1073)	0.0018 (0.0981)	-0.2665** (0.1078)	0.0020 (0.0982)	-0.2492** (0.1119)	0.0311 (0.1028)	-0.1804 (0.1192)	0.0805 (0.1061)
Other Ethnicity (=1)	0.2405 (0.2136)	0.5801*** (0.1786)	0.2314 (0.2134)	0.5823*** (0.1785)	-0.0766 (0.2435)	0.3676* (0.2040)	-0.0327 (0.2614)	0.3692* (0.2070)
No. Children Under 5	0.2090** (0.0846)	0.0759 (0.0770)	0.2140** (0.0847)	0.0747 (0.0770)	0.2458*** (0.0873)	0.0930 (0.0815)	0.2541*** (0.0900)	0.0818 (0.0827)
Got Divorced	0.0811 (0.4171)	0.5620* (0.3390)	0.0746 (0.4144)	0.5658* (0.3394)	0.2243 (0.4205)	0.7099* (0.3635)	-0.0632 (0.4488)	0.6031* (0.3433)
Household Income \$100,000+	0.1599 (0.1381)	-0.2200* (0.1288)	0.1649 (0.1387)	-0.2190* (0.1288)	0.1701 (0.1442)	-0.2138 (0.1333)	0.3111** (0.1538)	-0.1378 (0.1375)
Certification: None (=1)			0.8263*** (0.2550)	0.1066 (0.2601)	0.8463*** (0.2623)	0.1721 (0.2768)	1.0278*** (0.2882)	0.3712 (0.2905)
Certification: Other (=1)			-0.0444 (0.1435)	0.0068 (0.1224)	-0.0084 (0.1464)	0.0168 (0.1301)	0.1984 (0.1574)	0.1874 (0.1367)

Table 3.2. Multinomial Logit Estimates of Mobility for All Teachers (cont)

	Model I		Model II		Model III		Model IV	
	Leave	Switch	Leave	Switch	Leave	Switch	Leave	Switch
Teacher Agrees Satisfied with Teaching at School					-0.4632***	-0.2687***	-0.4500***	-0.2665***
					(0.0747)	(0.0687)	(0.0789)	(0.0698)
Teacher Agrees School Run Well					-0.1135	0.0918	-0.1578*	0.0672
					(0.0774)	(0.0695)	(0.0807)	(0.0710)
Teacher Agreement Thought of Transferring					0.0490	0.5461***	0.0234	0.5355***
					(0.0629)	(0.0548)	(0.0650)	(0.0560)
Teacher Agrees other Teachers Enforce Rules					0.0620	0.0440	0.0825	0.0455
					(0.0614)	(0.0534)	(0.0630)	(0.0547)
Teacher Has Control over Teaching Technique					-0.0357	0.0314	-0.0402	0.0295
					(0.0843)	(0.0785)	(0.0871)	(0.0799)
Teacher Has Control over Material					0.0701	-0.0529	0.0411	-0.0570
					(0.0520)	(0.0460)	(0.0547)	(0.0475)
Teacher Has Control over Discipline					-0.0355	0.0073	-0.0545	-0.0058
					(0.0773)	(0.0715)	(0.0816)	(0.0728)
Percent Students on IEP					0.1536	0.1771	0.2077	0.2216*
					(0.1390)	(0.1257)	(0.1470)	(0.1299)
Percent Students on LEP					0.2392	0.2309	0.2003	0.1841
					(0.2017)	(0.1853)	(0.2171)	(0.1960)
Ave. Class Size					0.0005	-0.0016	0.0009	-0.0032
					(0.0042)	(0.0038)	(0.0043)	(0.0040)
Percent Students on School Lunch					-0.1353	0.0181	-0.2151	-0.0791
					(0.2341)	(0.1952)	(0.2642)	(0.2120)
Percent Students Hispanic					-0.0008	-0.1279	0.2939	0.1362
					(0.3365)	(0.3026)	(0.4232)	(0.3575)
Percent Students Black					0.2710	0.6295**	0.9414**	1.0292***
					(0.3430)	(0.2930)	(0.3785)	(0.3263)
Percent Students Other Ethnicity					1.7697***	0.5490	0.8929	-0.0038
					(0.4723)	(0.4441)	(0.5539)	(0.5069)
Percent Teachers Black					-0.2747	-0.5549	-0.6247	-0.7361*
					(0.4578)	(0.4075)	(0.4929)	(0.4198)
Percent Teachers Hispanic					-0.7964*	-0.6281	-0.6829	-0.4540
					(0.4722)	(0.4281)	(0.5220)	(0.4435)
Percent Teachers Other Ethnicity					-0.9416	0.4010	-1.2881	0.2507
					(0.7244)	(0.6102)	(0.9124)	(0.6912)
School is for Problem Children (=1)					-0.0529	0.0315	0.0158	0.0464
					(0.4009)	(0.3847)	(0.4299)	(0.4064)
School Has Admissions Requirements (=1)					-0.2685*	-0.1038	-0.1996	-0.0516
					(0.1607)	(0.1441)	(0.1673)	(0.1465)
School Has Teachers without Classrooms (=1)					-0.3334***	-0.1535	-0.2720**	-0.0918
					(0.1050)	(0.0957)	(0.1118)	(0.1001)
School Has Block Scheduling (=1)					0.1399	0.0013	0.0653	0.0104
					(0.0979)	(0.0889)	(0.1058)	(0.0935)
School Has 12 Month Schedule (=1)					0.5727**	0.6743***	0.5201**	0.5626***
					(0.2392)	(0.2009)	(0.2493)	(0.2045)
School Has Interdisciplinary Teaching (=1)					0.1235	0.1544*	0.0856	0.1538
					(0.1029)	(0.0938)	(0.1110)	(0.0962)
School Has Team Teaching (=1)					-0.0637	-0.1521*	-0.0689	-0.1364
					(0.1019)	(0.0915)	(0.1101)	(0.0947)
City (=1)							0.0392	0.0631
							(0.1488)	(0.1342)
Suburb (=1)							-0.0718	-0.0015
							(0.1334)	(0.1167)
State Effects & Urbanicity	No	No	No	No	No	No	Yes	Yes
Constant	11.660***	7.4958***	11.3484***	7.4952***	13.2614***	6.3689***	6.1439**	0.7648
	(2.2723)	(2.0816)	(2.2856)	(2.0813)	(2.4924)	(2.2424)	(2.9094)	(2.5573)
Observations	3500	3500	3500	3500	3500	3500	3500	3500

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Reference category is stay at school.

Other controls include hours per week, Black or Hispanic ethnicity, number of family members, if the teacher got married between Dec 03 and Sept 04, marital status, household income categories under \$100,000. None of these were significant in the analysis.

Included in Model I are teacher individual characteristics, including their demographic and household characteristics, as well as their teacher qualifications and characteristics. The results of Model I indicate that charter teachers are not significantly more or less likely to leave teaching or to move schools than TPS teachers. Furthermore, the results indicate that graduating from Most Competitive colleges decreases the odds of moving versus staying, with the relative odds being 0.323 times the odds of those graduating from Non Competitive colleges. This translates to a decrease in the predicted probability of moving schools relative to staying by nearly 70%⁴ compared to those from Non Competitive colleges. Teachers who graduate from Competitive colleges are less likely to leave or move versus to stay in their schools than teachers from Non Competitive colleges. The odds of leaving for graduates of Competitive colleges are 0.69 times the odds of leaving for graduates of Non Competitive colleges. The relative odds of moving for Competitive graduates are 0.74 times the odds of the Non Competitive graduates.

Meanwhile, teachers with graduate degrees are more likely to leave teaching, with the relative risk of leaving increasing by a factor of 1.35 (a 35% increase in the predicted probability of leaving), than they are to stay in their schools. They are not more likely to move schools than they are to stay. Teachers with more experience appear more likely to leave teaching and to move schools, though this result is increasing at a decreasing rate and is somewhat surprising and quite small in magnitude. With respect to years of teaching in their schools, those with more experience at their schools are more likely to stay versus to leave or to move. This result is increasing at an increasing rate. The magnitude of experience at their schools is larger than the magnitude of years of experience total, so the net effect appears to suggest that teachers with more experience at their schools and more total experience are more likely to stay in their schools versus leave and move.

High school teachers' relative odds are 1.85 times the odds of primary school teachers for leaving versus staying at their schools. Teaching at a high school has no effect on the probability of moving versus staying. These results are consistent with the literature on attrition.

⁴ Transforming the estimates to odds ratios for interpretation, $e^{-1.833}=0.306$. Thus, graduating from a most competitive college leads to relative odds of moving versus staying are 0.306 times what they would be for a teacher graduating from a Non Competitive college.

Union members are less likely to leave teaching compared to non-union members, and they are less likely to switch schools. Part-time teachers appear more likely to leave teaching than to stay, but they are not more or less likely to move schools compared to full time teachers. Teachers who earn more money are less likely to leave teaching and are less likely to move schools versus staying.

With respect to age, teachers who are 40-44 years old or who are 55-59 years old are less likely to switch schools versus to stay. There is no age effect on the probability of leaving. Females are less likely to leave teaching than males. Teachers of other minority ethnicities are more likely to move schools than to stay.

With respect to household characteristics, the results indicate that for every additional child under age five that a teacher has, the relative odds of leaving teaching increases 1.23 times what they were before the additional child. Teachers who divorced between December 2003 and September 2004 are more likely to switch schools. Finally, teachers from households earning more than \$100,000 per year are less likely to switch schools than to stay, though they are not more likely to leave teaching.

In all, controlling only for teacher and demographic characteristics, the results suggest that charter teachers are not more or less likely to move schools versus to stay in their schools, and teachers from Most Competitive colleges are less likely to move schools. The findings are consistent with the idea that those with a higher opportunity cost of teaching are more likely to leave teaching. Furthermore, the results indicate that household characteristics do enter into teachers' mobility decisions.

Model II incorporates teacher certification status. Certification requirements vary by state and by school type. Some charter school teachers are not required to have a teaching certificate, while others are required to follow the same laws and requirements as traditional school teachers. Controlling for teacher certification status, charter teachers remain no more or less likely to leave or to move schools versus staying compared with TPS teachers. Having no state certification increases the relative risk of leaving teaching by a factor of 2.28. Certification status does not change the odds of moving schools versus staying. The results for all other controls are similar to those from Model I.

While teacher demographic characteristics may influence the mobility decision, school characteristics and teacher experiences at their schools matter as well. Model III incorporates the school characteristics. There remains no difference in the mobility decisions of charter and TPS teachers. Teachers from Most Competitive colleges are even less likely to move schools versus stay. Teachers graduating from Competitive colleges are less likely to leave teaching versus to stay, and they are less likely to switch schools as well. The results for other teacher demographic and household characteristics are similar to the previous models.

The teacher experience variables indicate that teachers who are more satisfied with their jobs are less likely to leave teaching and are less likely to move schools than to stay in their schools. Beliefs on how well the school is run does not affect the mobility decision in this specification. Teachers who have thought about transferring are more likely to move schools than to stay in their schools. These results are consistent with the a priori expectations. Interestingly, having control over teaching techniques, over choosing the materials for their courses, and over disciplining students does not have an effect on the mobility decisions. These results are surprising given prior expectations.

Teachers appear more likely to move schools versus stay in their schools if their school has a larger percentage of Black students. They are more likely to leave teaching if they teach in schools with a greater percentage of students of other minority ethnicity. They are less likely to leave schools with greater percentages of Hispanic teachers. They are less likely to leave teaching if their school has admissions requirements, likely reflecting a school quality characteristic. They are also less likely to leave teaching if they work at a school that does not have enough classrooms for all of the teachers. This finding is surprising, though it may reflect other attractive characteristics of the school.

Teachers who work at schools with 12 month schedules are more likely to leave teaching and to move schools versus to stay in their schools than teachers who do not face a 12-month schedule. Teachers are more likely to move schools if their sending school has an interdisciplinary teaching focus, but they are less likely to move if their school has a team teaching environment.

Finally, geographic controls are included in Model IV. Urban and rural areas serve different demographics, and the mobility decision may be influenced by school setting. Also, since state laws dictate

the terms of teachers' contracts in both public and charter schools, state fixed effects must be included to capture the differences in laws between states.

The results from previous models are generally robust to adding the urbanicity controls and state fixed effects. The results in Model IV suggest that charter status does not enter into the teacher mobility decision. Teachers graduating from Most Competitive colleges are less likely to move schools versus to stay in their schools compared to Non Competitive graduates. These teachers have a relative risk of moving versus staying that is 0.28 times the relative risk of Non Competitive graduates of moving schools. Graduates of Competitive colleges are no longer more or less likely to leave or switch schools compared to graduates of Non Competitive colleges. Teachers who hold graduate degrees are more likely to leave teaching, with the relative odds of leaving increasing by a factor of 1.31 (31% increase in the predicted probability of leaving teaching) compared to those without a graduate degree.

The results for other teacher demographic controls are similar to those from previous models. The most notable changes are that females are no longer less likely to leave and having a household income greater than \$100,000 increases the probability of leaving.

With respect to teacher experience and school characteristics, again, the majority of the results are similar to those from Model III. Having control and autonomy do not affect the mobility decision. Teachers are more likely to switch schools if they taught in schools with greater percentages of students on an IEP. They are more likely to leave teaching and to move if they taught in schools that serve a greater proportion of black students. Other minority ethnicity is no longer significant in the ethnicity decision. The percentage of teachers who are Hispanic no longer has an effect on the mobility decision. Admissions requirements no longer effect the mobility decision, nor does interdisciplinary or team teaching.

All in all, charter status does not affect the teacher mobility decision in the full sample. Teachers with greater opportunity costs of teaching, those with graduate degrees or those who teach high school, are more likely to leave teaching. Teachers from Most Competitive colleges are less likely to move schools versus stay. Teacher household characteristics continue to enter into the mobility decision. Investigating if these trends are the same for beginning teachers may help guide policymakers.

This study reestimated the main model for new teachers who started teaching within 5 years and who have three or fewer years of teaching experience. Again, the estimation added groups of controls at a time to illustrate how controls may influence findings. The results are presented in Table 3.3. The results are slightly different for newer teachers versus for the entire sample population.

In Model I, which only includes teacher demographics and household characteristics, it appears that charter teachers are more likely to leave teaching versus to stay in their schools by a factor of 2.13. Including certification status, in Model II, the charter effect disappears. Charter status continues to have no effect on the mobility decision in Model III, which includes school characteristics and teacher experiences and perceptions. Once state fixed effects and urbanicity are included, the charter effect reemerges. Hence, model specification may help explain the ambiguity in the literature

In the full specification (Model IV), for new teachers, those at a charter school have a greater relative risk of leaving teaching versus staying by a factor of 3.39 compared to TPS teachers. There is no effect on the decision of moving or switching schools versus staying. Also for new teachers, college competitiveness and graduate degrees do not appear to enter into the mobility decision, while they did for all teachers (Table 3.2).

Although they are relatively new to teaching, the more years of teaching experience, the less likely the teacher is to leave teaching. Likewise, the more tenure at a school a teacher has, the less likely to switch schools the teacher is. Teaching at a high school increases the relative odds of leaving versus staying by a factor of 2.42 compared to primary school teachers. Part time teachers are more likely to both leave teaching and to switch schools compared to full time teachers. Teachers aged 25-29 and 35-39 are less likely to switch schools, while new teachers in their 40s are significantly more likely to leave teaching versus staying. Hispanic teachers are more likely to switch schools versus stay compared to White teachers.

With respect to household characteristics, teachers who finalized a divorce are more likely to leave teaching than to stay at their schools. New teachers from households earning in the \$50,000-75,000 range are more likely to leave teaching than stay compared to those from households earning under \$50,000.

Having no state certification increases the relative odds of leaving teaching versus staying by a factor of 3.72. Certification status has no effect on the odds of moving schools.

Table 3.3. Multinomial Logit Estimates of Mobility for New Teachers

	Model I		Model II		Model III		Model IV	
	Leave	Switch	Leave	Switch	Leave	Switch	Leave	Switch
Charter (=1)	0.7562** (0.3467)	0.1255 (0.3293)	0.5538 (0.3452)	0.1026 (0.3333)	0.5148 (0.4086)	0.0857 (0.3753)	1.2204*** (0.4373)	0.3239 (0.4052)
Most Competitive College (=1)	0.6373 (0.6165)	-0.2485 (0.6596)	0.4706 (0.6513)	-0.2546 (0.6622)	0.7895 (0.6918)	-0.3723 (0.7076)	0.2537 (0.7260)	-0.3008 (0.7899)
Highly Competitive College (=1)	-0.2055 (0.5244)	-0.0472 (0.3689)	-0.1924 (0.5114)	-0.0238 (0.3698)	0.0123 (0.5295)	0.0177 (0.4224)	-0.2931 (0.5975)	0.2901 (0.5020)
Very Competitive College (=1)	0.3055 (0.3776)	0.1239 (0.3131)	0.2925 (0.3787)	0.1379 (0.3141)	0.2977 (0.4270)	0.1465 (0.3547)	-0.0558 (0.5047)	0.3236 (0.4436)
Competitive College (=1)	-0.0705 (0.3394)	-0.0021 (0.2743)	-0.0592 (0.3419)	0.0080 (0.2749)	-0.1089 (0.3777)	-0.0652 (0.3168)	-0.4045 (0.4539)	0.0171 (0.4061)
Less Competitive College (=1)	0.2828 (0.3788)	0.1270 (0.3131)	0.2972 (0.3778)	0.1273 (0.3131)	0.3601 (0.4137)	0.1379 (0.3526)	0.2369 (0.4897)	0.3257 (0.4361)
Graduate Degree (=1)	0.1321 (0.2794)	0.2097 (0.2199)	0.1722 (0.2889)	0.2152 (0.2202)	0.2636 (0.3236)	0.2347 (0.2340)	0.0254 (0.3545)	0.0521 (0.2667)
Years Teaching Total	1.4666* (0.8397)	-1.2170* (0.7197)	1.4678* (0.8462)	-1.2726* (0.7195)	0.9842 (0.9387)	-1.2412 (0.7727)	0.8102 (1.0408)	-1.7214** (0.8495)
Years Teaching Total Squared	-0.3416 (0.2111)	0.3592** (0.1784)	-0.3302 (0.2126)	0.3721** (0.1785)	-0.2200 (0.2363)	0.3673* (0.1919)	-0.1955 (0.2606)	0.4843** (0.2110)
Years Teaching at School	-1.3690*** (0.5050)	0.0699 (0.5167)	-1.3574*** (0.5044)	0.0966 (0.5189)	-1.0890* (0.6482)	0.2580 (0.5506)	-1.2182* (0.6576)	0.6277 (0.6151)
Years Teaching at School Squared	0.2434** (0.1100)	-0.0927 (0.1214)	0.2337** (0.1098)	-0.0998 (0.1224)	0.1508 (0.1485)	-0.1402 (0.1281)	0.1781 (0.1453)	-0.2088 (0.1445)
High School (=1)	0.7055*** (0.2058)	-0.1514 (0.1571)	0.6293*** (0.2072)	-0.1519 (0.1572)	0.6531** (0.2580)	-0.0254 (0.1865)	0.8871*** (0.2844)	-0.0116 (0.2088)
Union Member (=1)	-0.3929* (0.2169)	-0.3147* (0.1693)	-0.3953* (0.2165)	-0.3132* (0.1696)	-0.3274 (0.2311)	-0.2350 (0.1810)	-0.0152 (0.2767)	-0.2549 (0.2234)
Part Time Teacher (=1)	0.5721 (0.4648)	0.6671 (0.4382)	0.4888 (0.4825)	0.6825 (0.4391)	0.8905 (0.5440)	0.9413** (0.4726)	2.5143*** (0.6935)	1.7357*** (0.5999)
Log Yearly Earnings	-1.6533** (0.6606)	-0.5580 (0.4663)	-1.6111** (0.6875)	-0.5667 (0.4680)	-1.7340** (0.8070)	-0.6014 (0.5192)	0.2253 (0.9318)	0.5839 (0.6766)
Hours per Week	0.0009 (0.0098)	0.0014 (0.0079)	0.0018 (0.0100)	0.0016 (0.0079)	0.0015 (0.0107)	0.0005 (0.0086)	-0.0026 (0.0119)	-0.0001 (0.0093)
Age 20-24 yrs (=1)	0.2515 (0.3336)	-0.4122 (0.2695)	0.2749 (0.3310)	-0.4135 (0.2694)	0.3562 (0.3519)	-0.3715 (0.2947)	0.5412 (0.4045)	-0.4710 (0.3344)
Age 25-29 yrs (=1)	0.3785 (0.3328)	-0.4650* (0.2651)	0.3977 (0.3288)	-0.4597* (0.2650)	0.4195 (0.3602)	-0.4261 (0.2873)	0.6329 (0.4130)	-0.6284* (0.3363)
Age 30-34 yrs (=1)	0.4190 (0.4692)	-0.5043 (0.3758)	0.4283 (0.4692)	-0.5015 (0.3769)	0.4008 (0.4964)	-0.4311 (0.3954)	0.3400 (0.5423)	-0.6399 (0.4476)
Age 35-39 yrs (=1)	0.6692 (0.5066)	-0.7529* (0.4378)	0.6746 (0.5141)	-0.7480* (0.4375)	0.6011 (0.5505)	-0.7406 (0.4704)	0.7729 (0.6530)	-0.9871* (0.5120)
Age 40-44 yrs (=1)	0.8786* (0.5248)	-1.1320** (0.4864)	0.8894* (0.5320)	-1.1336** (0.4871)	1.1075** (0.5646)	-0.9182* (0.5269)	1.6045** (0.6272)	-0.9125 (0.6029)
Age 45-49 yrs (=1)	1.3378** (0.5766)	-0.5258 (0.5148)	1.3701** (0.5762)	-0.5092 (0.5150)	1.2128* (0.6252)	-0.4103 (0.5538)	1.5247** (0.7452)	-0.4923 (0.6197)
Age 50-54 yrs (=1)	0.2862 (0.6874)	-0.6837 (0.5954)	0.2755 (0.6889)	-0.6818 (0.5963)	0.4408 (0.7111)	-0.5409 (0.6100)	0.6981 (0.7584)	-0.8001 (0.7251)
Age 55-59 yrs (=1)	0.7437 (0.8582)	0.1412 (0.6184)	0.7172 (0.8579)	0.1534 (0.6240)	0.6508 (1.0101)	0.5856 (0.7115)	1.1017 (1.0019)	0.6786 (0.7584)
Age 60-64 yrs (=1)	1.9166* (1.0612)	-15.2416*** (0.9304)	1.8306* (0.9393)	-13.7737*** (0.8924)	1.9512* (1.0356)	-12.5183*** (0.8823)	2.3522** (1.1257)	-14.5463*** (0.9112)
Female (=1)	-0.1825 (0.2162)	-0.0896 (0.1840)	-0.1760 (0.2198)	-0.1029 (0.1853)	-0.1592 (0.2354)	-0.1709 (0.1983)	0.0071 (0.2713)	0.0013 (0.2272)
Black (=1)	-0.4636 (0.3495)	0.0293 (0.2580)	-0.6130* (0.3605)	0.0374 (0.2585)	-0.3086 (0.4531)	0.0140 (0.3494)	-0.4989 (0.4774)	0.0988 (0.3872)
Hispanic (=1)	0.1289 (0.4562)	0.3532 (0.3538)	-0.0062 (0.4538)	0.3358 (0.3541)	0.0459 (0.5160)	0.5343 (0.3861)	0.0606 (0.5092)	0.6562* (0.3948)
Got Divorced	1.3445* (0.7662)	0.6381 (0.6922)	1.3114* (0.7171)	0.6572 (0.6923)	1.1926 (0.7503)	0.8355 (0.6836)	1.5885* (0.8290)	0.6843 (0.6906)
Household Income \$50,000-\$75,000	0.3992 (0.2448)	0.1804 (0.2086)	0.4370* (0.2435)	0.1817 (0.2083)	0.4718* (0.2621)	0.2246 (0.2238)	0.6020** (0.2918)	0.3148 (0.2374)
Certification: None (=1)			1.0878*** (0.3370)	0.0526 (0.3349)	1.0630*** (0.3728)	0.0666 (0.3574)	1.3145*** (0.4235)	0.2673 (0.3793)
Certification: Other (=1)			0.1175 (0.2092)	-0.1017 (0.1628)	0.0549 (0.2243)	-0.1218 (0.1731)	0.3733 (0.2768)	0.1372 (0.1987)

Table 3.3. Multinomial Logit Estimates of Mobility for New Teachers (cont)

	Model I		Model II		Model III		Model IV	
	Leave	Switch	Leave	Switch	Leave	Switch	Leave	Switch
Teacher Agrees Satisfied with Teaching at Schl					-0.5420***	-0.3763***	-0.6757***	-0.4634***
					(0.1495)	(0.1327)	(0.1725)	(0.1458)
Teacher Agrees School Run Well					-0.1592	0.1142	-0.3538*	0.0618
					(0.1771)	(0.1423)	(0.1964)	(0.1537)
Teacher Agrees Thought about Transferring					0.1511	0.5678***	0.1067	0.5712***
					(0.1366)	(0.1100)	(0.1463)	(0.1211)
Teacher Agrees other Teachers Enforce Rules					-0.2006	0.1539	-0.1873	0.1869
					(0.1310)	(0.1045)	(0.1395)	(0.1151)
Teacher Has Control over Teaching Technique					-0.3622*	0.0618	-0.4522**	0.0334
					(0.1868)	(0.1625)	(0.2026)	(0.1756)
Teacher Has Control over Material					0.0534	-0.1451	0.0239	-0.1538
					(0.1091)	(0.0902)	(0.1197)	(0.0995)
Teacher Has Control over Discipline					-0.0314	0.0869	0.0129	0.1025
					(0.1632)	(0.1394)	(0.1794)	(0.1462)
Percent Students on IEP					0.2440	0.1657	0.3589	0.2065
					(0.3069)	(0.2345)	(0.3373)	(0.2621)
Percent Students on LEP					0.9271**	0.0788	0.6947	-0.0264
					(0.4385)	(0.3938)	(0.4761)	(0.4272)
Ave. Class Size					-0.0046	-0.0126*	-0.0022	-0.0145*
					(0.0092)	(0.0073)	(0.0092)	(0.0083)
Percent Students on School Lunch					0.0718	0.2115	0.0105	0.2055
					(0.4828)	(0.3793)	(0.5495)	(0.4363)
Percent Students Hispanic					-0.0815	0.2442	0.5165	0.5151
					(0.6957)	(0.5575)	(0.9125)	(0.7303)
Percent Students Black					-0.0700	0.4406	0.5866	1.2588*
					(0.7264)	(0.5604)	(0.8182)	(0.6530)
Percent Students Other Ethnicity					0.4088	-0.5724	-1.2796	-2.1263**
					(0.9260)	(0.8202)	(1.0763)	(1.0272)
Percent Teachers Black					-0.5760	-0.7171	-1.0883	-1.2337
					(0.9223)	(0.7808)	(0.9309)	(0.8323)
Percent Teachers Hispanic					-1.2936	-0.7302	-1.2285	-1.0578
					(0.9481)	(0.6381)	(1.0094)	(0.6991)
Percent Teachers Other Ethnicity					-0.5805	-0.0920	1.6053	1.3087
					(1.2517)	(1.0934)	(1.4823)	(1.6303)
School is for Problem Children (=1)					0.0156	-1.6982**	-0.0842	-2.1744**
					(0.6889)	(0.8652)	(0.7277)	(1.0186)
School Has Admissions Requirements (=1)					-1.0078***	-0.1963	-0.9412***	-0.0598
					(0.3374)	(0.2516)	(0.3528)	(0.2733)
School Has Teachers without Classrooms (=1)					-0.6004***	-0.1817	-0.5356**	-0.1382
					(0.2265)	(0.1800)	(0.2492)	(0.1985)
School Has Block Scheduling (=1)					-0.0260	0.0740	-0.0826	0.2000
					(0.2077)	(0.1677)	(0.2455)	(0.1858)
School Has 12 Month Schedule (=1)					0.6855	0.5472	0.6433	0.4307
					(0.5243)	(0.3630)	(0.5049)	(0.3624)
School Has Interdisciplinary Teaching (=1)					-0.0846	0.0810	-0.2299	0.0443
					(0.2333)	(0.1792)	(0.2682)	(0.1934)
School Has Team Teaching (=1)					0.1062	-0.1274	0.2574	-0.0681
					(0.2205)	(0.1694)	(0.2455)	(0.1841)
City (=1)							-0.2606	-0.4545
							(0.3187)	(0.2794)
Suburb (=1)							-0.1716	-0.0951
							(0.2995)	(0.2452)
State Effects & Urbanicity	No	No	No	No	No	No	Yes	Yes
Constant	15.5126**	7.5099	14.8758**	7.6486	20.2854**	7.0587	1.8768	-3.8002
	(6.7827)	(4.8666)	(7.0471)	(4.8838)	(8.4336)	(5.5306)	(9.7538)	(7.0362)
Observations		970	970	970	970	970	970	970

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Reference category is stay at school.

Other controls include hours per week, Other ethnicity, number of family members, number of children under 5, if the teacher got married between Dec 03 and Sept 04, marital status, household income categories above \$75,000. None of these were significant in the analysis.

School culture and experiences appear to matter more to newer teachers than they did to all teachers. Teachers who report being more satisfied with teaching are more likely to stay in their schools and are less likely to leave teaching or to move schools. Teachers who report greater satisfaction with how well their school is run are also less likely to leave teaching versus to stay. Teachers who agree more with the statement that they have thought about transferring are more likely to switch schools versus stay.

Autonomy matters to new teachers. Increases in the perceived amount of control teachers have in their classrooms over choosing their teaching techniques is associated with a decrease in the odds of leaving versus staying by a factor of 0.64.

Newer teachers are less likely to move schools versus stay if they have larger classes, though this effect is quite small and is significant at the 10% level. They are more likely to leave schools with larger percentages of black students, and they are less likely to leave schools with larger percentages of Asian, American Indian, or Pacific Islander students.

New teachers who teach at schools for problem children are less likely to move schools versus to stay. These results may reflect that some teachers enjoy working with higher risk students. Similarly, the results suggest that teaching at a school with admission requirements decreases the odds of leaving teaching compared to staying. Teachers who teach at schools with more classrooms are also less likely to leave teaching.

Thus far, the results suggest that among all teachers, charter status does not have an effect on teacher mobility. Teachers with a greater opportunity cost of teaching are more likely to leave teaching. Among new teachers, those teaching at a charter school are more likely to leave teaching. Newer teachers are also more sensitive to autonomy and control in their classrooms.

So far, the analysis has focused on all teachers, regardless of why they left or switched schools. Included in these teachers are those who voluntarily moved schools or left teaching as well as teachers who were forced to due to a school staffing action (e.g., lay off, unrenewed contract). Assuming schools act in their own best interest, it may be informative to examine what influences the decisions of voluntary leavers and movers.

Table 3.4 presents the multinomial logit results for all voluntary leavers and movers. The results indicate that again, model specification matters. For Models I through III, it appears that charter teachers are less likely to switch schools versus to stay in their school; however, including the geographic controls, charter status no longer has an effect on the mobility decision. Teachers from Most Competitive colleges are less likely to move schools versus to stay in their current schools. Teachers who have graduate degrees are more likely to leave teaching than to stay compared to those without a graduate degree. In general, teachers with a greater opportunity cost of teaching are more likely to leave teaching, including those who may have greater possibilities outside of teaching (those who teach high school, those who make less money, or those who have a graduate degree) and those who have more household responsibilities (e.g., more younger children).

Table 3.5 presents the results for new teachers who voluntarily leave. Again, the results are similar to the previous analysis with a few exceptions. In the full specification, teaching at a charter increases the odds of leaving versus staying by a factor of 3.04 compared to TPS teachers. Teachers who hail from Very Competitive colleges are more likely to switch schools versus those from Non Competitive colleges. Previously, college competitiveness did not affect teacher mobility among new teachers. Another notable difference is that married and divorced teachers are less likely to leave teaching than their single counterparts.

While charter status does not appear to matter in the full sample of leavers and movers, it does enter into the decision for new teachers. College competitiveness appears to affect the likelihood of moving schools but not of leaving teaching.

Table 3.4. Multinomial Logit Estimates of Mobility for All Voluntary Leavers/Movers

	Model I		Model II		Model III		Model IV	
	Leave	Switch	Leave	Switch	Leave	Switch	Leave	Switch
Charter (=1)	-0.1816 (0.2257)	-0.3339* (0.1941)	-0.2806 (0.2321)	-0.3421* (0.1953)	-0.3497 (0.2500)	-0.3646* (0.2132)	0.0119 (0.2766)	-0.1451 (0.2316)
Most Competitive College (=1)	0.0152 (0.5100)	-1.0717* (0.6038)	-0.0649 (0.5100)	-1.0929* (0.6066)	-0.0094 (0.4874)	-1.1003 (0.6755)	0.0413 (0.5202)	-1.2830* (0.7218)
Highly Competitive College (=1)	-0.0300 (0.2944)	-0.4497 (0.2766)	-0.0241 (0.2934)	-0.4472 (0.2764)	-0.0382 (0.2960)	-0.4082 (0.2902)	0.2869 (0.3411)	-0.2477 (0.3190)
Very Competitive College (=1)	-0.1781 (0.2152)	-0.1594 (0.1955)	-0.1763 (0.2152)	-0.1579 (0.1956)	-0.1503 (0.2231)	-0.0981 (0.2124)	0.1096 (0.2571)	0.0721 (0.2385)
Competitive College (=1)	-0.3186* (0.1850)	-0.2153 (0.1695)	-0.3231* (0.1849)	-0.2150 (0.1696)	-0.3312* (0.1899)	-0.2487 (0.1852)	-0.1043 (0.2197)	-0.1552 (0.2092)
Less Competitive College (=1)	0.0314 (0.1961)	-0.1037 (0.1815)	0.0289 (0.1957)	-0.1027 (0.1816)	0.0438 (0.2003)	-0.0927 (0.1964)	0.1924 (0.2251)	-0.0322 (0.2165)
Graduate Degree (=1)	0.3443*** (0.1141)	0.1254 (0.1018)	0.3487*** (0.1149)	0.1259 (0.1018)	0.3823*** (0.1194)	0.1661 (0.1082)	0.3089** (0.1280)	0.0898 (0.1129)
Years Teaching Total	0.0631** (0.0263)	0.0694*** (0.0232)	0.0634** (0.0269)	0.0688*** (0.0239)	0.0542** (0.0274)	0.0584** (0.0256)	0.0398 (0.0289)	0.0584** (0.0265)
Years Teaching Total Squared	-0.0010 (0.0007)	-0.0014** (0.0007)	-0.0011 (0.0008)	-0.0014** (0.0007)	-0.0008 (0.0008)	-0.0010 (0.0007)	-0.0006 (0.0008)	-0.0013* (0.0008)
Years Teaching at School	-0.1064*** (0.0249)	-0.1018*** (0.0229)	-0.1073*** (0.0250)	-0.1024*** (0.0230)	-0.1131*** (0.0260)	-0.1123*** (0.0247)	-0.1141*** (0.0274)	-0.1184*** (0.0257)
Years Teaching at School Squared	0.0031*** (0.0008)	0.0015* (0.0008)	0.0031*** (0.0008)	0.0015* (0.0008)	0.0033*** (0.0009)	0.0021** (0.0009)	0.0034*** (0.0009)	0.0023** (0.0009)
High School (=1)	0.6544*** (0.1087)	0.1088 (0.0916)	0.6460*** (0.1090)	0.1091 (0.0916)	0.6282*** (0.1280)	0.1119 (0.1119)	0.7006*** (0.1364)	0.1381 (0.1181)
Union Member (=1)	-0.3683*** (0.1134)	-0.4238*** (0.1002)	-0.3588*** (0.1136)	-0.4216*** (0.1002)	-0.3573*** (0.1155)	-0.3628*** (0.1070)	-0.1868 (0.1304)	-0.2753** (0.1185)
Part Time Teacher (=1)	0.3592 (0.2410)	-0.1790 (0.2454)	0.3545 (0.2426)	-0.1734 (0.2448)	0.3843 (0.2531)	-0.0088 (0.2524)	0.4930* (0.2832)	0.1452 (0.2713)
Log Yearly Earnings	-1.1429*** (0.2380)	-0.7549*** (0.2146)	-1.1341*** (0.2396)	-0.7571*** (0.2140)	-1.0919*** (0.2567)	-0.7151*** (0.2335)	-0.4142 (0.3015)	-0.0907 (0.2604)
Age 30-34 yrs (=1)	0.5546 (0.3533)	0.1321 (0.2850)	0.5484 (0.3514)	0.1308 (0.2851)	0.6206* (0.3518)	0.1942 (0.3062)	0.5352 (0.3718)	0.1738 (0.3171)
Age 35-39 yrs (=1)	0.5417 (0.3679)	-0.1146 (0.2987)	0.5439 (0.3664)	-0.1154 (0.2987)	0.5975 (0.3682)	-0.0312 (0.3204)	0.3939 (0.3871)	-0.1278 (0.3319)
Age 40-44 yrs (=1)	0.2398 (0.3807)	-0.3496 (0.3078)	0.2446 (0.3796)	-0.3486 (0.3076)	0.3192 (0.3808)	-0.3178 (0.3291)	0.1895 (0.4033)	-0.3617 (0.3420)
Age 45-49 yrs (=1)	0.1312 (0.3857)	-0.2435 (0.3034)	0.1347 (0.3848)	-0.2439 (0.3034)	0.1672 (0.3842)	-0.1520 (0.3254)	0.0054 (0.4029)	-0.2087 (0.3363)
Age 50-54 yrs (=1)	-0.0350 (0.3899)	-0.2635 (0.3025)	-0.0363 (0.3893)	-0.2647 (0.3023)	0.0416 (0.3882)	-0.0975 (0.3269)	-0.1638 (0.4093)	-0.1853 (0.3418)
Age 55-59 yrs (=1)	-0.2532 (0.3994)	-0.5741* (0.3207)	-0.2443 (0.3991)	-0.5742* (0.3206)	-0.1501 (0.3977)	-0.3862 (0.3407)	-0.4725 (0.4209)	-0.4787 (0.3528)
Age 60-64 yrs (=1)	0.3918 (0.4752)	-0.6340 (0.4177)	0.4071 (0.4748)	-0.6362 (0.4175)	0.6327 (0.4769)	-0.3516 (0.4555)	0.2673 (0.4954)	-0.5337 (0.4697)
Female (=1)	-0.2979** (0.1165)	0.1159 (0.1071)	-0.2957** (0.1170)	0.1153 (0.1072)	-0.2995** (0.1218)	0.1459 (0.1125)	-0.2792** (0.1310)	0.1890 (0.1172)
Other Ethnicity (=1)	0.1854 (0.2379)	0.5689*** (0.1937)	0.1961 (0.2361)	0.5722*** (0.1934)	-0.0175 (0.2640)	0.2789 (0.2246)	0.0351 (0.2884)	0.2537 (0.2346)
No. Children Under 5	0.2546*** (0.0909)	0.1017 (0.0819)	0.2594*** (0.0911)	0.1010 (0.0819)	0.2953*** (0.0927)	0.1282 (0.0876)	0.3123*** (0.0973)	0.1297 (0.0891)
Got Divorced	-0.2237 (0.5019)	0.6450* (0.3490)	-0.2320 (0.4981)	0.6475* (0.3490)	-0.0472 (0.5059)	0.8573** (0.3750)	-0.3521 (0.5329)	0.8084** (0.3646)
Household Income \$100,000+	0.1720 (0.1516)	-0.1417 (0.1385)	0.1787 (0.1522)	-0.1412 (0.1384)	0.1960 (0.1581)	-0.0998 (0.1442)	0.4072** (0.1698)	0.0369 (0.1497)
Certification: None (=1)			0.7384** (0.2886)	0.1344 (0.2897)	0.7837*** (0.3011)	0.2296 (0.3137)	0.9999*** (0.3345)	0.4210 (0.3323)
Certification: Other (=1)			-0.1528 (0.1593)	-0.0423 (0.1370)	-0.1043 (0.1618)	-0.0108 (0.1472)	0.1576 (0.1766)	0.1969 (0.1557)

Table 3.4. Multinomial Logit Estimates of Mobility for All Voluntary Leavers/Movers (cont)

	Model I		Model II		Model III		Model IV	
	Leave	Switch	Leave	Switch	Leave	Switch	Leave	Switch
Teacher Agrees Satisfied with Teaching at School					-0.4541***	-0.2167***	-0.4389***	-0.2148***
					(0.0805)	(0.0741)	(0.0855)	(0.0760)
Teacher Agrees School Run Well					-0.1015	0.1152	-0.1519*	0.0939
					(0.0842)	(0.0764)	(0.0884)	(0.0786)
Teacher Agrees Thought about Transferring					0.0375	0.6320***	0.0091	0.6215***
					(0.0676)	(0.0598)	(0.0707)	(0.0613)
Teacher Agrees other Teachers Enforce Rules					0.0405	0.0292	0.0513	0.0205
					(0.0667)	(0.0577)	(0.0686)	(0.0592)
Teacher Has Control over Teaching Technique					-0.0248	0.0618	-0.0157	0.0450
					(0.0912)	(0.0861)	(0.0958)	(0.0880)
Teacher Has Control over Material					0.0386	-0.0574	0.0140	-0.0505
					(0.0559)	(0.0507)	(0.0592)	(0.0523)
Teacher Has Control over Discipline					0.0010	-0.0328	-0.0172	-0.0422
					(0.0835)	(0.0768)	(0.0893)	(0.0780)
Percent Students on IEP					0.1471	0.1322	0.2223	0.1959
					(0.1510)	(0.1366)	(0.1610)	(0.1428)
Percent Students on LEP					0.0948	0.2794	0.0649	0.2532
					(0.2184)	(0.2008)	(0.2349)	(0.2158)
Ave. Class Size					0.0009	-0.0018	0.0011	-0.0032
					(0.0045)	(0.0040)	(0.0047)	(0.0042)
Percent Students on School Lunch					-0.2447	0.0104	-0.4850*	-0.0954
					(0.2560)	(0.2118)	(0.2915)	(0.2316)
Percent Students Hispanic					0.0312	-0.1905	0.6394	0.0547
					(0.3614)	(0.3379)	(0.4542)	(0.4135)
Percent Students Black					0.3401	0.6491**	0.9000**	1.0022***
					(0.3767)	(0.3146)	(0.4193)	(0.3535)
Percent Students Other Ethnicity					1.7729***	0.7915	1.2212*	0.5181
					(0.5410)	(0.4960)	(0.6346)	(0.5688)
Percent Teachers Black					-0.4708	-0.4940	-0.5666	-0.7452
					(0.4970)	(0.4407)	(0.5365)	(0.4571)
Percent Teachers Hispanic					-0.6332	-0.6388	-0.4647	-0.4081
					(0.5191)	(0.5006)	(0.5827)	(0.5257)
Percent Teachers Other Ethnicity					-1.3679	0.8393	-2.2629*	0.2981
					(0.9635)	(0.6812)	(1.1682)	(0.7535)
School is for Problem Children (=1)					-0.1061	0.2626	-0.0660	0.2883
					(0.4648)	(0.4036)	(0.5107)	(0.4386)
School Has Admissions Requirements (=1)					-0.1680	-0.1623	-0.0738	-0.1108
					(0.1704)	(0.1576)	(0.1763)	(0.1620)
School Has Teachers without Classrooms (=1)					-0.3497***	-0.1786*	-0.3223***	-0.1125
					(0.1141)	(0.1039)	(0.1224)	(0.1097)
School Has Block Scheduling (=1)					0.0908	-0.0231	0.0030	-0.0046
					(0.1065)	(0.0971)	(0.1170)	(0.1037)
School Has 12 Month Schedule (=1)					0.5607**	0.6612***	0.4865*	0.5346**
					(0.2632)	(0.2238)	(0.2759)	(0.2326)
School Has Interdisciplinary Teaching (=1)					0.1011	0.1715*	0.0616	0.1772*
					(0.1102)	(0.1022)	(0.1198)	(0.1060)
School Has Team Teaching (=1)					-0.0990	-0.1018	-0.0978	-0.0700
					(0.1099)	(0.1001)	(0.1202)	(0.1042)
City (=1)							0.0244	0.0982
							(0.1623)	(0.1464)
Suburb (=1)							-0.0123	0.0381
							(0.1459)	(0.1292)
State Effects & Urbanicity	No	No	No	No	No	No	Yes	Yes
Constant	10.7868***	7.8627***	10.6831***	7.8923***	11.7972***	6.1108**	5.4211*	0.2316
	(2.4797)	(2.2417)	(2.4974)	(2.2390)	(2.7247)	(2.4654)	(3.1626)	(2.7329)
Observations	3050	3050	3050	3050	3050	3050	3050	3050

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Reference category is stay at school.

Other controls include ages 20-24 and 25-29, hours per week, Black or Hispanic ethnicity, number of family members, if the teacher got married between Dec 03 and Sept 04, marital status, household income categories under \$100,000. None of these were significant in the analysis.

Table 3.5. Multinomial Logit Estimates of Mobility for All New Voluntary Leavers/Movers

	Model I		Model II		Model III		Model IV	
	Leave	Switch	Leave	Switch	Leave	Switch	Leave	Switch
Charter (=1)	0.4490 (0.3959)	0.1410 (0.3574)	0.2267 (0.4015)	0.0999 (0.3582)	-0.0463 (0.4920)	0.0506 (0.4072)	1.1139** (0.5561)	0.3607 (0.4374)
Most Competitive College (=1)	0.8886 (0.7257)	0.3909 (0.7306)	0.6648 (0.7436)	0.3770 (0.7351)	1.2115 (0.8600)	0.5507 (0.8440)	1.0842 (0.9131)	0.7271 (0.9261)
Highly Competitive College (=1)	0.0854 (0.6184)	0.0354 (0.4404)	0.1357 (0.6093)	0.0402 (0.4435)	0.3309 (0.6312)	0.1932 (0.4903)	-0.1412 (0.7307)	0.4743 (0.5993)
Very Competitive College (=1)	0.7088 (0.4657)	0.5422 (0.3775)	0.7232 (0.4702)	0.5445 (0.3808)	0.7220 (0.5252)	0.7324* (0.4228)	0.3507 (0.6511)	0.9095* (0.5393)
Competitive College (=1)	0.1684 (0.4378)	0.4044 (0.3387)	0.2151 (0.4427)	0.3989 (0.3425)	0.1592 (0.4842)	0.4392 (0.3796)	-0.2330 (0.5902)	0.4908 (0.4944)
Less Competitive College (=1)	0.3957 (0.4839)	0.4691 (0.3869)	0.4409 (0.4846)	0.4542 (0.3896)	0.4045 (0.5271)	0.5441 (0.4295)	0.1448 (0.6411)	0.7328 (0.5362)
Graduate Degree (=1)	0.4632 (0.3273)	0.4171 (0.2566)	0.5151 (0.3430)	0.4238* (0.2574)	0.6568 (0.4107)	0.5077* (0.2788)	0.5720 (0.4551)	0.2693 (0.3132)
Years Teaching Total	1.6015 (0.9798)	-1.6690** (0.8485)	1.5256 (0.9805)	-1.7517** (0.8463)	1.2737 (1.0984)	-2.2153** (0.9050)	0.9652 (1.2536)	-2.6745*** (0.9860)
Years Teaching Total Squared	-0.4152* (0.2480)	0.4857** (0.2090)	-0.3883 (0.2486)	0.5055** (0.2090)	-0.3307 (0.2781)	0.6304*** (0.2246)	-0.2603 (0.3138)	0.7512*** (0.2441)
Years Teaching at School	-1.3288** (0.6104)	0.0250 (0.5233)	-1.3018** (0.6094)	0.0417 (0.5269)	-1.5096** (0.6880)	0.1673 (0.5766)	-1.7214* (0.8938)	0.3526 (0.6862)
Years Teaching at School Squared	0.2512* (0.1353)	-0.0881 (0.1193)	0.2444* (0.1357)	-0.0946 (0.1207)	0.2642* (0.1529)	-0.1313 (0.1315)	0.3075 (0.2064)	-0.1674 (0.1627)
High School (=1)	0.9795*** (0.2450)	-0.1090 (0.1804)	0.9198*** (0.2457)	-0.1055 (0.1804)	0.7992** (0.3107)	0.0250 (0.2158)	1.1758*** (0.3569)	0.0283 (0.2464)
Union Member (=1)	-0.5589** (0.2509)	-0.5360*** (0.1935)	-0.5582** (0.2505)	-0.5323*** (0.1935)	-0.6427** (0.2744)	-0.4785** (0.2114)	-0.0941 (0.3409)	-0.4706* (0.2575)
Part Time Teacher (=1)	0.5762 (0.5399)	0.0724 (0.5192)	0.5026 (0.5654)	0.0962 (0.5182)	0.7155 (0.6658)	0.1796 (0.5522)	2.6315*** (0.8106)	0.8827 (0.7029)
Log Yearly Earnings	-1.9460** (0.8833)	-1.0090* (0.5587)	-1.9916** (0.9437)	-1.0183* (0.5641)	-2.3433** (1.1367)	-1.0574* (0.6273)	0.2147 (1.2779)	0.2975 (0.8268)
Age 20-24 yrs (=1)	0.5908 (0.3836)	-0.0631 (0.3057)	0.6292 (0.3828)	-0.0577 (0.3050)	0.7038* (0.4116)	-0.0020 (0.3335)	0.9729** (0.4862)	-0.0741 (0.3690)
Age 25-29 yrs (=1)	0.6074 (0.3753)	-0.2709 (0.3008)	0.6319* (0.3699)	-0.2579 (0.3013)	0.5685 (0.4149)	-0.2116 (0.3280)	0.8689* (0.4871)	-0.4146 (0.3769)
Age 30-34 yrs (=1)	0.5811 (0.5444)	-0.2245 (0.4297)	0.6615 (0.5448)	-0.2124 (0.4320)	0.6751 (0.5692)	-0.0854 (0.4621)	0.6529 (0.6572)	-0.2961 (0.5173)
Age 35-39 yrs (=1)	0.9773* (0.5858)	-0.7955 (0.5008)	0.9935* (0.5969)	-0.7686 (0.5001)	1.0871* (0.6419)	-0.6350 (0.5377)	1.2329 (0.7869)	-0.9325 (0.5920)
Age 40-44 yrs (=1)	0.8821 (0.6319)	-0.9848* (0.5764)	0.9269 (0.6365)	-0.9722* (0.5760)	1.0364 (0.6986)	-0.7709 (0.6332)	1.7530** (0.7651)	-0.7322 (0.7131)
Age 45-49 yrs (=1)	1.5970** (0.6360)	-0.8948 (0.5949)	1.6536*** (0.6326)	-0.8879 (0.5950)	1.6046** (0.6642)	-0.7768 (0.6357)	2.1043*** (0.8073)	-1.0173 (0.6799)
Age 50-54 yrs (=1)	0.9068 (0.8113)	-0.4453 (0.7058)	0.9239 (0.8184)	-0.4588 (0.7030)	1.1179 (0.7992)	-0.4569 (0.7743)	1.1616 (0.9738)	-0.6760 (0.9080)
Age 55-59 yrs (=1)	0.9242 (0.9640)	-0.2515 (0.7442)	0.9752 (0.9745)	-0.2311 (0.7597)	0.6923 (1.0056)	0.0218 (0.7789)	0.6470 (1.0381)	0.0384 (0.8479)
Age 60-64 yrs (=1)	1.5669 (1.1552)	-13.0758*** (0.9019)	1.7191 (1.1318)	-13.1015*** (0.9114)	0.8324 (1.0108)	-11.8311*** (0.8942)	0.7554 (1.2766)	-12.3516** (0.9854)
Black (=1)	-0.5938 (0.4062)	0.0340 (0.2886)	-0.7380* (0.4200)	0.0319 (0.2908)	-0.2851 (0.5267)	-0.0350 (0.3955)	-0.5393 (0.5542)	0.0682 (0.4495)
Married Dec. 2003	-0.4744 (0.2994)	-0.0007 (0.2540)	-0.4763 (0.3021)	0.0066 (0.2540)	-0.5519* (0.3334)	-0.1552 (0.2754)	-0.8067** (0.3985)	-0.2544 (0.3168)
Separated/Divorced Dec. 2003	-0.8752 (0.5365)	0.0964 (0.4176)	-0.8590 (0.5322)	0.1116 (0.4146)	-1.1631** (0.5504)	-0.1506 (0.4451)	-1.5556*** (0.5809)	-0.3842 (0.4775)
Household Income \$50,000-\$75,000	0.5438* (0.2847)	0.0744 (0.2488)	0.5366* (0.2842)	0.0729 (0.2489)	0.5758* (0.3078)	0.0894 (0.2672)	0.8651** (0.3477)	0.2513 (0.2835)
Certification: None (=1)			1.1953*** (0.4015)	0.1721 (0.3889)	1.2207*** (0.4719)	0.1923 (0.4195)	1.7305*** (0.5557)	0.3662 (0.4576)
Certification: Other (=1)			0.0819 (0.2442)	-0.1559 (0.1904)	-0.0217 (0.2679)	-0.1672 (0.2041)	0.4115 (0.3514)	0.1328 (0.2395)

Table 3.5. Multinomial Logit Estimates of Mobility for All New Voluntary Leavers/Movers (cont)

	Model I		Model II		Model III		Model IV	
	Leave	Switch	Leave	Switch	Leave	Switch	Leave	Switch
Teacher Agrees Satisfied with Teaching at School					-0.4490***	-0.2832*	-0.6173***	-0.3744**
					(0.1703)	(0.1546)	(0.2104)	(0.1676)
Teacher Agrees School Run Well					-0.2170	0.2739*	-0.4514*	0.2059
					(0.2113)	(0.1632)	(0.2498)	(0.1840)
Teacher Agrees Thought about Transferring					0.2357	0.7483***	0.1316	0.7756***
					(0.1561)	(0.1309)	(0.1704)	(0.1498)
Teacher Agrees other Teachers Enforce Rules					-0.3256**	0.0702	-0.3601**	0.1124
					(0.1577)	(0.1197)	(0.1731)	(0.1294)
Teacher Has Control over Teaching Technique					-0.6265***	0.1107	-0.7552***	0.1211
					(0.2116)	(0.1906)	(0.2371)	(0.2069)
Teacher Has Control over Material					0.1581	-0.0174	0.1656	0.0065
					(0.1372)	(0.1045)	(0.1517)	(0.1189)
Teacher Has Control over Discipline					0.1362	-0.0886	0.1670	-0.1446
					(0.1978)	(0.1582)	(0.2164)	(0.1672)
Percent Students on IEP					0.4399	-0.0430	0.5448	-0.0521
					(0.3591)	(0.2794)	(0.4189)	(0.3201)
Percent Students on LEP					0.9930**	-0.0589	0.6431	-0.3360
					(0.4878)	(0.4444)	(0.5181)	(0.4944)
Ave. Class Size					-0.0041	-0.0154*	-0.0053	-0.0231**
					(0.0106)	(0.0086)	(0.0109)	(0.0104)
Percent Students on School Lunch					-0.5362	0.0808	-1.1197*	0.0548
					(0.5960)	(0.4240)	(0.6736)	(0.4755)
Percent Students Hispanic					0.2002	0.5585	1.3813	0.6357
					(0.7800)	(0.6308)	(1.0508)	(0.8437)
Percent Teachers Black					-1.0511	-0.7328	-1.5370	-1.0776
					(1.2040)	(0.7923)	(1.2684)	(0.8460)
Percent Teachers Hispanic					-1.1352	-1.0706	-1.1729	-0.9065
					(1.1060)	(0.8106)	(1.3293)	(0.8757)
Percent Teachers Other Ethnicity					-3.1018	0.3377	-2.2433	1.8416
					(3.0941)	(1.5369)	(3.9905)	(1.7611)
School is for Problem Children (=1)					-0.1846	-2.3138**	-0.3236	-2.6116**
					(1.0396)	(1.0144)	(1.0802)	(1.1509)
School Has Admissions Requirements (=1)					-0.6971*	-0.1585	-0.5777	0.0011
					(0.3902)	(0.2815)	(0.4028)	(0.3099)
School Has Teachers without Classrooms (=1)					-0.5366**	-0.3223	-0.4612	-0.2159
					(0.2614)	(0.2077)	(0.2955)	(0.2258)
School Has Block Scheduling (=1)					-0.1312	0.1575	-0.2791	0.2849
					(0.2448)	(0.1967)	(0.3046)	(0.2186)
School Has 12 Month Schedule (=1)					0.2184	0.3922	0.4032	0.1938
					(0.7113)	(0.4342)	(0.7237)	(0.4178)
School Has Interdisciplinary Teaching (=1)					-0.4236	-0.0909	-0.4695	-0.2001
					(0.2651)	(0.2102)	(0.3141)	(0.2304)
School Has Team Teaching (=1)					0.2632	-0.1055	0.3709	0.0171
					(0.2542)	(0.1980)	(0.2970)	(0.2123)
City (=1)							-0.4366	-0.4854
							(0.4049)	(0.3331)
Suburb (=1)							-0.2616	0.1256
							(0.3613)	(0.2874)
State Effects & Urbanicity	No	No	No	No	No	No	Yes	Yes
Constant	15.5126**	7.5099	17.5120*	11.7088**	25.8742**	10.7333	2.4448	-2.0362
	(6.7827)	(4.8666)	(9.7265)	(5.8935)	(12.0127)	(6.6379)	(13.4520)	(8.5799)
Observations	750	750	750	750	750	750	750	750

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Reference category is stay at school.

Other controls include hours per week, female, Hispanic or other ethnicity, number of children under 5, number of family members, if the teacher got married or divorced between Dec 03 and Sept 04, marital status, household income categories above \$75,000. None of these were significant in the

3.5.3 Marginal Effects

While it is informative to understand how charter status and college competitiveness affect mobility decisions in general, it is also informative to analyze the marginal effects of these variables. Given the previous analysis on model specification, this study estimated the average marginal effects for the full specification (Model IV) for all four populations: all teachers, new teachers, all voluntary movers and leavers, and new voluntary leavers and movers⁵.

The average marginal effects for the variables of interest are presented in Table 3.6⁶. Charter status does not have an effect on the mobility decision for all teachers nor for all voluntary leavers and movers. For new teachers, the average marginal effect of teaching at a charter school decreases the probability of staying in the school by roughly 11.0 percentage points, and it increases the probability of leaving by nearly 11.9 percentage points. Among new teachers who voluntarily left teaching or switched schools, teaching at a charter school increases the probability of leaving teaching by 9.6 percentage points. It no longer significantly affects the probability of staying. These results suggest that while new charter teachers are more likely to leave teaching, some of this effect is due to school staffing issues. That is, the marginal effect appears bigger for all new teachers, including those who were forced to attrit, than it is for those teachers who voluntarily left. This may reflect that charter schools are exerting their power to control staffing and to choose to keep those teachers who are the better fit for their schools. A caution in this finding, however, is that among those who were forced to attrit, it is unclear if these teachers would have chosen to stay, leave, or switch schools regardless of the school's decision.

⁵ The average marginal effects were calculated for all models for all populations and are available upon request.

⁶ The average marginal effects for all other controls and variables are available upon request.

Table 3.6. Average Marginal Effects of Multinomial Logit of Mobility for Variables of Interest, by Sample

	All Teachers			New Teachers		
	Stay	Leave	Switch	Stay	Leave	Switch
Charter (=1)	0.0118 (0.0380)	0.0431 (0.0325)	-0.0549 (0.0360)	-0.1097* (0.0662)	0.1187*** (0.0426)	-0.0089 (0.0654)
Most Competitive College (=1)	0.1612* (0.0959)	0.0809 (0.0684)	-0.2422** (0.1085)	0.0237 (0.1214)	0.0451 (0.0759)	-0.0688 (0.1332)
Highly Competitive College (=1)	-0.0054 (0.0501)	0.0392 (0.0407)	-0.0339 (0.0476)	-0.0201 (0.0820)	-0.0490 (0.0623)	0.0690 (0.0847)
Very Competitive College (=1)	-0.0113 (0.0380)	0.0087 (0.0313)	0.0027 (0.0364)	-0.0377 (0.0716)	-0.0242 (0.0524)	0.0619 (0.0746)
Competitive College (=1)	0.0340 (0.0331)	-0.0078 (0.0263)	-0.0262 (0.0316)	0.0207 (0.0653)	-0.0463 (0.0471)	0.0256 (0.0684)
Less Competitive College (=1)	-0.0097 (0.0340)	0.0262 (0.0272)	-0.0165 (0.0328)	-0.0545 (0.0703)	0.0084 (0.0508)	0.0461 (0.0732)
Graduate Degree (=1)	0.0270 (0.0182)	0.0384** (0.0159)	-0.0114 (0.0180)	-0.0080 (0.0460)	-0.0001 (0.0358)	0.0081 (0.0436)
State Effects & Urbanicity	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3500	3500	3500	970	970	970
	All Voluntary Leavers/Switchers			New Voluntary Leavers/Switchers		
	Stay	Leave	Switch	Stay	Leave	Switch
Charter (=1)	0.0161 (0.0414)	0.0107 (0.0357)	-0.0268 (0.0380)	-0.1063 (0.0716)	0.0961* (0.0513)	0.0102 (0.0677)
Most Competitive College (=1)	0.1478 (0.1069)	0.0853 (0.0706)	-0.2332* (0.1215)	-0.1498 (0.1401)	0.0765 (0.0860)	0.0733 (0.1455)
Highly Competitive College (=1)	0.0064 (0.0555)	0.0558 (0.0428)	-0.0623 (0.0512)	-0.0505 (0.0931)	-0.0358 (0.0712)	0.0863 (0.0965)
Very Competitive College (=1)	-0.0172 (0.0413)	0.0110 (0.0327)	0.0062 (0.0386)	-0.1314 (0.0832)	-0.0059 (0.0633)	0.1373 (0.0861)
Competitive College (=1)	0.0265 (0.0361)	-0.0051 (0.0276)	-0.0214 (0.0336)	-0.0475 (0.0766)	-0.0458 (0.0573)	0.0933 (0.0792)
Less Competitive College (=1)	-0.0114 (0.0371)	0.0292 (0.0284)	-0.0177 (0.0349)	-0.0982 (0.0834)	-0.0186 (0.0614)	0.1169 (0.0848)
Graduate Degree (=1)	-0.0351* (0.0195)	0.0380** (0.0167)	-0.0030 (0.0188)	-0.0649 (0.0548)	0.0455 (0.0407)	0.0194 (0.0464)
State Effects & Urbanicity	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3050	3050	3050	750	750	750

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Reference category for original multinomial logit is stay at school.

Average marginal effects reported for Model IV specification.

With respect to college competitiveness, among all teachers, the average marginal effect of graduating from a Most Competitive college increases the probability of staying in their schools by 16.1 percentage points and it decreases the probability of switching schools by 24.2 percentage points. It does not

significantly affect the decision to leave. Among voluntary leavers and movers, the average marginal effect of graduating from a Most Competitive college decreases the probability of moving schools by roughly 23.3 percentage points. The average marginal effects of college competitiveness are not significant for new teachers. Therefore, it appears that teachers graduating from the top colleges are less likely to move schools than are teachers graduating from lower-ranked colleges. This may be indicative of the fact that these teachers were able to find a better match with their schools as they may have been the most desirable teachers and able to choose their ideal schools.

Thus, the marginal effects indicate that among new teachers, teaching at a charter school increases the probability of leaving teaching by 9.6 to 11.9 percentage points. Part of the attrition from charter schools may be charters exercising their ability to keep only teachers who are the best fit for their schools. Graduating from a better college does not affect the mobility decision of new teachers, but it significantly reduces the probability of moving schools by roughly 23 to 24 percentage points. Furthermore, among all teachers, including voluntary and involuntary leavers, teachers graduating from a Most Competitive college are 16.1 percentage points more likely to stay at their current schools than to switch schools or to leave teaching.

3.6 CONCLUSIONS

This study investigates teacher mobility in the public school system. It attempts to clarify ambiguity in the literature. In particular, this study investigates attrition, as measured by leaving teaching and moving schools, in charter and public schools. It finds that different specifications of the model and different samples of teachers contribute to the ambiguity in the literature. Household characteristics enter into the teacher mobility decision, though these are often overlooked in the literature.

In the fully specified model for all teachers, charter status does not affect teacher mobility. Among new teachers, charter teachers are more likely to leave teaching versus to stay in teaching compared to traditional public school teachers. The odds increase by a factor of 2.13 for all new teachers and by a factor

of 3.04 for new teachers who voluntarily leave. A potential limitation to this analysis is that it treats all charter schools the same, although they do vary quite significantly, even from charter to charter within states.

The marginal effect analysis indicates that among all new teachers, the average marginal effect of teaching at a charter school increases the probability of leaving teaching by 11.9 percentage points. Meanwhile, among new teachers who voluntarily left, the average marginal effect of teaching at a charter increases the probability of leaving teaching by 9.6 percentage points. The difference in the two rates may reflect charter schools exercising their freedom to let go of teachers that are not a good fit for their schools.

The marginal effect analysis also indicates that graduating from a Most Competitive college does not increase the probability of leaving teaching but it does reduce the probability of moving schools. College competitiveness does not affect mobility decisions of new teachers.

In sum, charter status appears to affect the mobility decisions of new teachers, while college competitiveness affects decisions of more tenured teachers. The multinomial logit results suggest that household characteristics do enter into teachers' mobility decisions, even though these characteristics are often ignored in the literature. Furthermore, teachers who have the greatest opportunity costs of teaching are more likely to leave than those with lower opportunity costs. These include high school teachers, teachers with graduate degrees, and teachers with greater responsibilities outside of the classroom (e.g., more children under the age of five). Ambiguities in the literature are due to different model specifications and different teacher populations, including newer and older teachers as well as voluntary and involuntary leavers.

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