WOULD SCHOOL CHOICE CHANGE THE TEACHING PROFESSION?

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Abstract

When parents have some form of school choice, schools should want to hire and keep teachers who help them attract students. Thus, choice may affect how schools structure teaching jobs and teachers' pay. This paper investigates whether schools that face choice-based incentives actually do create teaching jobs that are different. Using data on traditional forms of choice (Tiebout choice, choice of private schools) and a new survey of charter school teachers, I find evidence that suggests that choice makes schools place more value on teachers' effort, teachers' independence, the quality of teachers' college education, and teachers' math and science skills.

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I. Introduction

Teachers' organizations, such as the National Education Association and the American Federation of Teachers, have been antagonistic to school choice in its various forms (charter schools, vouchers, tax credits for private school tuition, and inter-district choice). This antagonistic stance has created the impression in Americans' minds that teachers stand to lose from school choice. Yet, economics suggests that school choice could change the teaching profession in ways that many incumbent and potential teachers would like. In particular, theory suggests that schools that face choice-based incentives would have a greater demand for teachers who raise a schools' ability to attract students. Teachers who attract students are likely to have certain characteristics, so the practical effect of choice might be to raise schools' demand for teachers with these characteristics. Thus, school choice might affect who became (and remained) a teacher. In this paper, I investigate whether schools that face choice-based incentives actually do demand teachers with different characteristics and (if so) what those characteristics are. I study whom schools hire, how schools structure teaching jobs, and which teacher characteristics schools reward with higher pay. Using data on traditional forms of choice (Tiebout choice, choice of private schools) and a new survey of charter school teachers, I find evidence that school choice *would* change the teaching profession–by raising the demand for teachers with high quality college education, teachers with math and science skills, teachers who make effort, and teachers who assume responsibility. I also find that school choice would *lower* the demand for certain credentials that are not valued by the labor market, such as certification. The contrast between the results on teachers' education and teachers' certification suggests that schools facing choice care a lot about the *content* of a teacher's education but little about a seal of approval that may correspond poorly to actual skills.

If school choice were to affect schools' demand for certain teacher characteristics, then it would create winners and losers among incumbent teachers–some of whom would find greater, and others of

whom would find less, demand for their services. Society should not, however, be interested only in the effect of choice on *incumbent* teachers. Society may be equally interested in the interests of people who *would be* teachers in an environment of greater school choice. Moreover, society is presumably mainly interested in the education that children receive, and this is a function of who teaches, the structure of teaching jobs, and teachers' pay.

One might expect that school choice would affect the teaching profession only very slowly, but this expectation is at least partly wrong. Consider the state of Arizona, where charter schools are very prevalent relative to the rest of the United States. (338 charter schools enrolled about 4.4 percent of Arizona's students in the 1999-00 school year.[1]) In Arizona, the vast majority of the *stock* of teaching jobs are in regular public schools, not charter schools. Yet, approximately a third of the *flow* of new teaching positions is provided by charter schools. Therefore, a person who considers becoming a teacher (or switching to a new teaching job) in Arizona should think seriously about the teaching jobs created by charter schools.

This paper's empirical strategy is based on a simple economic argument: If schools that face stronger choice-based incentives get greater benefits from certain teacher characteristics, they will demand more of these characteristics than other schools. As a result, they will pay a larger wage increment as a reward for the characteristic *and* they will end up hiring more of it. In other words, schools with greater demand for a teacher character will be moving up the supply curve for some teacher attributes (or up teachers' indifference curves for some behaviors). I formalize these ideas in a later section. My test for whether a teacher characteristic is demanded more by choice-driven schools is simple: do choice-driven schools pay a higher wage differential for the characteristic *and* hire more of

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[1] See *Fiscal Year 1999-2000 Annual Report of the Arizona Department of Education*. Some private research groups claim that charter schools enroll a larger share (up to 10 percent) of Arizona's students. There are more charter schools in Arizona than charter holders because some charter holders run multiple schools (sites).

the characteristic?

I perform this test using two types of evidence. I first analyze traditional forms of choice, such as private schools and Tiebout choice among public school districts (parents choosing a school by choosing a residence). Traditional forms of choice are useful because different metropolitan areas have different long-run, general equilibria with different amounts of traditional school choice. The data that I use to compile evidence on traditional choice is the Schools and Staffing Survey (SASS), a comprehensive survey of American public and private school teachers and administrators.

Second, I compare teaching jobs in charter schools to teaching jobs in regular public and private schools. Essentially, the tests take the form: compared to regular public schools, do charter schools pay more for certain teacher characteristics *and* hire more of those characteristics? To implement such tests, I compare data from a survey of charter school teachers and administrators (conducted specifically for this paper) to SASS data. The charter school teachers and administrators were asked questions identical to those in the SASS, in order to insure that their answers would be as comparable as possible.

The analyses of traditional choice and charter schools are complementary: each has strengths that covers potential weaknesses of the other. Traditional school choice has two weaknesses: (1) it does not exactly mimic the incentives that are created by reforms such as charter schools or vouchers; (2) when comparing different metropolitan areas, it is important to identify *exogenous* differences in their degree of traditional school choice. Clearly, direct examination of charter schools remedies the first of the two problems. Although I attempt to solve the second of the two problems using instrumental variables that create credibly exogenous, natural variation in school choice, some readers may prefer evidence from a policy experiment (such as charter schools) to evidence from natural experiments.

Comparisons of charter schools to other schools have three weaknesses. First, it is important to compare charter schools to schools that function in similar environments. Otherwise, one might attribute different school conduct to choice when the differences are actually generated by, say, differences in

local preferences. Second, one should check whether the different charter school conduct is simply a composition effect. Put another way, do charter schools simply replace some part of the local public school system had previously exhibited the same conduct that charter schools exhibit? If so, charter schools do not generate a *net* change in the teaching jobs. Third, most charter schools are new, so one must distinguish the aspects of teaching that are caused by the school's being new from those caused by the school's being subjected to choice. In my analysis of charter schools, I respond to each of these three weaknesses using appropriate methods: I control for schools' environments, check for composition effects, and control for teachers' age and experience. Nevertheless, some readers may prefer the evidence from traditional forms of choice.

II. The Teaching Profession and School Choice: What is Known

This paper is related to several issues that have recently received attention. There is a substantial literature that demonstrates that teachers' unions compress the distribution of teacher salaries within a district so that teachers with the same seniority and the same highest degree are likely to receive similar (if not identical) wages.[2] Even in districts that are not unionized, salary scales that resemble union scales are the rule. Although salary compression is not complete, differences in pay among teachers with the same tenure and highest degree are very small.

Indeed, the evidence suggests that the differences are too small to make teaching an equally attractive occupation to people with more and less aptitude, more or fewer math and science skills, and so on. Murnane (1984), Manski (1987), Murnane and Olsen (1989,1990), and Monk (1994) present evidence that people with high aptitude or math and science skills are less likely to start teaching (even if one conditions on their having obtained teaching certification) and less likely to remain in teaching if

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[2] A teacher' highest degree is usually either a baccalaureate or a master's degree. See Hoxby (1996) for a bibliography of the teachers' union literature.

they do start. This problem has become more acute over time, as professions such as management, law, and medicine have opened their doors to women. Women with high aptitude or math and science skills have chosen such professions over teaching, perhaps because such professions *do* reward higher productivity among workers with a given level of experience and highest degree.[3]

This paper is also related to the movement described as the "professionalization" of teaching. This movement comprises policies such as in-service training, apprenticeships and peer instruction, higher certification standards for new teachers (rarely for incumbent teachers), and rewards for teachers who earn additional credentials.[4] The professionalization movement includes a proposal to give the National Council for Accreditation of Teacher Education, a body that accredits education schools, more control over the number and origin of undergraduate degrees granted in education each year.[5] In short, the reform movement contains an element (credentials) that is characteristic of most professions, but it does not combine it with the market orientation of most professions, where credentials merely maintain minimal standards and rewards are based on how the market values a professional. Professionals typically maintain a high degree of market orientation and independence.[6] In fact, "professionalization" is a misnomer for the movement as it currently stands, since the cluster of policies is more characteristic of craft unions with their opposition to market orientation and their traditional reliance on credentials, especially at the point of entry. Yet, the rhetoric of the movement suggests that many teachers *do* want

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[3] See Flyer and Rosen (1997).

[4] The policies described are currently encouraged by the National Association of Teachers and the American Federation of Teachers, whose "professionalization" agendas are described in on their webpages: www.nea.org and www.aft.org. Readers may obtain a hard copy of the agendas from the author, should the webpages change.

[5] See Ballou and Podursky (1998).

[6] The independence sometimes takes the form of self-employment or partnership, which are often found in the law, medicine, consulting, accounting, and so on. More often, the independence takes the form of a willingness to switch employers while remaining in the profession. This willingness need not be exercised regularly so long as professionals are rewarded based on the market's valuation of them.

teaching to become more professional, in the sense of becoming filled with high productivity individuals who receive rewards closely linked to their performance.

Very little evidence has been compiled on how school choice affects teachers. Hoxby (1996) shows that Tiebout choice weakens the effect of teachers' unions on wages and schools' productivity, but does not examine how choice affects who goes into teaching or how teachers are rewarded.

There are a number of studies of charter and voucher schools that include comments, anecdotes, and even surveys of teachers. These include Finn, Manno, and Vanourek (2000), the Pioneer Institute (1998), and the Goldwater Institute (1999). Such studies provide helpful evidence on what teachers experience in choice schools, especially their job satisfaction, expectations of students, frustration with the meager resources on which choice schools often depend, and dislike of the politically charged atmosphere in which choice schools operate. Unfortunately, these studies do not focus on variables that are interesting to economists, and they have the additional disadvantage that they do not present comparable data for public or private school teachers. It is more useful to know that charter school teachers have a certain level of job satisfaction if one knows how satisfied public school teachers are with *their* jobs.

Finally, one can gain insight into the effects of choice by comparing teachers in regular public and regular private schools. After all, private schools are routinely subject to market forces and have an incentive to employ teachers who attract tuition-paying students. Ballou (1996) and Ballou and Podgursky (1997, 1998) provide a comprehensive comparison of public and private school teachers. They find that private schools value teacher aptitude more when making hiring decisions than public schools do. They also find that teacher pay is less compressed and more closely related to aptitude and scarce skills (such as math and science skills) in private schools than in public schools. There are several reasons, however, why private schools are not a perfect guide to what teachers will experience in choice schools. Because private school tuition is not government funded and parents who send their children to

private schools must continue to pay taxes that support public schools, private schools face different financial constraints than choice schools. Also, private schools are more likely (than choice schools) to have a religious affiliation, and (unlike charter schools) they are allowed to practice selective admissions. Thus, the fact that private schools typically pay teacher salaries that are about 60 percent of local public school salaries (United States Department of Education, *Private School Universe Survey*) is probably due to a combination of different financial constraints, religious affiliation, and different students.

III. Analytic Framework

When I suggest that schools under pressure from choice ("choice schools") and schools not under pressure from choice ("other schools") may higher different teachers and create different teaching jobs, what I mean is that choice schools and other schools may use different education production functions. In the introduction, I gave an intuitive version of what we predict if choice schools and other schools have different production functions, but this section presents a formal exposition of the predictions. It is useful to divide a teacher and teaching job into two parts: (1) attributes and requirements of the teaching job itself, (2) general skills that teachers may have, but that are also useful outside of teaching.

A. The Attributes and Requirements of Teaching Jobs

Let us first consider attributes and requirements of the teaching job. In order to understand how schools recompense teachers for attributes and requirements of their jobs, we use hedonic or "equalizing wage differential" analysis. Hedonics is the science of pleasure, but in labor applications it takes the form of a straightforward question: how much more (less) does a worker need to be paid if he is to endure some pain (enjoy some pleasure). Numerous attributes or requirements for a teaching job can be describe by some form of this question. I list several below, but–for now–let us make the question concrete by considering just one aspect of a teacher's job: the amount of time the teacher spends *above and beyond her contract hours* on extracurricular duties, such as organizing a student club or taking

students to local museums and community events. Assume that, apart from such extracurricular duties and earnings, other aspects of the teaching job are held constant.

If choice schools and other schools have different education production functions, they will be willing to pay different amounts for a teacher to endure (enjoy) some pain (pleasure). As a result, choice schools' and other schools' iso-rent curves will trace out the indifference curves of teaching candidates. This works as follows.

Figure 1 shows the indifference curve of a typical teaching candidate, where earnings are on the vertical axis and extracurricular duties are horizontal axis. The indifference curve has a typical shape that implies that the marginal utility generated by additional earnings is decreasing in earnings

$$\frac{\partial V}{\partial y}>0\ ,\ \frac{\partial^2 V}{\partial y^2}<0\ ;$$

and that the marginal disutility generated by additional extracurricular duties is increasing in extracurricular duties:

$$\frac{\partial V}{\partial d}<0\ ,\ \frac{\partial^2 V}{\partial d^2}>0\ .$$

V represents indirect utility as a function of earnings and extracurricular duties, y represents earnings, and d represents the amount of extracurricular duties.[7]

Consider a school subjected to choice and a school that is not, both of which face similar populations of students, teaching candidates, and taxpayers. Suppose that the choice school finds such extracurricular duties more valuable. That is,

$$\frac{\partial \pi^{choice}}{\partial d}>\frac{\partial \pi^{other}}{\partial d}>0\ ,$$

[7] We obtain V by substituting the candidate's budget constraint ($y=\boldsymbol{Xp}$) into a utility function defined in terms of d and other goods. $\boldsymbol{X}$ is the vector of other goods, and $\boldsymbol{p}$ is the vector of the prices of other goods.

where π represents schools' pseudo-rents. Figure 1 shows the iso-rent curves of the two schools. They are tangent to the candidate's indifference curve at different points. Specifically, the choice school is willing to pay more for every extracurricular duty that a teacher takes on and the choice school ends up purchasing more extracurricular duties. That is, the slope of earnings with respect to extracurricular duties is higher at point B (the point of tangency between the choice school's iso-rent curve and the indifference curve) than it is at point A (the point of tangency between the other school's iso-rent curve and the indifference curve). Also, the quantity of extracurricular duties associated with point B is greater than that associated with point A.

Thus, a logical test of whether choice schools find extracurricular duties more valuable is whether *both* of the following are true: the increase in earnings associated with extracurricular duties is greater in choice schools and the quantity of extracurricular duties performed in choice schools is higher. When these conditions hold simultaneously, it is likely that choice schools and other schools are tracing out the indifference curves of teaching candidates.

Jointly testing the quantity of the attribute and the slope of the earnings with respect to the attribute is useful because it distinguishes the case considered above from other situations. For instance, suppose that choice and other schools do not have different production functions but somehow face teaching candidates who have different *preferences*. It is unclear how such a situation might arise systemically, but it could happen merely through coincidence. Choice schools might coincidentally be more common in warm-weather states and a preference for warm weather might be positively (or negatively!) correlated with a taste for museum going or community events. In any case, Figure 2 shows a situation in which candidates in group A (the group facing other schools) dislike taking on extracurricular duties more than do the candidates in group B (the group facing choice schools). The two indifference sets trace out the schools' identical iso-rent curve. We would observe phenomena that would fail the joint test. A larger quantity of extracurricular duties would be performed in choice schools, but

the increase in earnings associated with extracurricular duties would be *lower* in choice schools. The joint test will fail in any situation where the production function of the choice and other schools is the same.

The joint test is also proof against the situation where the choice and other schools are on different iso-rent curves for the same production function. Such situations are illustrated by Figure 3. In Figure 3, the choice school faces less favorable conditions than the other school. This is not unrealistic if the choice school is a charter school that gets lower per-pupil spending than the regular public schools with which it competes. (Such spending differences are, in fact, the norm). The figure shows that the choice school obtains a lower quantity of extracurricular duties. However, the choice and non-choice schools have the *same* earnings increment for an increase in extracurricular duties. It is also possible that choice schools face more favorable conditions than other schools. A plausible example would be a charter school that, through some informal means, manages to cream-skim good students while the other school has no such means. (Charter schools are forbidden to use formal methods of selecting students, but informal means may be available.)[8] If we want to see what would happen in the scenario where choice schools face more favorable conditions, we need only reverse the "choice" and "non-choice" labels in Figure 3. We will find that the non-choice school obtains a lower quantity of extracurricular duties, but that both types of school pay the same earnings increment for an increase in extracurricular duties.

Of course, extracurricular duties are merely one example; any attribute or requirement of a job that can be considered a pain or pleasure can be analyzed similarly. Also, the analysis above is a partial analysis–I consider only one aspect of the job and hold other aspects constant. Obviously, a teaching job has many attributes and requirements, such as teaching duties outside of class (tutoring individual

[8] Existing evidence suggests, however, that the average charter school not only fails to cream-skim successfully, but actually gets below-mean students from its eligible population. Finn, Manno, and Vanourek [2000] provide a good overview of the charter school situation.

students), disciplinary duties, administrative duties, responsibility for curriculum design, responsibility for student performance, and certification requirements. It is important to note the distinction between a teaching job's certification requirements and the general skills (education) of its teachers. Teaching certification is a job requirement that is not useful outside of teaching jobs. It may be that the college education acquired in the process of gaining certification *is* generally useful, but we should distinguish between rewards for education and rewards for certification. Acquiring certification in order to take a particular job is "painful" in much the same way that engaging in curriculum design over the summer in order to take a particular job is "painful."

B. Skills that Teachers May Have

Now consider how a teaching job rewards teachers for general skills that are also useful outside of teaching. Such skills would include interpersonal skills, such as leadership, but would also include more quantifiable skills, such as knowledge of mathematics, science, foreign languages, or English composition. There are well-established wages for such skills that are largely set outside of teaching. If there were simply a going wage for math skills, say, then choice schools and other schools would pay the same (going) wage for such skills but perhaps hire different quantities.

All teaching jobs, however, share some distinctive features that other jobs that use the same skills lack. For instance, all teaching jobs involve working with school-aged children, making presentations, providing leadership, and didactic tasks. Some people enjoy such features of teaching, being eager to convey their understanding of the world to the next generation. Other people dislike the same features. Thus, schools are likely to face a supply curve for a general skill, such as mathematics, that is upward sloping and convex. The upward slope and convexity comes from the distribution, *among* workers, of taste for the features that teaching jobs share. That is, some mathematically skilled workers may be willing to sell their skills below the going wage in order to have access to the features of teaching jobs (which they view as amenities); other mathematically skilled workers may demand more than the

going wage in order to put up with the features of teaching jobs (which they view as disamentities). The greater is a school's demand for mathematics skills, say, the more likely it is that its marginal (last hired) mathematically-skilled teacher views the features of teaching as disamenities. (Note that the distribution of taste *among* workers generates this convexity, and that this is distinct from an individual's indifference curve exhibiting convexity about accepting more of some attribute of a teaching job.)

Figure 4 illustrates the effect of the convex, upward-sloping supply curve for a general skill for two local labor markets, one in which schools are subject to choice and another in which schools are not. I show the case in which schools subjected to choice demand more of the general skill, but the figure could illustrate the opposite case if the labels were reversed. The key thing to observe is that the schools that demand more of the skill also pay a higher wage for it. Again, we have a simple test. If a school hires more quantity of a given skill *and* pays a higher wage to that skill, it is evidence that the school's demand curve has shifted right along the supply curve for that skill. In other words, we have evidence that the school is *demanding* a different set of skills, as opposed to facing a different *supply* of skills.

I have been careful, in the last few paragraphs, to compare *local labor markets* where schools are and are not subjected to choice. This is because the joint test (hiring more quantity of the skill *and* paying a higher wage increment for the skill) holds strictly for such comparisons. If we are comparing choice-oriented schools, such as charter schools, and other schools *within* an area, the wage increment prediction holds only weakly. That is, the test becomes: do charter schools hire more quantity of the skill than local, regular public schools and do charter schools pay a wage increment for the skill that is at least as high as the wage increment in local, regular public schools? The test contains a weak inequality because choice-oriented schools may bid up the labor-market-wide wage increment that must be paid for the skill.

Of course, teachers can have multiple skills, and the analysis above is a partial analysis for one skill, holding the others constant. Indeed, we may think of a teacher's salary as the *sum* of all the wage

increments for her various job attributes, job requirements, and general skills.

IV. Empirical Strategy

Consider first an empirical strategy that would work for comparing metropolitan areas with different degrees of school choice. The empirical strategy for comparing schools in different sectors (public, private, and charter) is an extension of this strategy.

A. An Empirical Strategy for Comparing Metropolitan Areas with Different Degrees of Choice

We need an index of the degree to which schools in a metropolitan area face incentives that are driven by parents' choice. Let us call this index C_m, declare that it varies between zero (no choice) and one (maximum choice), and reserve further discussion of it for later. Let the word *characteristic* hereafter be interpreted as shorthand for the phrase, "attribute, requirement, or skill," where I do not need to distinguish among these three characteristics of a teaching job. Then, the test I have proposed amounts to the question: for teaching characteristic *k*, are *both* α_1 and β_3 positive and statistically significant in the following regressions:

(1) $$Q_{im}^{k} = \alpha_0 + \alpha_1 C_m + \boldsymbol{X}_m \alpha_2 + \epsilon_m + \epsilon_{im}$$

(2) $$\ln(W_{im}) = \beta_0 + \beta_1 C_m + \beta_2 Q_{im}^{k} + \beta_3 C_m \cdot Q_{im}^{k} + \ldots + \boldsymbol{X}_m \beta_4 + \xi_m + \xi_{im}$$

where *i* indexes the observations on individual teachers, *k* indexes teaching characteristics, requirements of teaching jobs, and skills of teachers?

Equation (1) is the quantity equation, and α_1 registers whether choice induces schools to hire a greater or smaller quantity of characteristic *k* (Q_{im}^{k}). Equation (2) is the wage equation, with $\ln(W_{im})$ being the natural log of the pay of teacher *i* who works in metropolitan area *m*.[9] The coefficient β_2 registers the pay increment that a teacher gets for having quantity Q_{im}^{k} of characteristic *k* if she teaches in

[9] Because wages are likely to increase proportionally with characteristics, it is standard in hedonic and labor demand analysis to use the natural log of wages.

a metropolitan area with zero choice. The coefficient β_3 registers the *additional* pay increment that a teacher gets for having quantity Q_{im}^k of characteristic *k* if she teaches in a metropolitan area with maximum choice–that is, a choice index equal to one. It is important to recognize that it is the coefficient β_3 that interests us. We want to know how much more a teacher is paid *for each unit* of characteristic *k* if she works in an area with choice.

Observe that both equations (1) and (2) have error terms at the metropolitan area level as well as individual error terms. The metropolitan (grouped) error terms are needed because key explanatory variables are at the metropolitan area level, and the standard errors should reflect the fact that the regressions depend mainly on variation *among* metropolitan areas. In fact, all of the explanatory variables in equation (1) are at the metropolitan area level, so the regression is merely a convenient way of aggregating up teacher observations. In equation (2), the individual level regression is necessary because an individual teacher's quantity of the characteristic must be interacted with the choice index to get the effect that is of interest.

There are factors other than choice that may raise a metropolitan area's demand for characteristic *i.* For example, if a metropolitan area has more employment in high technology industries, it may have a greater demand for teachers with math and science skills. Thus, equations (1) and (2) control for observable factors that are likely to be determinants of demand for various teacher characteristics. The vector $\boldsymbol{X}$ represents such factors. Of course, some determinants of demand may be unobserved and could be correlated with the choice index, either coincidentally or structurally. Therefore, it is prudent to estimate equations (1) and (2) by instrumental variables, using credible instruments for the choice index. I discuss the instruments below. For characteristics that are measured by binary variables, I estimate equation (1) by instrumental variables probit, following the method proposed by Newey [1987].

The vector $\boldsymbol{X}$ also includes variables that control for possible differences in metropolitan areas' *supplies* of teachers. An omitted determinant of the supply of teachers is, however, unlikely to generate a

false conclusion that school choice raises (or lowers) the demand for a certain teacher characteristic. If an omitted variable raises the supply of the characteristic and is positively correlated with school choice, then α_1 is likely to be greater than zero and β_3 is likely to be less than zero. Conversely, if the omitted variables raises the supply of the characteristic and is negatively correlated with school choice, then α_1 is likely to be less than zero and β_3 is likely to be greater than zero.

Finally, observe that equation (2) includes ellipses that indicate the other characteristics for which the teacher may also be rewarded. Given that teaching jobs have many characteristics simultaneously, we do want to include them simultaneously in the wage equation and then focus on the resulting (partial) coefficients. In practice, there will be mild tension between multicollinearity (which could make all of the coefficients uninterpretable) and including all relevant characteristics so that the coefficients represent the partial effects they are supposed to. In particular, there are multiple related measures of any given characteristic that are so collinear that their coefficients are uninformative when all of them included. For instance, the quality of a teacher's college may be measured by one of a few, highly collinear measures of selectivity–average SAT scores at the college, the Barron's ranking of the college, and so on. My approach to the multicollinearity problem is to include only one measure of each characteristic at a time. When I examine various measures of the same characteristic, they are cycled into the regression equation one at a time. (The cycling is made explicitly described by the notes below each table of results.) I believe that this is a reasonable approach given the goals of the paper, which do not require precise differentiation among various forms of a general characteristic. Of course, the reader should remember that results for multiple measures of the same characteristic are not independent of one another.

2. An Empirical Strategy for Comparing Public, Charter, and Private Schools

To get an empirical strategy for comparing schools in different sectors (public, private, and charter), we need only slightly modify the strategy outlined above. Tests will be based on the assumption

that charter schools and private schools have greater choice-driven incentives than public schools. (The assumption is not that public schools have *no* choice-driven incentives, but that they have fewer such incentives because their revenues do not depend directly on the number of tuition-paying students they attract.) We can be agnostic about which, private or charter schools, face greater choice-driven incentives, since we are primarily interested in the public school-charter school comparison.

Let I_i^{public} be an indicator that teacher *i* is in a regular public school; let $I_i^{charter}$ be an indicator that teacher *i* is in a charter school; and let $I_i^{private}$ be an indicator that teacher *i* is in a private school. Then, if charter schools demand more of characteristic *k* than public schools do, $\delta_1 < \delta_2$ and $\gamma_4 < \gamma_5$ in the equations:

(3) $$Q_{im}^{k} = \delta_1 I_i^{public} + \delta_2 I_i^{charter} + \delta_3 I_i^{private} + \boldsymbol{X}_m\delta_4 + \eta_m + \eta_{im}$$

(4) $$\ln(W_{im}) = \gamma_1 I_i^{public} + \gamma_2 I_i^{charter} + \gamma_3 I_i^{private} + \gamma_4 I_i^{public}\cdot Q_i^{k} + \gamma_5 I_i^{charter}\cdot Q_i^{k} + \gamma_6 I_i^{private}\cdot Q_i^{k} + \ldots + \boldsymbol{X}_m\gamma_4 + \omega_m + \omega_{im}\ .$$

Equation (3) is the quantity equation for characteristic *k*. Equation (4) is the wage equation, in which I have emphasized the effect of a school's sector on the wage increment for characteristic *k* (as opposed to other characteristics, which are in the ellipses). Again, notice that we are interested in the coefficients γ_4 and γ_5. That is, we need to know how choice affects a school's willingness to pay *for each unit* of a teacher characteristic.

The vector $\boldsymbol{X}$ is a set of variables that controls for the area in which the teacher's school is located. As in equations (1) and (2), the variables in $\boldsymbol{X}$ are other likely determinants of the demand for or supply of teachers. The vector $\boldsymbol{X}$ helps to solve the following identification problem: the *existence* of a charter (or private) school in an area may reflect factors that also determine the area's demand for certain

teacher characteristics.[10]

There is a additional problem with comparing schools, as opposed to comparing metropolitan areas. The problem is that charter schools may enter and simply replace a part of the public school sector that demanded the same teacher characteristics that charter schools demand. Comparing the charter and public schools afterwards, one would observe a difference between the sectors that could be described as a composition effect. Such composition effects are unlikely because charter schools would have little incentive to enter a market (and little ability to survive in a market) where public schools already existed that acted like charter schools. Nevertheless, I attempt to test for such composition effects, exploiting the fact that no charter schools existed early in the 1990s. I investigate whether the public schools in areas that got the most charter schools lost certain teacher characteristics.

Regardless of how it was carried out, the test of composition effects would depend largely on two states, Arizona and Michigan, where charter school teachers are a sufficiently large share of all teachers that one might be able to discern whether the public school sector was changing as charter schools replaced part of it. I use "before" and "after" data collected by the states themselves from each of their districts.

3. Instrumental Variables for the Metropolitan Area Measures of School Choice

Equations (1) and (2) are estimated by instrumental variables. The set of instruments is:

(8) $$(\boldsymbol{S}_m, \boldsymbol{R}_m, \boldsymbol{X}_m) ,$$

[10] Being concerned that controlling for variables in $\boldsymbol{X}$ might not deliver sufficiently comparable areas, I have also computed results in which public school districts and private schools are weighted by the presence of local charter schools. Public school districts got a weight based on charter school enrollment in their metropolitan area (or county, if the district is non-metropolitan). Private schools in the SASS data are not identified with counties or metropolitan areas even in the restricted access version of the data, so private schools were weighted by the enrollment of charter schools in their state. Of course, some areas got weights equal to zero under this procedure, but this is because some areas of the United States do not have laws that make charter schools possible. Results computed with these weights did not differ enough from the results shown to make a separate presentation useful. However, they are available from the author upon request.

where $\boldsymbol{S}_m$ is a vector of variables that measure the number of larger and smaller streams in a metropolitan area, and $\boldsymbol{R}_m$ is a vector of measures of the population density of nine Jewish and Christian denominations in 1950. I have used these instruments in other work, in which the rationale for the instruments is explained in considerable detail.[11] A brief version of the rationale goes as follows.

Metropolitan areas in the United States vary greatly in the degree to which parents can easily choose a residence in another school district (Tiebout choice) and the tuition that parents have to pay to send their children to a private school of a given quality. Tiebout choice, or traditional choice among public school districts, varies among metropolitan areas mainly because of arbitrary topographic and historical factors. I exploit topographic variation (streams) to identify the effects of Tiebout choice. The tuition for a private school of a given quality varies among metropolitan areas mainly because of historic differences in the population density of various religious groups, which have left some areas with private schools that are well-endowed or have an established donor base. In other areas, private schools have little or no income from contributions with which to subsidize tuition. I exploit variation in religious populations (in 1950, a time at which "traditional" donor bases had been established) to identify the effects of traditional private school choice.

In the United States, Tiebout choice varies from no-choice metropolitan areas like Miami, where one school district contains the entire metropolitan area, to many-choice metropolitan areas like Boston, where there are 70 districts within a 30-minute commute of downtown and more in the entire metropolitan area. Most metropolitan areas are, of course, somewhere between these two extremes. A typical metropolitan area has an amount of choice that corresponds to having four equal-sized school districts (or a greater number of less equally sized districts).

How does one measure the degree of Tiebout choice in a metropolitan area? A particularly good

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[11] In order to leave room for a discussion of the charter school survey data, which is original to this paper, I provide only a sketch of the instrumental variables strategies. See Hoxby [2000] and Hoxby [1996] for much more complete discussions.

measure is equal to 1 minus a Herfindahl index based on the enrollment shares of districts in the metropolitan area.[12] This measure has an intuitive interpretation. It is the probability that, in a random encounter, two students in the metropolitan area would be enrolled in different school districts. If there were only one district, as in Miami, this probability would be equal to one. If there were many districts, as in Boston, this probability would be very small (less than 0.05). Formally, the measure is equal to:

$$C_m = 1 - \sum_{j=1}^{J} s_{jm}^2 , \quad (9)$$

where s_{jm} is equal to the district *j*'s share of enrollment in metropolitan area *m*.

The instrumental variables for this measure should be variables that affect the formation of school districts in a metropolitan area but do not directly affect school districts' conduct. Streams and rivers provide good instruments because, early in American history, they were natural barriers that influenced the drawing of district boundaries. They probably have no direct effect on how schools conduct themselves now.

The number of private school places (of a given quality) that are available at a given tuition varies among metropolitan area in the United States.[13] For instance, in some metropolitan areas, up to 15 percent of the elementary student population is enrolled in private schools where tuition is about two-thirds of the schools' per-pupil expenditure. (Typical amounts for schools with religious affiliation would be tuition of about 1600 dollars and expenditure of about 2300 dollars). In other metropolitan areas, fewer than 1 percent of the elementary school population is enrolled in such schools (although places might be available in schools where tuition is higher and there are no tuition subsidies). In a

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[12] See Hoxby [2000] for additional detail on this measure and on alternative measures of Tiebout choice.

[13] The quality of a private school can be measured in various ways, the simplest of which is simply the amount of money the private school spends on educating a student. Expenditure sometimes understates the true cost of educating a private school student because, especially in schools with religious affiliation, labor is donated by volunteers and church buildings are used for educational purposes.

typical metropolitan area, about 6 percent of the elementary school population is enrolled in such schools. In short, the supply of private schooling varies among metropolitan areas, and (thus) the degree to which parents have choice between public and private schools varies among metropolitan areas.

It is reasonable to use the actual share of students who attend private school in a metropolitan area as a measure of private school availability *if* the measure is instrumented with credible instruments. In this case, the best available set of instrumental variables are the population densities of nine religious denominations in 1950 because, at that time, religious groups were building the foundations of the endowments and established donor populations that now allow private schools to offer places at subsidized tuition. So long as one controls for the current ethnic composition of metropolitan areas, the religious composition of 50 years ago probably has no direct effect on how schools conduct themselves now.

IV. Data

The empirical strategy just described requires data on teachers, school districts, private schooling, demographics, geography (streams), and religion. Because the other data are described elsewhere, I focus mainly on the teacher data in this section.[14]

The SASS is a stratified random sample of public and private school teachers and administrators in the United States. It includes weights to make its statistics nationally representative. I mainly use the 1993-94 sample, which includes 47,105 public school teachers. For variables common to both samples, I pool the 1993-94 sample with the 1990-91 sample (46,705 public school teachers) in order to maximize the number of teachers who represent each metropolitan area.[15] I use several SASS variables including

[14] For detailed descriptions of the other data, see Hoxby (2000) and Hoxby (1996).

[15] In practice, pooling the two samples does not affect the point estimates much, but it does increase the precision of the estimates.

the teacher's salary, her years of teaching experience, an indicator for whether she plans to stay in teaching for the next few years, the college at which she earned her baccalaureate degree, an indicator for whether she was a mathematics or science major, the number of undergraduate and graduate courses she has taken in mathematics and science, an indicator for whether she earned her baccalaureate degree in a field of the arts and sciences (as opposed to a degree in education), the number of hours per week (on top of required hours) that she spent on activities related to her students' academic progress, and the number of hours per week (on top of required hours) that she spent on activities related to her students' extra-curricular progress. (There is very little variation in *required* hours per week for full-time teachers.)

To obtain information on charter school teachers that was comparable to information in the SASS data, I distributed three surveys (one for an administrator and two for randomly selected teachers) to every charter school that was listed as being in operation in October 1998. The goal of the survey was to provide evidence on who becomes a charter school teacher and what charter school teaching is like as a job (in terms of both duties and rewards). The *Charter School Directory* was the main source of charter school addresses and enrollment information, although it was supplemented by information available on states' charter school websites. A "reminder" postcard was sent and respondents were given a gift certificate towards the purchase of a book. The response rate to the survey was approximately 70 percent (slightly lower for administrators; slightly higher for teachers). The questions were taken from the SASS administrator survey (for the charter school administrator survey) and the SASS teacher survey (for the charter school teacher survey). For the purposes of this paper, it is most important to know that teachers and administrators were asked about teachers' pay, required hours of work, actual hours of work on various activities, teaching and other labor market experience, college background, union membership, and career plans. They were also asked about their own demographic background, their students, the school atmosphere, and their degree of autonomy. Finally, they were asked an optional, open-ended question: "What would you like us to know about your experience as a charter school

teacher (administrator)?"

The SASS does not contain a measure of individual teachers' proficiency. The omission is largely unavoidable since, given most states' certification requirements, few teachers in the survey would have taken proficiency tests, and those who would have done so would not necessarily have taken comparable tests. The SASS does, however, contain information about each teacher's college, and a teacher's college is a good indicator of the quality of her education and, to some extent, of her aptitude. Colleges select students taking account of their aptitude, high school grades, extracurricular activities, and character. Colleges also differ in the quality of the inputs they provide and in the outcomes they produce. Thus, a teacher's college is an indicator of a complex set of information on aptitude, industriousness, leadership, creativity, education quality, and so on. I use two approaches to measuring college quality. First, I assign each teacher the average percentile score on the SATI among students at the college that she attended. Second, I use the more holistic ratings provided by the *Barron's Profiles of American Colleges*.[16] I assign the number 9 to colleges that *Barron's* labels "most competitive," the number 8 to colleges that *Barron's* labels "highly competitive plus," and so on down to the number 1 for colleges that are non-selective (that is, colleges that admit nearly any student with a high school diploma or GED).

Administrative data on school districts come from the Common Core of Data (CCD), a universe of administrative data on America's 15,304 school districts. Demographic data were created by aggregating the districts in the School District Data Book (SDDB) up into metropolitan areas. The SDDB is a school district-level special summary of the 1990 Census of Population and Housing. The SDDB is the source of data on the share of enrollment in private schools. The SDDB and the CCD are the sources of data for most of the variables (all at the metropolitan level) in the vector $\boldsymbol{X}$: the

[16] I use the 1982 rating because the year is close the year the median teacher in the sample attended college. In any case, *Barron's* rankings exhibit great stability, so the choice of the index year is not crucial to the results.

population, the land area, the log of mean household income, the Gini Coefficient based on household income, the share of households with incomes less than 17,500 dollars, the share of households with incomes greater than 75,000 dollars, the share of the population who are black, the share of the population who are Hispanic, the share of the population aged 19 or younger, the share of the population aged 64 or older, the share of the population with at least some college education, the share of the population with a four year college education, and indicators for the 9 census regions of the United States. The sole remaining variable in the vector $\boldsymbol{X}$ is the share of teachers who are members of organizations that engage in collective bargaining. The source for this variable is the author's 1992 update of the Employment Files of the 1987 Census of Governments.[17]

For the test of composition effects, I use variables collected by the state of Michigan for its *Michigan School Report* and by Arizona for its *School Report Card*. The variables are teacher salaries, master's degrees, and years of teaching experience.

The numbers of larger and smaller streams come from inspection of the 24,000 quadrangle series of maps and from the Geographic Names Information System (GNIS), all of which are products of the United States Geographic Survey (USGS). The religious data are from 1950 edition of the Survey of Churches and Church Membership. I use the population density of nine denominations (which together account for most of the religiously affiliated private schooling in the United States): Baptist, Catholic, Episcopalian, Friends, Jewish, Lutheran, Methodist, Mormon, and Presbyterian.

Appendix Tables 1 and 2 show, respectively, the descriptive statistics for the teacher variables and metropolitan variables.

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[17] Relatively few districts began doing collective bargaining for the first time between 1987 and 1992. Thus, most unionization information is contained in the 1987 Census of Governments and little updating is required.

V. The Effects of Traditional Choice on the Teaching Profession: Results

All of the tables have a similar structure. Teaching characteristics are listed across the top of the table. For each characteristic, there are two columns. The one on the left shows the coefficients from the quantity equation (1). The one on the right shows the coefficients of interest from the wage equation (2). Appendix Table 3 presents coefficients on all of the covariates for the first two columns in Table 1. Otherwise, I show only the coefficients on the variables of interest. However, the variables included in each regression are listed, in their entirety, in the notes at the bottom of each table. It is worth observing that the estimated coefficients on the variables in $\boldsymbol{X}$ are what one might expect. For instance, in metropolitan areas with higher mean household incomes, teachers attended more selective colleges.

An area with a high degree of private school choice has a share of students attending private school that is about 0.10 higher than an area with a low degree of private school choice. In order to describe realistic magnitudes, I consistently interpret the coefficients on the private school share by multiplying them by 0.10.

The test in this section is whether both quantity of a characteristic and the wage increment associated with a increase in the measures of choice (which are instrumented). Consider Table 1, which shows the effects of traditional choice on measures of the quality of teachers' college education. The first column of Table I shows that teachers who work in a metropolitan area with more Tiebout choice attended more selective colleges. An area with maximal Tiebout choice has teachers who attended colleges where SAT scores were 4.391 percentiles higher and that ranked 0.482 points higher on the Barron's scale. Private school choice does not appear to affect the quantity of teachers from selective colleges: none of the coefficients on the private school share variable is different from zero at conventional levels of statistical significance.

Investigation reveals that, for teachers, nearly all of the action in the *Barron's* ranking is among colleges assigned the numbers 4 ("competitive plus") to 1 (non-selective). This is not surprising.

Teachers are known to be disproportionately drawn from the bottom half of the college-going population's aptitude distribution.[18]

Therefore, I also show results for indicators of the Barron's ranking "competitive plus" or better and "competitive" or better. Compared to a teacher in a metropolitan area with minimal Tiebout choice, a teacher in an area with maximal Tiebout choice is 11.2 percent more likely to attend a college that is at least "competitive plus" in selectivity and is 29 percent more likely to attend a college that is at least "competitive" in selectivity.

The other columns in the table show the effect on the log wage paid to college selectivity. Keep in mind that the coefficient shown is β_3 from equation (2)–that is, it is the effect of choice on the *slope* of log earnings with respect to the teacher's characteristic. Of course, choice may also affect the intercept of teacher pay–that is the amount that a school would pay to a teacher with the minimal level of each characteristic. However, what interests us is whether choice makes schools pay more *for each unit* of a characteristic

Table 1 shows that, compared to a teacher in a metropolitan area with minimal Tiebout choice, a teacher in an area with maximal Tiebout choice gets earnings that rise by 0.2 percent more for every SAT percentile and rises 3.8 percent more for every Barron's ranking point. Compared to a teacher in an area with minimal Tiebout choice, her earnings rise by 10.2 more for having gone to a "competitive plus" college and by 6.4 percent more for having gone to a "competitive" college. It appears, however, that the degree of private school choice does not statistically significantly affect the wages paid for college selectivity.

Because schools that are in metropolitan areas with more Tiebout choice both hire more teachers from selective colleges and pay more for each unit of selectivity, the evidence in Table 1 strongly

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[18] This is an oft-repeated fact. See Murnane (1984), Murnane and Olsen (1989,1990), Manski (1997), or Monk (1994).

suggests that such schools *do* have a higher demand for teacher's college quality. That is, they are moving up the supply curve for teachers' college quality. Although the point estimates for private school choice tend to have the same signs as the estimates for Tiebout choice, the standard errors are so large that we cannot determine whether metropolitan areas with more private school choice also have greater demand for college quality.

Table 2 is motivated by the substantial body of evidence that suggests that schools have a particular need for teachers who have math or science skills. The table shows that, in areas with more Tiebout school choice, teachers are more likely to have math and science skills. There is also weak evidence that private school choice raises the demand for math and science skills. To commence, note that only 7.2 percent of teachers in the United States majored in math or science in college. Thus, I measure a teacher's skills by the number of college courses she took in math and science.[19] Someone who majored in math and science typically takes about 10 courses in the field, and someone who majors in a related field (economics, geography) is likely to take 4 or 5 such courses. A teacher in an area with maximal Tiebout choice took about 0.113 more math courses and 0.115 more science courses than a teacher in an area with minimal Tiebout choice. Put another way, about 1 in 10 teachers took an additional math or science course in areas with maximal Tiebout choice. Private school choice does not have a statistically significant effect on the quantity of teachers with math and science skills, although the point estimates are positive.

A teacher receives earnings that rise by 0.4 percent more with every math course and by 0.5 percent more with every science course if she is in an area with maximal Tiebout choice (as opposed to an area with minimal Tiebout choice). To put these amounts in perspective, consider a math major who

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[19] I do not include courses on math or science pedagogy–that is, I do not count courses that explain *how to teach* math or science. I include only courses in which the *content* is math or science because I am attempting to identify math and science skills that are likely to be valued both inside teaching and outside of teaching.

took 10 math courses. Her 10 math courses are worth 4 percent more in an area with maximal Tiebout choice, *above and beyond* what they are worth in area with minimal Tiebout choice. Also, a teacher's earnings rise by 0.31 percent more with every math course and by 0.43 percent more with every science course if she is in an area with a high degree of private school choice (as opposed to a low degree of private school choice).

In short, Tiebout choice raises both the quantity of and wage paid for math and science skills. Private school choice raises the wage paid for math and science skills, but has an insignificant effect on the quantity of those teacher characteristics. The results Table 2 thus suggest that Tiebout choice, at least, raises schools' demand for teachers with math and science skills. Private school choice may also have a positive effect on demand, but the evidence is much weaker.

In Table 3, I analyze two measures of teacher effort and one measure of a teacher's responsibilities. All three measures are based on teacher self-reports.[20] The first two dependent variables in the table are the number of hours that the teacher spends on instructional tasks (like tutoring) and the number of hours that the teacher spends on non-instructional tasks (like directing a school play) *beyond* the required hours in her contract. The third dependent variable is an index of the duties for which a teacher is responsible. It is the mean of several responsibility variables, all of which were coded 1 (minimally responsible for the task) to 6 (maximally responsible for the task). The tasks are: choice of textbooks, selection of topics, choice of teaching methods, establishment of grading methods, exercise of discipline, assignment of homework, and planning the curriculum. Private school choice does not have a statistically significant effect on the quantity of any of the measures of effort and responsibility, but it does raise the wage paid for additional responsibilities. A teacher in an area with a high degree of private school choice earns 0.66 percent more for every point on the responsibility index, above and beyond

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[20] Interestingly enough, the teachers' self-reports are highly correlated with their administrators' reports regarding the effort and control that they (administrators) think that their teachers exert.

what a teacher in an area with a low degree of private school choice earn for responsibilities. Moreover, compared to teachers in an area with minimal Tiebout choice, teachers in an area with maximal Tiebout choice spend 0.15 extra hours per week on instructional work and 0.52 extra hours per week on non-instructional work. Also, compared to teachers in an area with minimal Tiebout choice, teachers in an area with maximal Tiebout choice earn 0.1 percent more for every extra instructional hour, 0.3 percent more for every non-instructional hour, and 3.8 percent more for every point on the responsibility index. Remember that such pay is above and beyond whatever teachers earn for extra hours and responsibilities in areas with minimal Tiebout choice.

Overall, the evidence in Table 3 suggests that schools that face Tiebout choice demand more effort and responsibilities from their teachers. Although the positive point estimates are again suggestive, the effect of private school choice cannot be determined. The consistent imprecision of the coefficients on private school choice is almost certainly an indication that the instruments for the private school share are slightly too weak. They simply do not allow us to sort out the effects of private school choice from the effects of all the other determinants of teacher characteristics and the pay for those characteristics.

Table 4 shows the relationships between traditional choice and teachers' credentials. There is almost no variation in whether teachers in the SASS have a baccalaureate degree, so I do not analyze this variable. Instead, I analyze whether teachers have master's degrees, whether they are certified at all, and whether they are certified in the state in which they actually teach. It is worth noting that many teachers' contracts contain scale scales with standard "steps" for master's degrees and certification. Therefore, what I am analyzing in Table 4 is whether traditional school choice motivates schools either to make the salary steps larger or to give discretionary bonuses for credentials.

Examining the master's degree columns, one sees that traditional forms of choice have no statistically significant effect on either the quantity of master's degrees or the wage increases associated

with master's degrees. Similarly, neither Tiebout nor private school choice affects the quantity of certified teachers or the wage paid for certification, regardless of the certification measure used. Indeed, throughout the table, the point estimates are mainly *negative*. This suggests that, if anything, schools that face more choice have *less* demand for master's degrees and certification.

We know that teachers earn more for having master's degrees and being certified–for instance, the regression results in Appendix Table 3 show that teachers with masters degrees earn 19 percent more than other teachers. Thus, what the results in Table 4 are telling us is that schools facing choice do not demand master's degrees and certification more than schools that face no choice. It is useful to consider why there is a contrast between these results and those in Tables 1 and 2, which indicate that schools facing choice demand more college quality and more math and science skills. Commentators have long suggested that the automatic pay increases for master's degrees and certification found in most teachers' contracts encourage teachers to get the cheapest such credentials, regardless of their quality. Given that a teacher is ordinarily not rewarded more for a high quality master's degree, which requires higher tuition and more study, she is likely to choose a low quality degree. Schools that do not face choice pay bonuses for such credentials, but it appears that schools facing choice are–if anything–less willing to pay. This unwillingness is particularly notable given their greater willingness to pay for education-related skills that probably *are* valued by the market.

In summary, Tables 1 through 4 indicate that Tiebout choice raises schools' demand for teachers who were educated at selective colleges, who have math and science skills, who make effort and who assume responsibilities. Tiebout choice does not raise a schools' demand for credential like master's degrees and certification. Although there are few statistically significant results for private school choice, the coefficients that are significant and the sign pattern of the point estimates suggest that private school choice exerts a similar but very weak version of the force exerted by Tiebout choice.

VI. Results Comparing Charter, Public, and Private School Teachers

Table 5 is identical in structure to Table 1, except that the school choice variables are replaced by indicator variables for public, charter, and private schools. The table presents the estimates of the the coefficients δ_1 through δ_3 from equation (3) and γ_4 through γ_6 from equation (4). Keep in mind that the coefficients in the log(wage) columns show the effect that the school's sector has on the *slope* of pay with respect to the teacher characteristic. Of course, it is the case that a school's sector may also affect the intercept of teacher pay–that is, the amount it would pay a teacher with the minimal level of every characteristic. We are interested, however, in how a school's sector changes what it pays to each unit of a characteristic.

Our question for Tables 5 through 8 is whether the coefficients show that charter schools hire more of a teacher characteristic than public schools do *and* pay a higher wage increment for that characteristic. If there are statistically significant, positive differences between the charter and public school coefficients in both the quantity and wage equations, we may infer that charter schools have a greater demand for the teacher characteristic. We may make similar inferences for private schools. An asterisk on a charter or private school coefficient indicates that it is statistically significant different from the corresponding public school coefficient with at least 95 percent confidence.

For example, consider the left-hand columns of Table 5, where the dependent variable is the SAT percentile score of the teacher's college. All else equal, an average public school teacher's college was at the 46.1 percentile, the average private school teacher's college was at the 51.6 percentile, and the average charter school teacher's college was at the 54.3 percentile. For every SAT percentile, public schools raise a teacher's earnings by 0.01 percent, private schools by 0.62 percent, and charter schools by 0.85 percent. The differences between the public and charter school coefficients (in both the quantity and wage regressions) are statistically significant at the 5 percent level. In short, a charter school teacher went to a college with SAT scores that are 8 percentiles higher than the college of a public school

teacher, and she is paid about 7 percent more because her college had such scores. This suggests that charter schools have greater demand for teachers who graduated from selective colleges. The other columns in Table 5 reinforce this conclusion. For instance, all else equal, 3.9 percent of public school teachers are from colleges that are at least "competitive plus," 12.1 percent of private school teachers are, and 19.5 percent of charter school teachers are. Public school teachers are paid 0.84 percent more if they are from "competitive plus" colleges, but private schools pay 4.88 percent more and charter schools pay 7.11 percent more for the same boost in college selectivity.

Table 6 analyzes the same variables as Table 2: a teacher's undergraduate courses in math and science. The table shows that, all else equal, public school teachers have 2.1 math courses and 0.7 science courses; private school teachers have 2.1 math courses and 1.2 science courses, and charter school teachers have 3.5 math courses and 2.4 science courses. The differences between the charter and public school teachers are statistically significant, as are the science differences between the private and public teachers. The wage results suggest that the increased quantities of math and science skills in charter and private schools reflect higher *demand*. A public school teacher earns about 0.3 percent more for each math course and 0.4 percent more for each science course. Thus, a math or science major who teaches in a public school would earn 3 to 4 percent more, all else equal. In contrast, the results for charter schools suggests that a math or science major would 6 to 9 percent more for her skills. A private school teacher would earn 5 to 7 percent more for the same math and science skills. All in all, it appears that charter schools (and, to a slightly lesser extent, private schools) have greater demand for teachers who have taken college-level math and science courses than public schools do.

Table7 corresponds to Table 3. In it, I analyze the measures of teacher effort and responsibility. Table 7 shows that, all else equal, public school teachers work 6.36 extra instructional hours per week, private school teachers work 6.98 extra instructional hours per week, and charter school teachers work 10.82 extra instructional hours per week. The differences between charter and public and private and

public school teachers are statistically significant. In the public sector, teachers are apparently not paid more for working extra instructional hours (the coefficient is not statistically significantly different from zero). In private and charter schools, teachers are paid–respectively–0.17 and 0.22 percent more for each extra instruction hour they work. Thus, a typical charter school teacher who works 10.8 hours beyond her required contract hours earns about 2.4 percent more for her effort than she would if she did the same in a public school. The results for instructional hours are echoed by the results for non-instructional hours and teachers' responsibilities. For instance, a charter school teacher has about 1 more point than a public school teacher does on the index of responsibilities, and she is 4.5 percent more for assuming such responsibilities. Her public school counterpart would apparently receive *no* increase in earnings for additional responsibilities–indeed, it appears that a public school teacher takes a tiny but statistically significant earnings *hit* for assuming extra responsibility.

In summary, the estimates in Table 7 suggest that charter schools and (to a slightly lesser extent) private schools have a greater demand for teacher effort and responsibility than public schools do. Interestingly enough, Appendix Table 1 shows that charter school teachers have the longest required hours in their contracts, although required hours do not vary much outside the range of 32 to 38 hours per week.

Table 8, like Table 4, examines teachers' credentials. The table shows that, all else equal, about 9.4 percent of public school teachers, 0.5 percent of private school teachers, and 13.0 percent of new charter school teachers have master's degrees. I say *new* teachers to emphasize the fact that I am controlling for a teacher's age and experience. Indeed, I control for age and experience in Tables 5 through 8 so that charter schools do not appear different from public schools merely because they are all recent start-ups and therefore have younger, less experienced teachers. However, controlling for age and experience does not have much effect on the coefficients of interest in Tables 5 through 7. Age and experience *do* have important effects on master's degrees: most teachers acquire a master's degree (if

they do) in the midst of their teaching careers. In any case, the difference between the share of charter and public school teachers with a master's degree is marginally statistically significant (with only 10 percent confidence), in favor of charter schools. This result is interesting because charter schools pay, if anything, less than public schools for a master's degree (the difference is again significant with only 10 percent confidence). Thus, although the weak results are only suggestive, we may speculate that charter schools do not have a higher *demand* for master's degrees but may face a slightly greater *supply* of people with master's degrees. I explored this idea by examining the teachers' master's degrees in more detail. Charter school teachers are more likely to have master's degrees in fields like business, arts, and science (as opposed to education), and they are more likely to have obtained them *before* becoming a teacher. Nearly all public school teachers with a master's degree have their degree in education, and most obtained their degree on a part-time basis while teaching. Perhaps charter schools do not pay bonuses for master's degrees *per se* but do pay bonuses for skills that are correlated with a person's having obtained a master's degrees on her own initiative. Again, we are confronted with intriguing results that suggest what happens when public schools reward credentials without reference to their value on the broader labor market. Even though public schools *appear* to pay a similar bonus for a master's, by paying for credentials rather than skills, they may be attracting a lower supply of well-educated people and the master's degrees they get are probably of a lower quality.

Table 8 also shows that nearly 100 percent of public school teachers are certified, while–all else equal–only 89.7 percent of charter school teachers are certified at all and only 72.6 percent are certified in the state where they teach. Private school teachers are even less likely to be certified. Not surprisingly, given that certification is virtually required of public school teachers, they are not paid more for having certification (the coefficients are zero to the fourth decimal place). Private and charter schools do not typically require certification and thus could be expected to pay more for it if they value it. However, charter schools appear not to pay for certification (the point estimate is negative) and private

schools actually pay slightly *less*. These results suggest that private schools may actually *prefer* non-certified teachers, and that charter schools probably have less demand for them than public schools do. Perhaps private schools have a lower demand for certification because they dislike certain teaching methods or habits that teachers acquire in the pedagogy classes typically required for certification.

VII. Do Charter Schools Merely Replace an Existing Part of the Public School Sector?

In Table 9, I use administrative data from Michigan and Arizona school districts to determine whether charter schools are simply displacing a part of the public school sector. For instance, if there were an innovative magnet school in the district with specially qualified teachers, its place and teachers could possibly be taken by a charter school. This seems unlikely, given that charter schools get smaller per-pupil budgets than public schools do, but it is best to investigate the possibility rather than rule it out simply because it seems unlikely.

In other work, I have shown that public schools appear not to notice charter school competition when charter schools enroll less than about 6 percent of local students. Indeed, 6 percent of local enrollment is a very modest level of competition. Even so, only two states have more than a few districts that face such competition: Michigan and Arizona. This is because Michigan's and Arizona's laws impose relatively few restrictions on charter schools.[21] Table 9 table shows statistics on teacher salaries, master's degrees, and teaching experience in districts where charter schools have taken over no enrollment, more than zero but less than 6 percent of enrollment, and at least 6 percent of enrollment. Both Michigan and Arizona enacted charter school laws in 1994, so I use 1993-94 as the “before” year and 1998-99 as the "after" year in a simple differences-in-differences regression. The regression is:

$$(10) \qquad y_{j,1998-99} - y_{j,1993-94} = \mu_0 + \mu_1 I_j^{charter \geq 6\%} + \mu_2 I_j^{0<charter<6\%} + \boldsymbol{X}_{j,1990}\mu_3 + \omega_j \ ,$$

[21] For more detail on both states' laws and charter school enrollment, see Hoxby [2002].

where *j* indexes school districts. The dependent variable is the "after minus before" change in the characteristics (salaries, master's degrees, teaching experience) of a district's teachers. The explanatory variables are an indicator variable for the district's having at least 6 percent of local students in charter schools by 1998-99, and indicator variable for the district's having more than zero but fewer than 6 percent of local students in charter schools, and a vector of variables that describe the district's initial conditions and demographics in 1990.[22] If composition effects account for the differences between charter and public schools that we saw in Tables 5 through 8, then there should be some changes in teacher characteristics that reflect charter school incursion. For instance, if charter schools disproportionately took young, energetic teachers, then one would expect teachers' experience to fall in districts with large charter school incursions. In fact, experience is not at all affected by charter school competition. In fact, one would be hard-pressed to find *any* patterns in the changes in teacher characteristics, let alone a pattern that supports the notion of composition effects. In short, although I focus on the states where composition effects would be most likely to be found if they existed, I find no evidence that charter schools are simply displacing an existing part of the public school sector.

VIII. Other Differences between Charter, Public, and Private Schools

It is worth noting answers to some other survey questions. In describing their past jobs and what job they would be doing if they were not in their current job, charter school teachers described a *much* broader array of occupations than did public school teachers. Many have held jobs in business, public service organizations, or colleges. Charter school administrators described an even wider array of occupations than charter school teachers did.

Charter, public, and private school teachers are all about equally likely to say that they plan to

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[22] The per-pupil spending variable is actually from 1991-92, when the Census of Governments recorded it.

continue teaching. This result is surprising because one would expect charter school teachers to be more likely to stop teaching, given that they trying out an experimental type of school. One does not expect veteran public school teachers, whose jobs contain few surprises and who are vested in their district's benefit plans, to behave like teachers testing new waters.

The average charter school teacher earns 10.6 percent less than the average public school teacher, but she earns 28 percent more than the average private school teacher. Charter school teachers earn much more pay as bonuses for merit or extra work than public school teachers do (1,766 dollars as opposed to 272 dollars). Charter school teachers' open-ended responses often featured descriptions of the extra work they found themselves doing (cleaning, construction, and so on), but the statistics suggest that their non-instructional work is more notable for its unconventionality than its consumption of time.

It is worth noting that many administrators wrote that, when they started up their charter school, they initially adopted the local district's salary scale. According to them, they soon realized that they could not recruit and retain the teachers they wanted using the district's scale. Many described a gradual process by which they adjusted budget priorities so that they could raise pay for especially skilled teachers.

Finally, autonomy was by far the most prominent theme in charter school teachers' open-ended responses. More than half of the teachers who chose to answer the open-ended question wrote about their greater autonomy in charter schools. No other theme was discussed by more than 20 percent of writers.

IX. Conclusions

Many people assume that American teachers only stand to lose from school choice, despite the fact that economics suggests that choice could have benefits for the teaching profession. The evidence presented in this paper suggests that school choice would change the teaching profession by raising the

demand for teachers with high quality college education, raising the demand for teachers with math and science skills, and raising the demand for teachers who make extra effort and assume responsibility. Keep in mind that school choice raises the demand for teacher characteristics that attract parents. The evidence suggests, therefore, that parents value teachers' college quality, teachers' effort, and teachers' subject area knowledge (math and science are field with chronic shortages of subject area knowledge). All of the characteristics apparently valued by parents are characteristics likely to improve student achievement. This is fortunate because society cares not just about whether parents value these characteristics, but about whether these characteristics produce better educated children.

The evidence suggests that school choice would *reduce* the demand for credentials that are not valued by the broader labor market, such as master's degrees in education (many of which are low quality) and teachers' certification. It is useful to dwell momentarily on the difference between public schools' conduct regarding credentials like master's degrees and their conduct regarding math skills. On the one hand, the typical public school automatically gives a significant salary boost to a master's recipient regardless of whether there is any indication that the school needs the skills acquired. On the other hand, the typical public school refuses to give a significant salary boost to people with math skills, even when there are persistent vacancies for teachers of higher level math.

In summary, evidence based on traditional forms of choice (especially Tiebout choice) and on charter school reforms suggests that school choice would create a more high-powered incentive environment within the teaching profession. That is, teachers would be required to have higher levels of human capital and effort in return for higher marginal wages for such characteristics.[23] Although some incumbent teachers would dislike such changes, the many incumbent and prospective teachers who support the professionalization of teaching might like such changes a great deal. Under increased school

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[23] Specifically, I mean “high-powered” as the phrase is used in the literature on mechanism design.

choice, less skilled or motivated incumbent teachers might find themselves earning smaller salary increases than some of their peers. As a result, such teachers might leave the teaching profession early. This would reverse the current pattern, in which able teachers are more likely to exit early.

It is worth emphasizing that, at least for new teachers, the profession of teaching could change quickly in an environment where growing choice schools offered a disproportionate share of the *new* teaching positions. It would take longer for changed demand for teacher characteristics to make itself felt among the ranks of veteran teachers. Such teachers would notice change only when their schools began to feel competition for students from choice schools and, as a consequence, began to feel stronger incentives to reorganize teaching jobs and pay in order to attract teachers who attract parents.

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Table 1
The Effect of Traditional Forms of School Choice on the Quality of Teachers' College Education[a]

Measure of College Quality:	Mean SAT Percentile (combined verbal and math) at Teacher's College		Barron's Rating of the Selectivity of Teacher's College (1=nonselective, 9=most selective)		Teacher's College was at least "Competitive Plus" in Selectivity[b]		Teacher's College was at least "Competitive" in Selectivity[c]	
	effect on quantity of this charac-teristic	effect on log wage paid to this charac-teristic	effect on quantity of this charac-teristic	effect on log wage paid to this charac-teristic	effect on quantity of this charac-teristic	effect on log wage paid to this charac-teristic	effect on quantity of this charac-teristic	effect on log wage paid to this charac-teristic
Index of Choice among Public School Districts in Teacher's Metropolitan Area	4.391 (2.084)	0.002 (0.001)	0.482 (0.153)	0.038 (0.010)	0.112 (0.043)	0.102 (0.040)	0.290 (0.073)	0.064 (0.028)
Share of Students who Attend Private Schools in Teachers' Metropolitan Area	8.633 (10.574)	0.002 (0.002)	0.354 (0.780)	0.030 (0.040)	0.036 (0.176)	0.121 (0.166)	0.175 (0.359)	0.005 (0.119)
Metropolitan & Teacher Characteristics Controls	metro[d]	metro,tchr[d]	metro[d]	metro,tchr[d]	metro[d]	metro,tchr[d]	metro[d]	metro,tchr[d]
# Observations (Teachers)	26,474	26,474	26,474	26,474	26,474	26,474	26,474	26,474
# Metropolitan Areas Represented	292	292	292	292	292	292	292	292

[a] This table shows instrumental variables estimates of α_1 and β_3 from equations (1) and (2) in the text. See exemplary regressions in Appendix Table 3 for full set of covariate estimates. Standard errors that account for grouping at the metropolitan area level are in parentheses. The observations are teachers who work in metropolitan areas. The source for teacher data is the 1993-94 SASS data (the relevant questions were not asked in the 1990-91 SASS). Additional sources of data are the CCD, SDDB, GNIS, Survey of Churches and Church Membership 1950, and United States Geographic Survey maps. The instruments are the number of larger and smaller streams in the metropolitan area (which are significant determinants of the amount of Tiebout choice) and the population density of 9 religious denominations in 1950 (which are significant determinants of the supply of private schooling).

[b] Colleges that are "Competitive Plus" consider applicants who have grade point averages of B- at least and who rank in the top 67% of their graduating class. These colleges typically report median SAT scores between 500 and 525.

[c] Colleges that are "Competitive" consider applicants who have grade point averages of C+ at least and who rank in the top 67% of their graduating class. These colleges typically report median SAT scores between 425 and 500.

[d] The metropolitan-level control variables are: ln(population); ln(land area); ln(mean household income); Gini coefficient for household income; shares of households with incomes less than $17,500 and greater than $75,000; shares of the population who are black and Hispanic; shares of the population age 0 to 19 and 65 plus; shares of the population with at least some college education and a baccalaureate education; share of public school teachers who are represented by a union; indicators for the 9 census divisions of the United States. Teacher characteristics controls are her number of math courses, responsibility index for the teacher, and whether she has a master's degree (coefficients are shown in Tables 2-4).

Table 2
The Effect of Traditional Forms of School Choice on Teachers' Math and Science Skills[a]

Measure of Math and Science Skills:	Number of College Courses Teacher Took in Math		Number of College Courses Teacher Took in Science	
	effect on quantity of this characteristic	effect on log wage paid to this characteristic	effect on quantity of this characteristic	effect on log wage paid to this characteristic
Index of Choice among Public School Districts in Teacher's Metropolitan Area	0.113 (0.063)	0.004 (0.002)	0.115 (0.059)	0.005 (0.002)
Share of Students who Attend Private Schools in Teachers' Metropolitan Area	0.107 (0.406)	0.031 (0.011)	0.133 (0.299)	0.043 (0.012)
Metropolitan & Teacher Characteristic Controls	metro[b]	metro,tchr[b]	metro[b]	metro,tchr[b]
# Observations (Teachers)	53,846	53,846	53,846	53,846
# Metropolitan Areas Represented	308	308	308	308

[a] This table shows instrumental variables estimates of α_1 and β_3 from equations (1) and (2) in the text. Standard errors that account for grouping at the metropolitan area level are in parentheses. The observations are teachers who work in metropolitan areas. The sources for teacher data are the 1990-91 and 1993-94 SASS. Additional sources of data are the CCD, SDDB, GNIS, Survey of Churches and Church Membership 1950, and United States Geographic Survey maps. The instruments are the number of larger and smaller streams in the metropolitan area (which are significant determinants of the amount of Tiebout choice) and the population density of 9 religious denominations in 1950 (which are significant determinants of the supply of private schooling).

[b] The metropolitan-level control variables are: ln(population); ln(land area); ln(mean household income); Gini coefficient for household income; shares of households with incomes less than $17,500 and greater than $75,000; shares of the population who are black and Hispanic; shares of the population age 0 to 19 and 65 plus; shares of the population with at least some college education and a baccalaureate education; share of public school teachers who are represented by a union; indicators for the 9 census divisions of the United States. Teacher characteristic controls are the mean SAT percentile of her college, responsibility index for teacher, and whether she has a master's degree (coefficients are shown in Tables 1, 3, 4).

Table 3
The Effect of Traditional Forms of School Choice on Teachers' Effort and Responsibilities[a]

Measure of Effort or Responsibilities:	Extra Instructional Hours Teachers Work (on top of required hours)		Extra Non-Instructional Hours Teachers Work (on top of required hrs)		Index of Duties for which Teacher is Responsible (scale of 1 to 6)[b]	
	effect on quantity of this characteristic	effect on log wage paid to this characteristic	effect on quantity of this characteristic	effect on log wage paid to this characteristic	effect on quantity of this characteristic	effect on log wage paid to this characteristic
Index of Choice among Public School Districts in Teacher's Metropolitan Area	0.147 (0.258)	0.001 (0.002)	0.516 (0.214)	0.003 (0.001)	0.128 (0.057)	0.038 (0.007)
Share of Students who Attend Private Schools in Teachers' Metropolitan Area	1.407 (1.791)	0.005 (0.006)	2.368 (1.684)	0.008 (0.007)	0.003 (0.251)	0.066 (0.027)
Metropolitan & Teacher Characteristic Controls	metro[c]	metro,tchr[c]	metro[c]	metro,tchr[c]	metro[c]	metro,tchr[c]
# Observations (Teachers)	53,846	53,846	53,846	53,846	53,846	53,846
# Metropolitan Areas Represented	308	308	308	308	308	308

[a] This table shows instrumental variables estimates of α_1 and β_3 from equations (1) and (2) in the text. Standard errors that account for grouping at the metropolitan area level are in parentheses. The observations are teachers who work in metropolitan areas. The source for teacher data is the 1993-94 SASS data (the relevant questions were not asked in the 1990-91 SASS). Additional sources of data are the CCD, SDDB, GNIS, Survey of Churches and Church Membership 1950, and United States Geographic Survey maps. The instruments are the number of larger and smaller streams in the metropolitan area (which are significant determinants of the amount of Tiebout choice) and the population density of 9 religious denominations in 1950 (which are significant determinants of the supply of private schooling).

[b] The index of duties for which the teacher is responsible is the mean of the following sub-areas of responsibility (each is on a scale from 1 to 6, where 6 is most responsibility for a duty): choice of textbooks, selection and order of topics, teaching methods, grading methods, discipline, assignment of homework, planning of curriculum..

[c] The metropolitan-level control variables are: ln(population); ln(land area); ln(mean household income); Gini coefficient for household income; shares of households with incomes less than $17,500 and greater than $75,000; shares of the population who are black and Hispanic; shares of the population age 0 to 19 and 65 plus; shares of the population with at least some college education and a baccalaureate education; share of public school teachers who are represented by a union; indicators for the 9 census divisions of the United States. Teacher characteristic controls are the mean SAT percentile score for her college, her number of math courses, and whether she has a master's degree (coefficients are shown in Tables 1, 2, 4).

Table 4
The Effect of Traditional Forms of School Choice on Teachers' Credentials[a]

Measure of Credentials:	Master's Degree		Certified to Teach in Some State		Certified to Teach in Own State	
	effect on quantity of this characteristic	effect on log wage paid to this characteristic	effect on quantity of this characteristic	effect on log wage paid to this characteristic	effect on quantity of this characteristic	effect on log wage paid to this characteristic
Index of Choice among Public School Districts in Teacher's Metropolitan Area	-0.011 (0.043)	-0.018 (0.035)	0.002 (0.006)	0.063 (0.063)	0.002 (0.006)	0.027 (0.053)
Share of Students who Attend Private Schools in Teachers' Metropolitan Area	-0.142 (0.235)	0.004 (0.146)	-0.012 (0.031)	0.103 (0.238)	-0.014 (0.037)	0.046 (0.223)
Metropolitan & Teacher Characteristic Controls	metro[b]	metro,tchr[b]	metro[b]	metro,tchr[b]	yes[b]	yes[b]
# Observations (Teachers)	53,846	53,846	53,846	53,846	53,846	53,846
# Metropolitan Areas Represented	308	308	308	308	308	308

[a] This table shows instrumental variables estimates of α_1 and β_3 from equations (1) and (2) in the text. Standard errors that account for grouping at the metropolitan area level are in parentheses. The observations are teachers who work in metropolitan areas. The source for teacher data is the 1993-94 SASS data (the relevant questions were not asked in the 1990-91 SASS). Additional sources of data are the CCD, SDDB, GNIS, Survey of Churches and Church Membership 1950, and United States Geographic Survey maps. The instruments are the number of larger and smaller streams in the metropolitan area (which are significant determinants of the amount of Tiebout choice) and the population density of 9 religious denominations in 1950 (which are significant determinants of the supply of private schooling).

[b] The metropolitan-level control variables are: ln(population); ln(land area); ln(mean household income); Gini coefficient for household income; shares of households with incomes less than $17,500 and greater than $75,000; shares of the population who are black and Hispanic; shares of the population age 0 to 19 and 65 plus; shares of the population with at least some college education and a baccalaureate education; share of public school teachers who are represented by a union; indicators for the 9 census divisions of the United States. Teacher characteristic controls are the mean SAT percentile score for her college, her number of math courses, and responsibility index for teacher (coefficients are shown in Tables 1, 2, 3).

Table 5
The Effect of Charter and Private Schols on the Quality of Teachers' College Education[a]

Measure of College Quality:	Mean SAT Percentile (combined verbal and math) at Teacher's College		Barron's Rating of the Selectivity of Teachers' College (1=nonselective, 9=most selective)		Teacher's College was at least "Competitive Plus" in Selectivity[b]		Teacher's College was at least "Competitive" in Selectivity[c]	
	effect on quantity of this charac-teristic	effect on log wage paid to this charac-teristic	effect on quantity of this charac-teristic	effect on log wage paid to this charac-teristic	effect on quantity of this charac-teristic	effect on log wage paid to this charac-teristic	effect on quantity of this charac-teristic	effect on log wage paid to this charac-teristic
Public School	46.084	0.0001	2.794	0.0063	0.039	0.0084	0.720	0.0230
	(0.629)	(0.0001)	(0.048)	(0.0013)	(0.013)	(0.0029)	(0.016)	(0.0041)
Private School	51.635*	0.0062*	3.268*	0.0260*	0.121*	0.0488*	0.819*	0.0373*
	(0.671)	(0.0013)	(0.051)	(0.0030)	(0.014)	(0.0094)	(0.017)	(0.0099)
Charter School	54.385‡	0.0085‡	3.340‡	0.0436‡	0.195‡	0.0711‡	0.771	0.0389‡
	(1.365)	(0.0035)	(0.101)	(0.0127)	(0.027)	(0.0182)	(0.033)	(0.0121)
Age & Teaching Experience	yes	yes	yes	yes	yes	yes	yes	yes
Metro & Teacher Characteristic Controls	metro[d]	metro,tchr[d]	metro[d]	metro,tchr[d]	metro[d]	metro,tchr[d]	metro[d]	metro,tchr[d]
# Public Schl Teacher observations	26,474	26,474	26,474	26,474	26,474	26,474	26,474	26,474
# Charter Schl Teacher observations	1,090	1,090	1,090	1,090	1,090	1,090	1,090	1,090
# Private Schl Teacher observations	7,585	7,585	7,585	7,585	7,585	7,585	7,585	7,585

[a] This table shows least squares and probit estimates of δ_1 through δ_3 and γ_4 through γ_6 from equations (3) and (4) in the text. Standard errors that account for grouping at the school level are in parentheses. The observations are teachers. The symbols "*" and "‡" mean, respectively, that the charter or private school effect is statistically significantly different from the public school effect with at least 95 percent confidence. The source for teacher data is the 1993-94 SASS and the charter school survey. Additional sources of data are the CCD and SDDB.

[b,c] See notes to Table 1 for definitions of "Competitive Plus"and "Competitive".

[d] The control variables that are not shown are all measured at the local school district level. They are the log(population); log(land area); log(mean household income); Gini Coefficient for household income; shares of households with incomes less than 17,500 dollars and greater than 75,000 dollars; shares of the population who are black, Hispanic, age 19 or younger, and age 65 or older; shares of the population with at least some college education and a baccalaureate degree; indicator variables for the 50 states of the United States. Teacher characteristics controls are her number of math courses, responsibility index for the teacher, and whether she has a master's degree (coefficients are shown in Tables 6-8).

Table 6
The Effect of Charter and Private Schools on Teachers' Math and Science Skills[a]

Measure of Math and Science Skills:	Number of College Courses Teacher Took in Math		Number of College Courses Teacher Took in Science	
	effect on quantity of this characteristic	effect on log wage paid to this characteristic	effect on quantity of this characteristic	effect on log wage paid to this characteristic
Public School	2.132 (0.103)	0.0030 (0.0004)	0.724 (0.113)	0.0043 (0.0005)
Private School	2.066 (0.116)	0.0045* (0.0005)	1.205* (0.128)	0.0074 (0.0006)
Charter School	3.548‡ (0.197)	0.0058‡ (0.0016)	2.395‡ (0.220)	0.0091‡ (0.0023)
Age & Teaching Experience	yes	yes	yes	yes
Other Control Variables	yes[b]	yes[b]	yes[b]	yes[b]
# Public Schl Teacher observations	53,846	53,846	53,846	53,846
# Charter Schl Teacher observations	1,090	1,090	1,090	1,090
# Private Schl Teacher observations	15,014	15,014	15,014	15,014

[a] This table shows least squares estimates of δ_1 through δ_3 and γ_4 through γ_6 from equations (3) and (4) in the text. Standard errors that account for grouping at the school level are in parentheses. The observations are teachers. The symbols "*" and "‡" mean, respectively, that the charter or private school effect is statistically significantly different from the public school effect with at least 95 percent confidence. The source for teacher data is the 1990-91 SASS, the 1993-94 SASS, and the charter school survey. Additional sources of data are the CCD and SDDB.

[b] The control variables that are not shown are all measured at the local school district level. They are the log(population); log(land area); log(mean household income); Gini Coefficient for household income; shares of households with incomes less than 17,500 dollars and greater than 75,000 dollars; shares of the population who are black, Hispanic, age 19 or younger, and age 65 or older; shares of the population with at least some college education and a baccalaureate degree; indicator variables for the 50 states of the United States. Teacher characteristics controls are the mean SAT percentile score of her college, responsibility index for the teacher, and whether she has a master's degree (coefficients are shown in Tables 5, 7, and 8).

Table 7
The Effect of Charter and Private Schools on Teachers' Effort and Responsibilities[a]

Measure of Effort or Responsibilities:	Extra Instructional Hours Teachers Work (on top of required hours)		Extra Non-Instructional Hours Teachers Work (on top of required hrs)		Index of Duties for which Teacher is Responsible (scale of 1 to 6)[b]	
	effect on quantity of this characteristic	effect on log wage paid to this characteristic	effect on quantity of this characteristic	effect on log wage paid to this characteristic	effect on quantity of this characteristic	effect on log wage paid to this characteristic
Public School	6.363	0.0011	5.411	-0.0006	4.710	-0.0070
	(0.111)	(0.0001)	(0.343)	(0.0001)	(0.017)	(0.0009)
Private School	6.978*	0.0017*	6.902*	0.0054*	5.454*	0.0331*
	(0.130)	(0.0006)	(0.133)	(0.0007)	(0.020)	(0.0054)
Charter School	10.824‡	0.0022‡	7.579‡	0.0029‡	5.506‡	0.0451‡
	(0.336)	(0.0016)	(0.113)	(0.0035)	(0.050)	(0.0169)
Age & Teaching Experience	yes	yes	yes	yes	yes	yes
Other Control Variables	yes[c]	yes[c]	yes[c]	yes[c]	yes[c]	yes[c]
# Public Schl Teacher observations	53,846	53,846	53,846	53,846	53,846	53,846
# Charter Schl Teacher observations	1,090	1,090	1,090	1,090	1,090	1,090
# Private Schl Teacher observations	15,014	15,014	15,014	15,014	15,014	15,014

[a] This table shows least squares estimates of δ_1 through δ_3 and γ_4 through γ_6 from equations (3) and (4) in the text. Standard errors that account for grouping at the school level are in parentheses. The observations are teachers. The symbols "*" and "‡" mean, respectively, that the charter or private school effect is statistically significantly different from the public school effect with at least 95 percent confidence. The source for teacher data is the 1990-91 SASS, the 1993-94 SASS, and the charter school survey. Additional sources of data are the CCD and SDDB.

[b] The index of duties for which the teacher is responsible is the mean of the following sub-areas of responsibility (each is on a scale from 1 to 6, where 6 is most responsibility for a duty): choice of textbooks, selection and order of topics, teaching methods, grading methods, discipline, assignment of homework, planning of curriculum..

[c] The control variables that are not shown are all measured at the local school district level. They are the log(population); log(land area); log(mean household income); Gini Coefficient for household income; shares of households with incomes less than 17,500 dollars and greater than 75,000 dollars; shares of the population who are black, Hispanic, age 19 or younger, and age 65 or older; shares of the population with at least some college education and a baccalaureate degree; indicator variables for the 50 states of the United States. Teacher characteristics controls are the mean SAT percentile score of her college, her number of math courses, and whether she has a master's degree (coefficients are shown in Tables 5, 6, and 8).

Table 8
The Effect of Charter and Private Schools on Teachers' Credentials[a]

Measure of Credentials:	Master's Degree		Certified to Teach in Some State		Certified to Teach in Own State	
	effect on quantity of this characteristic	effect on log wage paid to this characteristic	effect on quantity of this characteristic	effect on log wage paid to this characteristic	effect on quantity of this characteristic	effect on log wage paid to this characteristic
Public School	0.094 (0.009)	0.1710 (0.0017)	0.988 (0.004)	0.0000 (0.0084)	1.000 (0.006)	0.0000 (0.0077)
Private School	0.005* (0.010)	0.1265‡ (0.0075)	0.664* (0.005)	-0.0374‡ (0.0075)	0.630* (0.006)	-0.0291‡ (0.0080)
Charter School	0.130 (0.026)	0.1533 (0.0256)	0.897‡ (0.008)	-0.0186 (0.0400)	0.726‡ (0.011)	-0.0099 (0.0432)
Age & Teaching Experience	yes	yes	yes	yes	yes	yes
Other Control Variables	yes[b]	yes[b]	yes[b]	yes[b]	yes[b]	yes[b]
# Public Schl Teacher observations	53,846	53,846	53,846	53,846	53,846	53,846
# Charter Schl Teacher observations	1,090	1,090	1,090	1,090	1,090	1,090
# Private Schl Teacher observations	15,014	15,014	15,014	15,014	15,014	15,014

[a] This table shows probit estimates of δ_1 through δ_3 and γ_4 through γ_6 from equations (3) and (4) in the text. Standard errors that account for grouping at the school level are in parentheses. The observations are teachers. The symbols "*" and "‡" mean, respectively, that the charter or private school effect is statistically significantly different from the public school effect with at least 95 percent confidence. The source for teacher data is the 1990-91 SASS, the 1993-94 SASS, and the charter school survey. Additional sources of data are the CCD and SDDB.

[b] The control variables that are not shown are all measured at the local school district level. They are the log(population); log(land area); log(mean household income); Gini Coefficient for household income; shares of households with incomes less than 17,500 dollars and greater than 75,000 dollars; shares of the population who are black, Hispanic, age 19 or younger, and age 65 or older; shares of the population with at least some college education and a baccalaureate degree; indicator variables for the 50 states of the United States. Teacher characteristics controls are the mean SAT percentile score of her college, her number of math courses, and responsibility index for the teacher (coefficients are shown in Tables 5-7).

Table 9
Do Charter Schools Merely Replace an Existing Part of the Public School Sector?
A Test for Composition Effects based on Michigan and Arizona Districts[a]

	dependent variable:		
	Change in Ln(Avg Teacher Salary)[b] 1998-99 minus 1993-94 –Michigan–	Change in Percentage of Teachers with Master's Degree or Higher 1998-99 minus 1993-94 –Arizona–	Change in Avg Teacher Experience 1998-99 minus 1993-94 –Arizona–
Charter Schools enroll ≥ 6% of students	0.045 (0.037)	0.035 (0.078)	-0.021 (0.073)
Charter Schools enroll ≥ 0 but <5% of students	-0.045 (0.032)	0.019 (0.064)	-0.011 (0.102)
ln(median family income)	-0.025 (0.070)	0.135 (0.276)	-0.276 (0.347)
ln(median house value)	-0.046 (0.044)	-0.162 (0.421)	0.317 (0.447)
percentage of children defined as "at risk"	-0.006 (0.003)	0.014 (0.098)	-0.023 (0.049)
percentage of children in poverty	0.002 (0.003)	-0.023 (0.085)	0.018 (0.057)
percentage of population in poverty	-0.003 (0.004)	-0.003 (0.453)	-0.029 (0.107)
percentage of population who are black	-0.002 (0.001)	0.187 (0.658)	-0.026 (0.127)
percentage of population who are Hispanic	-0.002 (0.005)	-0.007 (0.764)	0.048 (0.094)
ln(per pupil spending of district in 1992)	-0.027 (0.035)	0.031 (0.048)	0.136 (0.205)
constant	1.028 (0.559)	20.874 (0.956)	5.645 (1.361)

[a] This table shows least squares estimates. All covariates are shown. Standard errors are in parentheses. The observations are school districts in Michigan (left-hand column) and Arizona (right-hand column). The data sources are the Michigan School Report, the Arizona School Report Card, and the SDDB.
[b] Average teacher salaries are $2001.

Appendix Table 1
Mean Characteristics of Charter, Public, and Private School Teachers[a]

	Charter Teachers	Public Teachers (comp Charter Tchrs)[b]	Public Teachers (national)[c]	Private Teachers (comp Charter Tchrs)[b]	Private Teachers (national)[c]
female	0.77	0.64	0.72	0.75	0.77
white	0.90	0.76	0.86	0.85	0.92
black	0.06	0.05	0.08	0.04	0.03
Hispanic	0.03	0.10	0.04	0.04	0.03
Asian	0.01	0.07	0.01	0.06	0.01
American Indian	0.01	0.03	0.01	0.01	0.01
family income,1998$	58930	71138	69355	58046	57133
year of birth	1960	1949	1950	1951	1950
attended private college	0.31	0.20	0.25	0.46	0.51
%ile, avg verbal SAT	61.0	49.0	44.0	59.1	59.1
%ile, avg math SAT	49.5	39.2	34.5	48.7	48.6
certified teacher?	0.87	0.96	0.97	0.54	0.65
experience	10.16	16.38	17.15	15.27	13.47
plan to keep teaching	0.79	0.79	0.79	0.81	0.79
salary	32070	34690	32392	21286	20030
additional pay/bonus	2407	582	714	n/a	n/a
required hours per week	37.91	33.61	33.59	31.86	33.41
member of a union	0.23	0.81	0.82	0.56	0.56
assign homework	0.87	0.80	0.78	0.84	0.81

	Charter Teachers	Public Teachers (comp Charter Tchrs)[b]	Public Teachers (national)[c]	Private Teachers (comp Charter Tchrs)[b]	Private Teachers (national)[c]
influence on curriculum[d]	4.98	3.25	3.14	4.53	4.34
influence on discipline[d]	4.89	3.26	3.21	4.44	4.35
influence on in-service training[d]	4.48	3.08	3.06	3.63	3.66
influence on student grouping[d]	4.40	3.17	3.18	3.83	3.88
control over discipline[d]	5.13	4.35	4.34	5.15	5.25
control over homework[d]	5.40	4.90	4.89	5.36	5.43
Number of Observations	1,090	93,810	93,810	15,014	15,014

[a] The table contains the mean characteristics of charter, public, and private school teachers. The sources of the data are the charter school survey and the SASS.
[b] Teachers are weighted by the number of charter school students in their state-urbanicity cell to make them more comparable to charter school teachers, who are not evenly distributed throughout the United States.
[c] Teachers are weighted by SASS weights designed to make the statistics nationally representative.
[d] This variable is coded on a scale from 1 to 6, where 6 is maximum influence and maximum control.

Appendix Table 2
Unweighted Descriptive Statistics for Metropolitan Areas in which Teachers Work[a]

	Mean	Std. Dev.
Index of Choice among Public School Districts in Teacher's Metropolitan Area	0.747	0.255
Share of Students who Attend Private Schools in Teacher's Metropolitan Area	0.136	0.053
Number of Smaller Streams in Metropolitan Area	287	269
Number of Larger Streams in Metropolitan Area	16	29
Share of Metropolitan Adherents who are Baptists	0.192	0.201
Share of Metropolitan Adherents who are Catholics	0.489	0.270
Share of Metropolitan Adherents who are Episcopalians	0.034	0.020
Share of Metropolitan Adherents who are Friends (Quakers)	0.002	0.005
Share of Metropolitan Adherents who are Jewish	0.009	0.008
Share of Metropolitan Adherents who are Lutherans	0.085	0.103
Share of Metropolitan Adherents who are Methodists	0.124	0.093
Share of Metropolitan Adherents who are Mormons (Latter Day Saints)	0.051	0.147
Share of Metropolitan Adherents who are Presbyterians	0.014	0.025
Metropolitan Population (thousands)	1720.7	2254.2
ln(Metropolitan Population in thousands)	6.678	1.355
Metropolitan Land Area (square miles)	3627.6	3681.6
ln(Metropolitan Land Area in square miles)	7.875	0.815
Mean Household Income in Metropolitan Area (thousands of 2001 dollars)	51.7	9.3
ln(Mean Household Income in thousands of 2001 dollars)	3.930	0.173
Gini Coefficient for Household Income in Metropolitan Area	0.404	0.022
Share of Households in Metropolitan Area with 1989 Income < $17,500	0.272	0.068
Share of Households in Metropolitan Area with 1989 Income > $75,000	0.096	0.051
Share of Population who are Black in Metropolitan Area	0.105	0.095
Share of Population who are Hispanic in Metropolitan Area	0.079	0.123
Share of Population who are Age 0 to 19	0.288	0.032
Share of Population who are Age 65 or more	0.117	0.027
Share of Adult Population who have At Least Some College	0.492	0.078
Share of Adult Population who are College Graduates	0.207	0.053
Share of Public School Teachers who are Represented by a Union	0.822	0.382
Share of Observations (Teachers) in New England Census Division	0.098	0.298

	Mean	Std. Dev.
Share of Observations (Teachers) in Middle Atlantic Census Division	0.088	0.283
Share of Observations (Teachers) in East North Central Census Division	0.126	0.332
Share of Observations (Teachers) in West North Central Census Division	0.098	0.298
Share of Observations (Teachers) in South Atlantic Census Division	0.150	0.357
Share of Observations (Teachers) in East South Central Census Division	0.064	0.244
Share of Observations (Teachers) in West South Central Census Division	0.122	0.328
Share of Observations (Teachers) in Mountain Census Division	0.118	0.323
Share of Observations (Teachers) in Pacific Census Division	0.136	0.342
Number of Observations (Teachers) for whom Metropolitan Variables are Calculated	53,846	

[a] The table contains the means and standard deviations of metropolitan area characteristics that are explanatory variables in the regressions shown in Tables 1-8. The statistics are unweighted and *are therefore representative of the observations (teachers) in the SASS*.

Appendix Table 3

	dependent variable is:	
	mean SAT percentile score of teacher's college	log(total pay) of teacher
Index of Choice among Public School Districts in	4.391	0.3383
Teacher's Metropolitan Area	(2.084)	(0.0290)
Share of Students who Attend Private Schools in	8.633	0.5087
Teachers' Metropolitan Area	(10.574)	(0.1248)
		0.0012
mean SAT percentile score of teacher's college		(0.0004)
(index of choice among public districts) •		0.0019
(mean SAT percentile score of teacher's college)		(0.0004)
(share of students in private schools) •		0.0018
(mean SAT percentile score of teacher's college)		(0.0009)
	0.336	-0.0302
log(metropolitan area population)	(0.657)	(0.0048)
	-0.934	0.0118
log(metropolitan land area)	(0.589)	(0.0032)
	112.095	-0.0955
log(mean household income in metropolitan area)	(41.189)	(0.2471)
	-138.912	1.8650
Gini coefficient, household incomes in metropolitan area	(90.137)	(0.5686)
share of metropolitan households with incomes <	127.941	-0.7362
$17,500 in 1989	(87.085)	(0.5019)
share of metropolitan households with incomes >	-242.183	1.8827
$75,000 in 1989	(53.977)	(0.3562)
	-9.506	0.0689
share of metropolitan population who are black	(6.957)	(0.0366)
	8.894	0.3173
share of metropolitan population who are Hispanic	(5.383)	(0.0248)
	-37.246	-1.1125
share of metropolitan population age 0-19	(17.226)	(0.1142)
	-5.346	-0.3791
share of metropolitan population age 65 plus	(20.675)	(0.1258)
share of adult metropolitan population with at least *some*	19.167	0.6981
college	(14.270)	(0.0882)
share of adult metropolitan population with a	2.267	-1.8832
baccalaureate degree	(21.563)	(0.1478)
	0.440	0.2798
share of teachers in metropolitan area who are unionized	(4.504)	(0.0216)
		-0.0007
teacher's number of college math courses		(0.0020)
(index of choice among public districts) •		0.0042
(teacher's number of college math courses)		(0.0023)
(share of students in private schools) •		0.0311
(teacher's number of college math courses)		(0.0106)
		-0.0010
index of teacher's responsibilities		(0.0063)
(index of choice among public districts) •		0.0383
(index of teacher's responsibilities)		(0.0071)

	dependent variable is:	
	mean SAT percentile score of teacher's college	log(total pay) of teacher
(share of students in private schools) •		0.0664
(index of teacher's responsibilities)		(0.0272)
		0.1882
teacher has a master's degree		(0.0315)
(index of choice among public districts) •		-0.0181
(teacher has a master's degree)		(0.0353)
(share of students in private schools) •		0.0043
(teacher has a master's degree)		(0.1459)
state indicator variables	yes	yes
number of observations	26474	26474
number of metropolitan areas represented	292	292
R-squared	0.1372	0.2822

This table shows the full set of coefficient estimates for the first two columns in Table 1. All notes from that table apply.

Figure 1

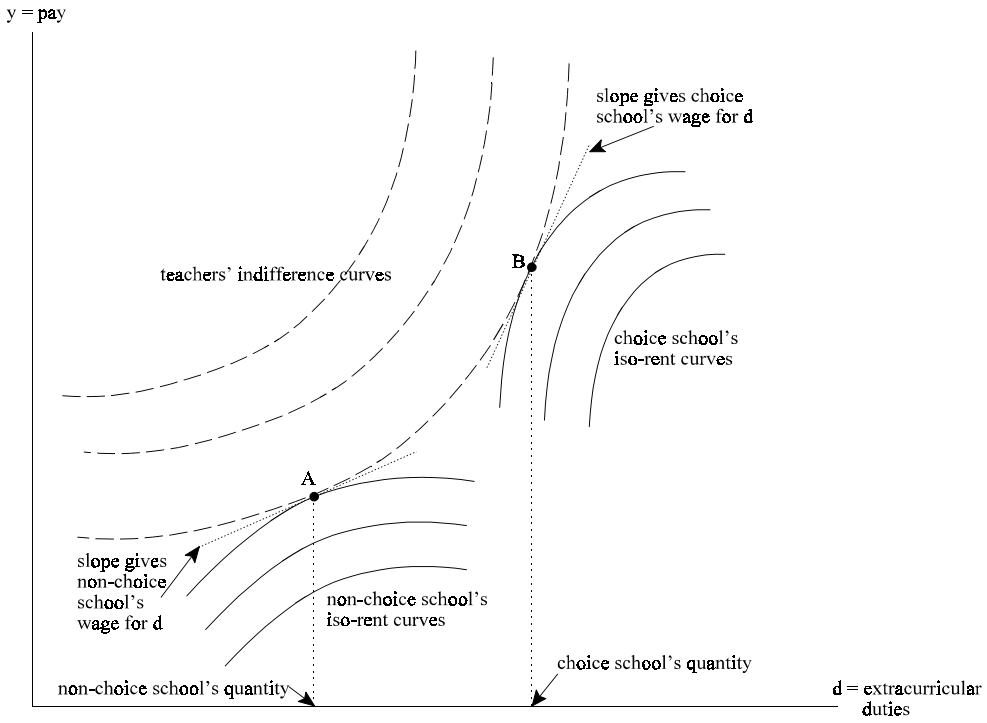

Figure 2

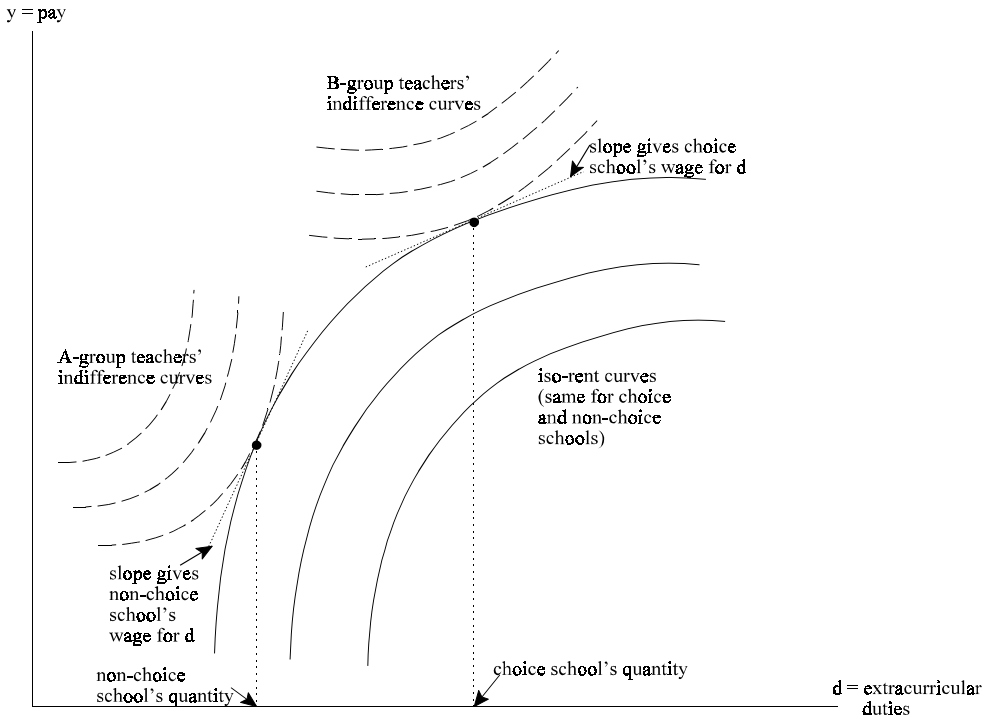

Figure 3

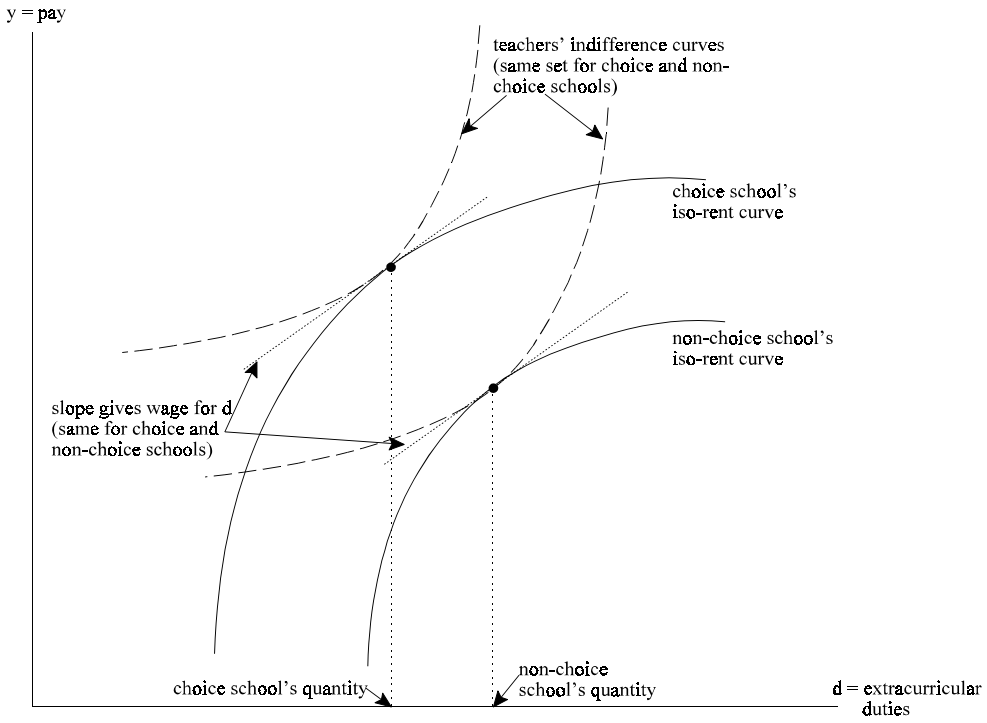

Figure 4