Incentives to Teach Badly?
After-School Tutoring in Developing Countries*

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Preliminary Version

Abstract

Schoolteachers in developing countries frequently offer for-profit tutoring to their own students. The teachers have an incentive to teach less during school to increase demand for their tutoring in many cases. Thus, the market for tutoring can have spillover effects even on students who do not partake in tutoring. I model and present empirical evidence on these effects, using survey and test score data from Nepal. I find that when teachers offer for-profit tutoring, they teach less during the regular school day, causing students to do worse on the national secondary-school exam. Tutoring also increases inequality in test scores among classmates. In this context, banning teachers from tutoring their own students or reducing entry barriers for third-party tutors could increase student achievement.

JEL codes: O12, O15, I20, J45

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1 Introduction

Many students in developing countries—from primary school to secondary school—receive tutoring in addition to their regular school instruction. In Bangladesh, over 40% of primary school students attend tutoring sessions. In Kenya, the figure is over 65%; in rural Egypt, 50%; and in Sri Lanka, 75% (Bray, 2005; Glewwe and Jayachandran, 2008). Among the Nepali secondary school students studied in this paper, over 40% take tutoring classes. The prevalence of tutoring may be partly due to parents being less educated and less able to help their children with their homework. In addition, the education systems in developing countries often have competitive exams at several stages that determine whether a student can continue her studies and the caliber of school she can attend, which also increases the demand for tutoring.

It is very common for the student's own teacher to serve as the tutor. Tutoring is usually done in groups rather than one-on-one, and schools often are the ones offering the tutoring classes. The classes are held on campus after the regular school day, and fees are charged.

Tutoring provided by the student's regular teacher is common in poor countries but rare in rich countries, and this sharp difference could be due to several factors. First, teachers may have a lower opportunity cost of time in poor countries because of income effects on labor supply. Second, there may be a smaller supply of educated non-teachers who can serve as tutors. Third, less monitoring of teachers by supervisors and parents might result in more scope for rent-seeking by teachers, which in turn would increase their interest in providing tutoring. Fourth, banning tutoring by teachers, which rich countries such as Singapore have done, might be less feasible in poor countries, perhaps because of stronger political clout of government teachers or the inability to enforce regulation.[1] Fifth, governments sometimes view tutoring as a way to boost the income of teachers. In fact, a few countries have banned

[1] After-school tutoring is prevalent in East Asia, and while there is debate about the pressure on young children and the inequality of opportunities, distortions in teachers' incentives are not seen as a major problem. The bans on tutoring by teachers in Singapore and Hong Kong are apparently effective, which is consistent with the higher opportunity cost of teachers' time and better enforcement (Bray, 2003, 2005). In contrast, policy makers and newspaper editorials in developing countries often call for a ban on tutoring, but most initiatives have either not come to fruition or have been ineffective (Foondun, 2002).

other tutors and granted government teachers the exclusive right to offer tutoring for this reason.[2]

One welfare question raised by tutoring is what its effect on equity is. On the one hand, wealthier families or those who put a higher value on education may be willing to spend more on tutoring, exacerbating inequality in education compared to a scenario where all education is publicly funded. On the other hand, tutoring might be most helpful for the weakest students, enabling them to catch up to their peers. Even if tutoring increases inequality, the popularity of tutoring suggests that the demand for education is not being adequately met by public schools, so greater inequality might be the price to pay for greater choice and efficiency in the market for education.

However, the fact that the child's schoolteacher is very often the one providing the tutoring raises a second concern about teacher incentives and inefficiency. Anecdotal evidence suggests that teachers sometimes refrain from teaching some of the curriculum during school in order to generate demand for their fee-generating tutoring classes. Teachers say, in not so many words or sometimes even explicitly, "You need to know X, Y, and Z to pass the exam. We'll cover X and Y in class. If you want to learn Z, come to tutoring." When the teacher intentionally teaches less during school, all students are made worse off, and the students whose academic achievement suffers most are those who cannot afford (or otherwise do not demand) tutoring. As a result, rather than making the education sector more efficient, the market for tutoring might create inefficiencies. In such a setting, a ban on tutoring one's own students or policies that reduce entry barriers for third-party tutors could be welfare-enhancing for students, even those who never take tutoring.[3]

While the anecdotal evidence suggests that teachers' incentives are worse when they offer for-profit tutoring, the direction of the incentive effect is theoretically ambiguous. If school

[2]For example, the government of Zanzibar allows schoolteachers to tutor and has banned private tutors for the express purpose of raising teachers' incomes.

[3]There is anecdotal evidence that teachers also sometimes coerce students to take their tutoring classes by threatening to fail them on exams or otherwise punish them. A previous version of this paper studied this effect, as well.

instruction and tutoring are substitutes, then teachers who teach less during the school day are rewarded with higher tutoring profits. But, conversely, if the demand for tutoring is higher when students learn *more* during the regular school day, then being able to offer tutoring could give teachers the incentive to do a better job during the regular school day. For example, tutoring and regular school instruction could be complementary when students face a high-stakes exam with a pass-or-fail outcome. Tutoring would not be valuable if students learned so little during the regular school day that, even with tutoring, they could not pass the exam. In this scenario, allowing teachers to offer tutoring could improve the quality of schooling.

This paper models teacher incentives and student achievement in the presence of school-provided tutoring. It then uses survey and test score data from secondary-school students in Nepal to empirically assess the effects of tutoring. First, I examine the effects of school-provided tutoring on student achievement. The outcome measure is the test score on the national exam that students take at the end of secondary school. The analysis measures the externality of tutoring, or the effect of the school *offering* tutoring, rather than the individual-level effect of *taking* tutoring. I find that tutoring has a negative effect on test scores, suggesting that being able to offer tutoring gives schoolteachers perverse incentives during the school day. The negative spillover from teacher-provided tutoring causes about a 0.1 standard deviation drop in test scores.

The identification strategy uses variation across subjects (math, science, and English) within a school and tests for effects in public schools, using private schools as a comparison group. The incentive to downgrade teaching during the school day is weaker in private schools: They charge tuition fees for regular school instruction so would be penalized financially if they downgraded it. In addition, the scope for teaching less is likely more limited in private schools, where parental monitoring is likely much stronger.

Second, I use the same difference-in-differences approach to look directly at how teacher-provided tutoring affects teachers' effort during the school day. The outcome measures are students' assessments of teacher performance, e.g., whether he teaches for the full class period. I find that offering tutoring classes indeed causes teachers to put in less effort. Through various specification tests, I am able to rule out several alternative explanations of the results. The negative effect on student achievement seems to be due to teachers distorting their effort in order to generate demand for tutoring classes.

Third, I examine how teacher-provided tutoring affects inequality in academic performance. I find suggestive evidence that tutoring widens the achievement gap among classmates. Tutoring's negative spillovers into the classroom seem to especially hurt weaker students. School-offered tutoring therefore causes both a decrease in efficiency and an increase in inequality.

This paper is related to the literature on quality of education in developing countries, in which an emerging theme is that low teacher effort is a central problem. For example, Chaudhury et al. (2006) and Duflo, Hanna, and Ryan (2007) have highlighted teacher absenteeism. Others have examined whether explicit performance incentives for teachers improve student achievement (Lavy, 2002; Glewwe, Ilias, and Kremer, 2003; Duflo, Hanna, and Ryan, 2007; Muralidharan and Sundararaman, 2008). The paper is also related to work on red tape and corruption insofar as a teacher lowering the amount taught during class in order to boost tutoring profits is analogous to a bureaucrat creating inefficient obstacles so that he can extract bribes (Banerjee, 1997). Finally, there is a growing literature on tutoring in developing countries. Previous work examines the prevalence and reasons for tutoring (Foondun, 2002; Bray, 2005); the adverse consequences of it (Biswal, 1999; Bray, 2003); and its effectiveness at improving student achievement (Ha and Harpham, 2005; Dang, 2007; Glewwe and Jayachandran, 2008).

The remainder of the paper is organized as follows. Section 2 presents the model. Section 3 provides background on education in Nepal, describes the data, and presents descriptive statistics. Section 4 describes the empirical strategy used to estimate the effects of school-provided tutoring. Section 5 presents the empirical results. Section 6 concludes.

2 Model

There are two types of agents in the model, households and a public school teacher. Each household has one child, and a household's utility is increasing in consumption and the child's academic achievement. While the household cannot directly choose their child's achievement, denoted by s, it can spend money on tutoring t which raises s. There are a continuum of households indexed by i that have identical preferences but vary in income.

The teacher provides the regular school-day instruction to the children and also offers for-profit tutoring. The teacher decides how much material to teach during the regular school day, denoted m, where $m > 0$. The teacher also chooses the price p of tutoring. The regular school day is free.

Note that I refer to this agent as the teacher, but the terminology should be thought of as shorthand for the teacher and the school jointly making decisions. I treat the teacher and school's interests as aligned, an assumption based on what seems to hold in practice. A teacher's income from tutoring is often a salary rather than a piece rate per student, in which case the school is the residual claimant on tutoring revenues. In addition, the head teacher (principal) often teaches regular school classes and tutoring classes in addition to his administrative duties. Modeling a principal-agent problem between the school and the teacher in cases where they have unaligned interests is beyond the scope of this paper.

Student achievement $s(m, t)$ is an increasing function of the amount of material taught during school and the amount of tutoring. A crucial parameter is whether tutoring improves achievement more when *less* material is taught during the regular school day ($s_{mt} < 0$), or when *more* material is taught ($s_{mt} > 0$). (The notation s_{mt} denotes $\partial^2 s/\partial m \partial t$.) Consider the case where $s_{mt} < 0$, or tutoring and school are substitutes. If, as seems reasonable in many cases, there is more benefit from being taught material the first time than the second time, then t is more valuable when m is lower. An implication is that a teacher can raise demand for tutoring by teaching less during the school day. A teacher might lower m by skipping certain modules of the curriculum during the school day, and then teaching those modules in the tutoring sessions.

Suppose instead that tutoring and school instruction are complements ($s_{mt} > 0$). This assumption might hold if there is a threshold achievement level that students are aiming for, e.g., the level needed to obtain admission at a prestigious school for the next year. For levels of student achievement just shy of the threshold, there are convex returns to improving achievement. Tutoring then would have opposite effects: it would lead teachers to teach more than they otherwise would.

Tutoring classes are taught for a fixed amount of time, and the supply cost to the teacher is the opportunity cost of his time. Extra instruction is taught in groups, and I assume the group size can be scaled up freely, so that the marginal cost of providing t is zero. I abstract from the fact that quality might decline with the size of the tutoring group.[4] For the household, whether to sign up for tutoring is a discrete choice of either no tutoring or a single unit of tutoring, $t_i \in \{0, 1\}$. I denote the total demand for tutoring from the teacher as T, that is, $T \equiv \sum_i \mathbb{1}(t_i = 1)$.

The teacher's objective function depends on profits from tutoring, effort costs of teaching, and penalties for teaching too little during the school day. I make the simplifying assumptions that these components of the teacher's utility are additively separable and that profits enter linearly. One can write the teacher's objective function as

$$V(p, m) = \begin{cases} p \cdot T(p, m) - W + \phi(m) & \text{if} \quad T > 0 \\ \phi(m) & \text{if} \quad T = 0 \end{cases}$$

W is the opportunity cost of time which is incurred if a non-zero quantity of tutoring is supplied. The term $\phi(m)$ represents, in reduced form, the utils from teaching an amount m. It encompasses effort costs that increase in m and penalties or psychic costs that decrease in m.[5] I assume that $\phi(m) \to -\infty$ both as $m \to 0$ and as $m \to \infty$. This assumption ensures

[4]If quality declines with class size, this leads to one natural interpretation of why the third-party tutors introduced later offer a higher quality service: they cannot use school facilities so have a smaller tutoring group size.

[5]For example, if the teacher teaches next to nothing (very low m), parents might complain and he could

an interior solution, or that $\phi(m)$ is maximized for some intermediate value of m.[6]

This teacher's decision problem differs from the standard monopolist's problem in some important ways. First, the seller (teacher) has an additional way to raise demand besides by lowering prices: he can lower (raise) m if m and t are substitutes (complements) in the household's utility function. Second, the teacher's maximand is not profits. His utility also depends on m, so he faces a tradeoff between the costs of changing m and the benefit of higher profits induced by changing m.

I now model household utility more specifically using a vertical product differentiation setup. The household has two options: tutoring or no tutoring. It spends its income net of tutoring expenses on the consumption good c. A household receives $u = s(m,t) + v(c)$ where $v''(c) < 0$. Households vary in income y_i. The household's utility is thus $u_i = s(m,1) + v(y_i - p)$ if $t_i = 1$ and $u_i = s(m,0) + v(y_i)$ if $t_i = 0$.

A higher-income household will have a higher willingness to pay for tutoring because of the diminishing marginal utility of the consumption good. A household will make the following choice.

$$t_i = \begin{cases} 0 \ \text{(no tutoring)} & \text{if} \quad y_i < y^*(m,p) \\ 1 \ \text{(tutoring from teacher)} & \text{if} \quad y_i \geq y^*(m,p) \end{cases} \tag{2.1}$$

where y^* is the level of income such that $s(m,1) - s(m,0) = v(y^*) - v(y^* - p)$.

Let $F(\cdot)$ be the cumulative distribution function for y_i, with $F(\cdot)$ twice differentiable over a finite support. The teacher's problem is now to choose p and m as follows,

$$\max_{p,m\geq 0} \ p \cdot [1 - F(y^*(m,p))] + \phi(m), \tag{2.2}$$

where I have focused on the interior solution where tutoring is offered. An equilibrium can be characterized by the (m^*, p^*) choice of the teacher, which in turn corresponds to an income threshold y^* above which households consume tutoring.

be demoted.

[6]One could make the weaker assumption that $\phi(m)$ is not maximized at $m = 0$ and $\phi'(m) < 0$ as $m \to \infty$.

Results

To compare outcomes when teachers do offer tutoring and when they do not, I consider a policy that bans tutoring by teachers and compare it to the scenario modeled where teachers are allowed to offer for-profit tutoring to their students. In the model, the ban can be thought of as the teacher's cost of providing tutoring becoming infinite, or $W \to \infty$.

Proposition 1. *If tutoring and school instruction are substitutes (complements) in the household's utility, then the amount taught during the school day will be lower (higher) when teachers are allowed to offer for-profit tutoring to their students compared to when they are banned from doing so.*

Proof. Let m_b be the level of m that solves $\phi'(m) = 0$, the first order condition when tutoring is banned. When tutoring is allowed, the first order condition is $\phi'(m) - pF'()y_m = 0$. Since $u_s > 0$, if $s_{mt} < 0$, then demand for tutoring will be higher when m is lower, or $y_m^* > 0$. (Fewer people take tutoring when more is taught in the regular school day.) Combined with the fact that $F' > 0$, this implies that m^* when tutoring is allowed is lower than m_b. Conversely, if $s_{mt} > 0$, then $y_m^* < 0$ and m^* when tutoring is allowed is higher than m_b. ∎

If tutoring is more valuable when m is lower, then teachers will withhold material during the school day to generate demand for tutoring.[7] If, instead, increasing m raises the demand for tutoring, then tutoring will have the opposite effect on m.[8]

For the case where $s_{mt} < 0$ and tutoring lowers m, the problem is closely related to second-degree price discrimination by a monopolist. The monopolist will offer a lower value product (bundle of m and no tutoring) to the low-demand consumers in order to induce the high-demand consumers to choose the higher value product (bundle of m and tutoring).[9] An

[7]An alternative reason that the amount taught might increase if teachers cannot moonlight is that they might be less tired during the school day. In other words, tutoring might reduce m not because it is a choice variable of a teacher but because m mechanically decreases when he is working more hours. Many of the same welfare implications as strategic downgrading of m would apply; teachers' moonlighting would still lower student achievement. One different implication of this alternative story is that it would be immaterial whether the teacher was teaching specifically his own students.

[8]The model assumes that the function $s()$ is identical across households. If for some households m and t are complements and for other households they are substitutes, then what is relevant for the equilibrium effect on m is the shape of $s()$ for the marginal tutoring customers.

[9]The monopolist can only offer two choices; his time is an input into tutoring, and he can only offer one bundle with tutoring. (In principle, teachers could offer multiple tutoring classes of shorter duration, but in practice they do not.) The restriction to two bundles is not an important feature of the problem for my purposes.

important way this problem differs from the standard price discrimination problem is that there is a constraint on the gap between the value of the high-value bundle, $s(m, 1)$, and the low-value bundle, $s(m, 0)$. For simplicity, suppose $s = m + t$ (the reasoning here does not depend on this assumption). Then the difference in utility from consuming one bundle versus the other is fixed at 1 util ($m + 1$ versus m.) In setting the two bundles, the monopolist has only one degree of freedom rather than two. This is due to classroom instruction being a public good: The teacher teaches all students together during the school day and cannot give some students a different level of m than others.[10]

One implication is that "efficiency at the top" does not hold. Efficiency at the top here would mean that the high-value bundle is set at $s = m_b + 1$, since the marginal cost of providing tutoring is zero. (m_b is the level of m when tutoring is banned.) However, providing $s = m_b + 1$ implies that the lower-value bundle is $s = m_b$. Then, at a given price p, there will be some individuals for whom choosing the high-value bundle is not incentive compatible but who would choose the high-value bundle at $m = m^* < m_b$. Providing more teaching to the high types by raising m weakens their incentives to choose the high bundle.

In addition, there is no participation constraint for the low-demand customers and the price charged to them is fixed at zero. There is no free disposal of public education in the model, and there is no fee for it. Since the monopolist cannot extract rents from the low-demand types, he has no incentive to improve their bundle (raise m) in exchange for charging a higher price to them. Only the cost of providing very low m (represented by $\phi(m)$) prevents the monopolist from offering the lowest possible amount of instruction to them. This point is relevant for the empirical strategy, as laid out in section 4. This model applies to public schools, where there is no charge for the regular school day. Empirically, I compare public schools to private schools, who can and do charge for m.

Finally, note that while the typical result for two-part tariffs set by a monopolist is that customers at the bottom receive zero surplus, here the combination of no participation

[10] The teacher could give more attention to some students during school, but the scope for teaching students different amounts is limited, especially when the class size is large.

constraint and zero price makes it possible that the services of the teacher provide positive surplus (participation constraint would not bind and monopolist cannot extract rents because of zero price) or negative surplus (participation constraint would be binding) to the lowest-demand households.[11] In either case, the low-demand students are worse off when the teacher can offer tutoring.

I now return to the general case where school instruction and tutoring could be substitutes or complements. The next result examines the effects on student achievement and welfare when the teacher offers tutoring.

Proposition 2. *If tutoring and school instruction are substitutes (complements) in the household's utility, then a ban on teachers offering for-profit tutoring to their own students would*

1. *Increase (decrease) student achievement and welfare in low-demand households (that is, those who do not consume tutoring when it is offered).*
2. *Have an ambiguous effect on (decrease) student achievement for high-demand households (that is, those who do consume tutoring when it is offered).*
3. *Have an ambiguous effect on (decrease) the welfare of high-demand households in which the child's achievement is lower under the ban.*
4. *Raise the welfare of high-demand households if their child's achievement increases under the ban.*

Proof. 1. This result follows from the increase (decrease) in m shown in Proposition 1 and the fact that utility is increasing in s, and s is increasing in m. The ban does not affect c or t for this group.

2. If $s(m_b, 0) > s(m^*, 1)$ where m_b is the level of m under a ban and m^* is the level without the ban, then the ban will increase achievement of this group. Otherwise it will decrease it. If $m^* > m_b$ as is the case when $s_{mt} > 0$, then $s(m_b, 0) > s(m^*, 1)$. When $m_b > m^*$, $s(m_b, 0)$ can be larger or smaller than $s(m^*, 1)$.

[11] To illustrate the case with negative surplus, suppose there were a binding participation constraint at m_b for a non-participant in tutoring. If the teacher lowers m, the standard problem would require a reduction in the price for those consuming the lower-value product, or in this case a payment to non-participants in tutoring. The teacher does not need to provide this compensation in the absence of a participation constraint, however. Similarly, if there is positive surplus for a low type, lower m reduces her surplus.

3. If $s(m_b, 0) < s(m^*, 1)$, there is a decrease in utility from lower achievement. When $s_{mt} < 0$, this loss may or may not be outweighed by the increased utility from higher consumption. If $s(m_b, 0) + v(y_i) < s(m_b, 0) + v(y_i - p)$, utility decreases for these households under a ban; otherwise their utility increases. When $s_{mt} > 0$, the ban eliminates a positive externality, so by revealed preference, the households that demanded tutoring are worse off.

4. This case only applies when $s_{mt} < 0$. The reasoning from part 1 applies, with the additional gain to this group that their consumption increases by p^* units. When $s_{mt} < 0$, the ban also improves achievement so welfare increases. ■

I do not model entry and exit into the teaching profession. If a ban on tutoring lowers the effective wage for schoolteachers, then another potential welfare effect, detrimental to households, is that fewer or lower quality individuals would enter the teaching profession. In addition, even without effects on entry or exit, a full welfare calculation might want to consider that the marginal utility of income could be higher for teachers than for households. If there were no other way to transfer money from wealthier households to the teacher (for example, if raising taxes and using the money to raise teacher salaries is too costly), then tutoring might be a second-best way to make transfers from households to teachers.

Extension: Competition from third-party tutors

In addition to a ban on school-provided tutoring, another potential policy is to reduce barriers to entry for third-party tutors. In Appendix 1, I introduce to the model a third-party tutor. Here I give an overview of this extension.

The third-party tutor does not teach students during the regular school day, but just offers after-school tutoring. She offers a higher-valued tutoring service than the teacher, that is, one that raises s by more. In practice, outside tutoring is often in smaller groups, which may lead to higher quality.

Competition has implications for the teacher's behavior. If a teacher has incentives to downgrade the regular school day, then in doing so, he will drive some students away from the teacher-provided tutoring toward third-party tutoring. Thus, competition causes the teacher to alter his decisions as follows.

Proposition 3. *If tutoring and school instruction are substitutes, competition from third-party tutors raises the amount taught during school and lowers the price of school-provided tutoring relative to when the schoolteacher has a monopoly on tutoring.*

Proof. See Appendix 1. ■

Competition will lead to lower prices and higher quality which is welfare improving for households, for the case where tutoring and school instruction are substitutes.[12] For those who consume tutoring, competition adds choice and lowers prices. More households consume tutoring, and those who consume tutoring enjoy more consumer surplus from it. In addition, everyone—both those who do and do not consume tutoring—enjoys the benefit that teachers will not downgrade the school-day instruction as much.

The intuition for the result is that teachers have less incentive to manipulate m when only some of those who are induced by lower m to purchase more tutoring will purchase tutoring from *them*. Third-party tutoring becomes relatively more valuable when m is lower, given the assumption that $s_{mt} < 0$. Therefore, teachers will drive some of their customers away to third-party tutoring by lowering m. Thus, even a student who has no willingness to pay for tutoring (e.g., $y_i = 0$) benefits from competition in the tutoring market because of the externality that the demand for tutoring has on quality of instruction during the regular school day.[13]

3 Background and Data

Background on education in Nepal

The setting in which I test the model is secondary school in Nepal. Education in Nepal is divided into primary school (grades 1 to 5), lower secondary school (grades 6 to 8) and secondary school (grades 9 to 10). About 50% of children complete primary school, and of

[12] Appendix 1 discusses the complements case, as well.

[13] Another possible effect arises if the teacher's utility depends on student achievement. There could be a free-riding effect, and existence of tutoring exclusively provided by others might lower teacher effort.

these, about two thirds continue through the end of secondary school. At the end of grade 10, students sit a national School Leaving Certificate (SLC) exam. The certificate is the analogue of a high school diploma in the United States, both a terminal credential with value in the labor market and a prerequisite for continuing one's education. Grades 11 and 12, which previously were part of the university system, are now called higher secondary school, and are outside of the Ministry of Education's system of public education. After grade 12, students attend university.

There were 3850 public secondary schools and 890 private secondary schools in Nepal in 2004 (the year the data were collected).[14] Of the 511,000 secondary school students that year, 79,000, or 15%, attended private schools. In the sample I use, median annual fees in private schools were 6640 rupees. Per capita gross domestic product (GDP) was 20,800 rupees in 2004, so private-school fees were about 30% of per capita GDP. (The 2004 exchange rate was 76 Rupees per US dollar.) Median public school fees (administrative fees, since tuition is free) were 640 rupees.

This paper focuses on students who have recently completed grade 10 and have sat the national SLC exam. Students sit the national exam at exam centers around the country in May or June. The exam is scored on an absolute scale and measures "the extent to which she has acquired the knowledge and skills prescribed by the curriculum," (Bhatta, 2005, page 19). The student take tests in several subjects: math, science, English, Nepali, social studies, and HPE (health, population and environment), as well as two optional subjects. Students receive a numerical score and pass or fail status for each subject.

The scores are added together for an overall SLC score and pass or fail status. Students who pass receive different levels of distinction (distinction, first, second, third). Besides needing to have a sufficiently high total score, a student must pass every subject to receive a passing grade overall. Thus the overall pass rate is considerably lower than the pass rate in each subject. In 2004, 175,000 students took the exam and 46% passed (Government of

[14]Public schools are known as community schools in Nepal, and private schools, as institutional schools.

Nepal, 2005). The pass rate varies considerably year to year; in 2003, 32% passed. The low pass rate has earned the SLC exam the nickname "The Iron Gate," because it blocks many students from further study.

Largely because of the importance of the SLC exam, tutoring is common in secondary school. The common format is group classes offered after school by the school's teachers. In addition, there are some group classes organized by outside agencies and students can also get private tutoring, either one-on-one or few-on-one. (These correspond to the third-party tutoring described in the model.) Tutoring is most common in math, science, and English, followed by Nepali. Perhaps not surprisingly, these are the subjects with the most challenging SLC exams, as measured by low pass rates.

Overview of the data set

The data I use are from a large nationwide survey of students, schools, teachers, and families conducted in Nepal in late 2004 and early 2005. The survey was commissioned by the Ministry of Education to assess student- and school-level determinants of success on the SLC exam. The sample frame is students who took the exam in 2002, 2003, or 2004 (the years 2058, 2059, and 2060 in the Nepali calendar).

Using stratified random sampling, 28 districts and then 450 schools within these districts were selected to be surveyed. The sample was stratified on geographic zones (that vary in terrain and level of development) and the school's public-or-private status. The survey set out to interview 11,250 students (50% of the sample) who took the exam in 2004, 5625 who took the exam in 2003, and 5625 students from 2002. About 16,400 students took the SLC exam nationwide in 2004, so a high proportion of students, roughly 70%, were sampled for that year. The sampling strategy is described in detail by Bhatta (2005). The survey appears to have been carefully designed and executed.

I use the data collected from the school and from students. The school questionnaire asked the head teacher about demographics of the school and also whether the school offered tutoring in each of math, science, English and Nepali (as well as several other questions not relevant to this study). The student questionnaire asked the student whether she took tutoring in each subject and who provided the tutoring. The student questionnaire also asked for subjective assessments of the teacher and about socioeconomic status of the student's family. In addition, I use SLC test score data for the student that the survey team collected from the school records. The teacher questionnaire, unfortunately, is of limited use since relatively few teachers were surveyed. I also do not use the family questionnaire since only a quarter of students' families were surveyed.

The sample includes students who took the exam in 2002, 2003, and 2004, but the survey was conducted in 2004. Because of a longer recall period, the student data may be less reliable for 2002 and 2003. The school questionnaire refers to whether tutoring was offered in 2004, but it seems likely that whether a school offers tutoring is persistent over the three years. I include all years of test takers in the main analysis, but also show results using only the 2004 test takers.

The identification strategy compares public schools and private schools. The starting data set includes 303 public schools and 109 private schools. (These numbers exclude some surveyed schools for which the student and school data cannot be matched or the school cannot be classified as public or private.) To make the subsamples of private and public schools more comparable, I construct a propensity score for being a public school. That is, I use individual- and school-level characteristics that differ between the two types of schools and estimate a probit model in which the dependent variable is a dummy variable that equals one if the school is public. I then use the predicted values to calculate the mean propensity score for a school and restrict the sample to the region of common support between public and private schools: I drop schools that are above the 95th percentile of the propensity score for private schools (which drops mainly poor public schools) and schools below the 5th percentile of the propensity score for public schools (which drops mainly rich private schools). Figure 1 depicts the distribution of the propensity score for public and private schools and the thresholds used. The mean propensity score is 0.75 for private schools and 0.79 for public schools in the sample I use (and 0.57 for private schools and 0.86 for public schools in the full sample).[15] The analysis is at the student-subject level (the subjects are math, science, and English), and the resulting sample comprises 14,265 student-subject observations from 82 public schools and 4052 student-subject observations from 45 private schools.[16]

Descriptive statistics

Table 1 presents descriptive statistics on tutoring, by subject. The school questionnaire asked about tutoring in the four subjects in which tutoring is most commonly offered: math, science, English, and Nepali. (The student-level data also asked about tutoring in other SLC subjects). The first row shows how often tutoring is offered by the school. Each observation (student) is weighted equally, so, for example, for 69% of the sample of students, the school offers math tutoring. For science, the number is 63%, for English, it is 57%, and for Nepali, it is much lower at 11%. For this reason (as well as other reasons discussed below), the analysis focuses on math, science, and English.

The proportion of students passing each exam section is between 68 and 80%. I normalize the exam score to have a mean of 0 and standard deviation of 1 within each subject-year and also report the mean within-school-subject standard deviation.

The student questionnaire asked the student to rate the teacher on several dimensions. These subjective assessments are very helpful for the analysis because they enable one to directly measure whether the teacher taught less and put in less effort when he offered tutoring. The first two questions are measures of how much the teacher taught, the outcome of interest. The first question asks whether the teacher completed the curriculum. The second is whether the teacher taught for the entire class period. This second question was asked on a 4-point scale. Since the scale has no natural cardinal interpretation, I construct

[15] I use the 5th and 95th percentile rather than the absolute minimum and maximum of the common support because there is a large mass of public schools between the 95th percentile and maximum propensity score for private schools, as can be seen in Figure 1. Including them makes the sample substantially less balanced on the propensity score.

[16] Observations are dropped if there are missing values for any of the main outcome or explanatory variables (whether the school offers tutoring, whether the student takes tutoring, test scores, teacher effort.) Note that some specifications use other variables with missing values, so the sample size is sometimes slightly smaller.

a dummy variable for whether the answer was a 3 or 4, or whether the teacher taught for the entire period "over half the time" or "almost always," rather than "never" or "only sometimes." The mean for whether the teacher completes the curriculum is about 0.7 and the mean for teaching the entire period is about 0.85.

The next four variables, which are used to rule out alternative hypotheses, were also asked on 4-point scales, and I convert the answers to a dummy for whether one of the highest two scores was given. There are two subjective assessments of the teacher's ability rather than effort. These variables ask whether the teacher has good command of the subject matter and whether his teaching style is clear and understandable. The last two subjective questions are measures of the teacher's time and effort outside the classroom: whether the teacher is well prepared for class (mean of about 0.8) and how often he assigns and checks homework (mean of about 0.55).

The last rows of the table show means of variables conditional on the school offering tutoring. I first show the proportion of observations from private schools. Note that the sample mean of the private school variable is 0.22. Among schools that offer tutoring in math and science, the proportion that are private is slightly higher. It is considerably lower for English and considerably higher for Nepali. This pattern is likely due the fact that private schools are often English-medium, so students need to improve their Nepali more, while public schools are Nepali-medium, so students need to improve their English.[17] Conditional on the school offering tutoring, the take-up rate is about 60% for math and English, a little lower for science and much lower for Nepali (another reason I exclude Nepali from the analysis).

Finally, I create and report statistics for a student-level wealth index. I use principal components analysis of several proxies for the family's socioeconomic status (listed in Appendix Table 1).[18] The wealth measure has an overall sample mean of 0.14, so the schools

[17]This fact suggests that tutoring in Nepal falls into the substitutes case described in the model. Tutoring appears to be remedial, aimed at fixing weaknesses rather than building on strengths.

[18]The survey does not have a good measure of income or expenditure. There is a categorical question about total household income (which is included in the wealth index), but asking about total income may not be a good way to elicit income in this setting. Moreover, the question is asked of the student, who may not be well-informed about the family's total income.

that offer tutoring in math and science are a little above average, those that offer English have below average wealth, and those that offer Nepali have above average wealth. Because math and science are more comparable to each other than to English on this measure and others, in an appendix table I show the results when English is dropped. The remainder of the paper excludes Nepali (except in that same appendix table).

Table 2 presents descriptive statistics separately for private and public schools. Both types of schools offer tutoring about 60% of the time, with the take-up rate slightly higher in public schools. Private-school students perform better on the SLC exam, though the within-school standard deviations of the test score are similar. Students in private schools are wealthier, slightly more likely to be male, and less likely to have failed a grade in lower secondary school. Students in private schools give somewhat higher ratings to their teachers.

A final helpful background fact is how much tutoring costs. While the survey did not collect very reliable data on tutoring fees, there is a question on total tutoring fees per month. The median tutoring fees, conditional on taking at least one of the three subjects, is 300 Nepali rupees (measured in 2004 terms) per month, both for private schools and public schools. These statistics are shown in Appendix Table 2. GDP per capita in 2004 was 20,800 rupees per year, or 1735 per month, so tutoring expenses were about 17% of GDP per capita. Unfortunately, the survey lacks good household level income or expenditure data to measure tutoring expenses as a proportion of total spending at the household level. Appendix Table 2 also presents additional summary statistics about tutoring, by subject and type of school. It also reports summary statistics for test scores on the grade 9 exam, data that I use to probe for selection bias. These data are unfortunately only available for a small subset of the sample.

4 Empirical strategy

This section lays out the empirical strategy used to test for spillovers of school-provided tutoring on student achievement. Negative spillovers would result from teachers teaching less during the school day to induce demand for tutoring. Conversely, there would be positive spillovers if the way for teachers to increase tutoring demand is to teach more during school. In addition to using student achievement (test scores on the national secondary exam) as the outcome, I also use direct measures of teacher effort during the school day to examine how teachers' regular job performance is affected when they offer tutoring.

Basic estimating equation

When the teacher offers tutoring, student achievement is hypothesized to decrease or increase, depending on whether teachers cover less or more material during the school day to induce demand for tutoring. There should be a positive effect on student achievement if tutoring and school instruction are complements and a negative effect if they are substitutes. Though theoretically the effect could go either way, it is worth keeping in mind that the anecdotal stories point to a negative effect.

Also note that I am considering the teacher and the school as jointly making decisions, with aligned interests. In practice, the teachers and the school usually share the profits from tutoring. Thus, I use the language that "the teacher" or "the school" offers tutoring interchangeably.

Linearizing the student achievement production function assumed in the model, where achievement is increasing in tutoring, I begin by estimating the following equation to measure the effect of $Offers$—whether the school offers tutoring—on test scores ($ExamScore$):

$$ExamScore_{ijk} = \beta \cdot Offers_{jk} + \lambda \cdot Takes_{ijk} + \eta_i + \rho_k + \epsilon_{ijk} \tag{4.1}$$

The subscript i denotes the student, j denotes the school and k is the subject (such as math or English). The equation includes student fixed effects (η_i) and subject fixed effects (ρ_k). The unit of observation at which tutoring is or is not offered is a subject within a school, and the standard errors are clustered at this level. If the coefficient β is negative, then student achievement falls when the school offers tutoring, and if it is positive, student achievement improves. The identification of β comes from comparing subjects within a school. (Forty percent of schools in the data offer tutoring in some but not all subjects.)

The results are shown in Panel A of Table 3. When the outcome is an indicator variable for passing the test, the coefficient on $Offers$ is negative and insignificant. When the test score is the outcome, the coefficient is negative and marginally significant. The results are suggestive of negative externalities from tutoring.

Note that the aim of the estimation is to measure the effects on average achievement in a school-subject, not to compare students who do and do not participate in tutoring. However, since I observe the student's academic achievement (test score) inclusive of any tutoring she takes, and downgrading of school instruction might induce more tutoring (this is the hypothesized motive for downgrading), I also include in the regression whether the student takes tutoring ($Takes$). Then β can be interpreted as the *spillover* effect on student achievement when the school offers tutoring. I do not interpret the coefficient on $Takes$ as a causal effect, but simply to condition on the take-up rate of tutoring when estimating β. Columns 3 and 4 of Panel A show the results controlling for take-up. One would expect the coefficient on *Offers* to become more negative once the hypothesized positive effects of taking tutoring are conditioned on, but surprisingly, this pattern is not seen.[19]

Making comparisons within a school helps solve some of the potential endogeneity problems, such as schools with more resources being able to offer tutoring (positive bias in the estimate of β) or schools with strong students not needing to offer tutoring (negative bias). However, even within a school, there could be selection: Whether the school offers tutoring in a subject could be correlated with unobserved (positive or negative) predictors of test scores in that subject, such as teacher quality or students' subject-specific ability. If there is selection, then a negative estimate of β could reflect either negative spillover effects of tutoring or negative selection into *Offers* (that is, the tendency of schools to offer tutoring in their weakest subjects).

[19] One reason a student might take tutoring even if it does not help is if she fears that the teacher will punish her otherwise. For primary school, tutoring classes might also function as child care, but this seems unlikely for secondary school.

To solve this potential selection problem, I use a difference-in-differences strategy with private schools as a comparison group. The goal is to subtract out any selection into *Offers* by using the comparison group. Meanwhile, tutoring's incentive effects on teachers differ between public and private schools, so the comparison allows one to test hypotheses about these incentive effects.

Before introducing the difference-in-differences strategy, a preliminary step is needed: determining if selection into offering tutoring is negative or positive. As explained below, this fact will inform us if we are in the case of negative incentive effects and spillovers or positive ones. The step is needed is because, while the difference-in-differences strategy estimates a causal effect, it does not pin down whether the spillovers are negative or positive. Negative spillovers should be stronger in public schools. Positive spillovers should be stronger in private schools. Both of these cases generate the same interaction effect between *Offers* and *Public* (being a public school).

Selection into which schools offer tutoring

If selection into offering tutoring is negative, I draw the conclusion that tutoring and school instruction are substitutes (and vice versa). In other words, if tutoring is remedial, as evidenced by its being offered when initial student achievement is lower, then we are not in the case of increasing returns to knowledge where tutoring is aimed at building on academic strengths (complements case). Instead, we are in the substitutes case, where the aim of tutoring is to shore up weaknesses. The purpose of assessing selection into *Offers*, then, is to determine the direction of teacher incentives, and whether spillovers in the classroom should be negative or positive.

I estimate the following equation where *Offers* is the outcome, and the independent variable is a measure of the student's earlier exam scores.

$$Offers_{jk} = \pi \cdot PriorExamScore_{ijk} + \eta_i + \rho_k + \epsilon_{ijk} \tag{4.2}$$

If $\pi < 0$, then selection into tutoring is negative, and we are in the case of negative spillovers where teacher incentives are to downgrade regular school instruction. The data I have to test this story—test scores from grade 9—are far from ideal, but they provide some evidence on this question. A first limitation of the data is that they are collected for only a small subset of the sample, since few schools kept these records, and the subsample is non-random. Second, the exams are from the end of grade 9, while ideally they would be from the end of grade 8. Tutoring is offered throughout secondary school, so the grade 9 test score is not truly pre-determined. (That being said, tutoring tends to be more concentrated in grade 10, which is not surprising since the SLC exam is taken after grade 10.) Third, the exam is not a national exam, but is specific to a school. I normalize the test score within a school to improve the comparability across schools. Keeping these caveats in mind, the results are shown in the first two columns of Panel B of Table 3. In both columns, the selection into *Offers* is negligible.

I also use student-level selection into *taking* tutoring to get a sense of school-level selection into *offering* tutoring. The logic is as follows. We can tell if tutoring is remedial if the weaker students are more likely to take it. If tutoring and student ability are substitutes, then it seems very likely that tutoring and school instruction are also substitutes.

Note that we saw a first piece of evidence on this question in Panel A. When the exam score is the outcome, the coefficient on $Takes$, conditional on whether the school offers tutoring, is negative. We expect that the causal effect of $Takes$ on passing the exam to be positive. On a priori grounds, getting more hours of academic instruction should be helpful. Moreover, by revealed preference, it should be helpful given that families are paying money for it.[20] (Students also report that they think it helps them on the exam, as reported in Appendix Table 2.) Thus, the negative coefficient on $Takes$ suggests that the student-level selection is negative. I also can examine selection into $Takes$ more directly. I estimate an equation analogous to (4.2) except that $Takes$ is the outcome. These results are in columns 3 and 4 of Table 3, Panel B, and indicate that weaker students are more likely to take tutoring.

[20]Footnote 19 suggested a reason that taking tutoring might have no effect, but it is harder to make a coherent argument for how it could have a negative effect.

This provides further suggestive evidence that, if there is any selection into *Offers*, it is likely to be negative.

In sum, based on the patterns of selection into offering tutoring and taking tutoring, I conclude that positive spillover effects of *Offers* are not applicable in the context I study. The relevant case is that of negative teacher incentives and negative spillover effects of *Offers*. I now turn to describing the identification strategy I use to estimate the effects of *Offers* in a way that addresses potential selection bias.

Difference-in-differences strategy

To estimate the effects of *Offers*, I use a difference-in-differences comparison between public schools and private schools. The identifying assumption is that selection into offering tutoring within a school is the same for public and private schools.

The approach is based on the fact that incentives to distort teaching during the regular school day differ between public and private schools. As seen above, the relevant case is when tutoring gives teachers the incentive to lower the quality of regular school instruction. If the quality of the regular school day falls, parents' willingness to pay for it will fall. This fact is irrelevant to public schools since they cannot charge for regular school instruction; their only lever to raise revenue is to offer tutoring. Private schools are very different. They charge tuition for the regular school day, so they will suffer financial consequences if they lower the quality of the school day and the value parents place on it.[21] Another reason that the moral hazard problem should be smaller in private schools is that the parents likely keep a closer watch on teachers and prevent them from lowering quality. Both of these differences suggest that the negative incentive effects on teachers from offering tutoring should be stronger in public schools.[22]

[21] Private schools might still choose a two-part tariff to price discriminate, but since they are not constrained to charge zero for the regular school day, they will not have as strong an incentive to drive its quality down.

[22] To understand why determining that we are in the substitutes case was a needed step, consider the complements case. If tutoring and school instruction are complements, then both public and private schools have the incentive to improve school instruction when they offer tutoring. The effect is likely to be stronger among private schools since they are rewarded not just with more demand for tutoring, but also with higher demand for their regular school instruction. Thus, the positive effects of tutoring should be weaker in public

I estimate a standard difference-in-differences equation where the variable of interest is the interaction of offering tutoring and being a public school.

$$ExamScore_{ijk} = \beta \cdot Offers_{jk} + \gamma \cdot Offers_{jk} \times Public_j + \eta_i + \rho_k \times Public_j + \lambda \cdot Takes_{ijk} + \epsilon_{ijk} \quad (4.3)$$

The coefficient γ is the differential effect in public schools when the school offers tutoring. The specification allows the subject fixed effects to vary between public and private schools. Student fixed effects absorb the main effect of *Public*. The interpretation of $\gamma < 0$ is that offering tutoring has stronger negative incentive effects on teachers in public schools.

The identification assumption is that omitted factors that cause there to be tutoring in one subject but not another are the same between public and private schools. One might expect private schools to be more responsive to where tutoring is most valued by students. This would bias the estimates toward zero, since private schools' decision to tutor would be more responsive to observed factors causing low student exam scores (e.g., low student ability). The more serious concern would be if there is more negative selection into tutoring in public schools. I show below that, if anything, selection leads me to underestimate the magnitude of tutoring's spillover effects.[23] I now turn to presenting the results.

5 Empirical results

Effects of school-offered tutoring on exam scores

The main results on how *Offers* affects test scores are shown in Table 4. In Panel A the outcome is a dummy for whether the student passes the SLC exam in a subject, and in Panel B the outcome is the student's exam score. The regression includes student fixed effects and subject fixed effects that vary between public and private schools. Since the regressor of interest only varies between school-subjects, standard errors are corrected for clustering at

schools. This case also predicts that the differential effect on test scores for public schools should be negative.

[23] On a related point, suppose that the complements case applies for private schools and the substitutes case applies for public schools. Such a scenario does not threaten the identification but does alter the interpretation. The estimates are then measuring the gap between how much public schools are downgrading school instruction and private schools are upgrading it. The results, though, suggest that for both types of schools, tutoring and school instruction are substitutes.

this level. Panel A, column 1, shows the basic difference-in-differences results where the outcome is passing the exam. The variable of interest is the interaction term *Offers*×*Public*, and its coefficient is negative as predicted and statistically significant at the 1% level. When the school offers tutoring in a subject, students in public schools are differentially more likely to fail the exam. Panel B shows the corresponding result for the exam score. The interaction effect is negative but insignificant. The point estimate suggests that when the school offers tutoring, test scores fall by 0.1 standard deviations.

Column 2 adds the individual-level regressor of whether the student took school tutoring in that subject (the variable $Takes$). To isolate the spillover consequences when the school *offers* tutoring from the individual-level effects of *taking* tutoring, one wants to condition on take-up. The point estimate on *Offers*×*Public* becomes slightly larger in magnitude when the effects of take-up are netted out. I allow the coefficient on $Takes$ to vary between public and private schools. The main effect is negative and the interaction effect $Takes \times$ *Public* is positive, which is suggestive that selection into taking tutoring is negative but more pronounced in private schools (if treatment effects of $Takes$ are the same for both types of schools). Under the assumption that selection into take-up has a similar pattern as selection into offering tutoring, this finding suggests that differential selection cannot explain the coefficient on *Offers*×*Public*. (Appendix Table 3 provides more direct evidence on differential selection at the school-subject level that also suggests that, if anything, there is more positive selection in public schools.)

Column 3 includes the interaction term between *Offers* and the propensity score for being a public school. Adding this control variable does not substantially affect the coefficient in Panel A (passing the exam), but the coefficient in Panel B (exam score) becomes smaller in magnitude. It is worth noting that the results on the exam score are much more robust when the sample is restricted to math and science (as discussed in the robustness checks section). The weaker results when English is included may be due to the infrequency of English tutoring among private schools combined with the fact that English tutoring in some public schools is NGO-supported, in which case teacher profit motives may be less relevant.

Column 4 examines the subsample of schools in smaller towns and villages, those not located in the district center. The theory modeled schools as monopolists, with no competition either for tutoring students or for regular students. This assumption is less true in larger municipalities where there are more educated people to serve as third-party tutors, and where there is often more than one secondary school among which students can choose.[24] Thus, one expects the downgrading of school instruction to be more prevalent in small towns. This pattern is indeed what I find.

Finally, column 5 restricts the sample to only test takers from 2004. The survey was conducted in 2004 and the questions about whether the school offers tutoring are asked about 2004 rather than retrospectively about each year. Therefore, there may be more measurement error (or perhaps a concern about reverse causality) in the 2002 and 2003 data. The results using the 2004 subsample are similar to the main results.

To summarize, school-provided tutoring has a differentially more negative effect on test performance in public schools than in private schools. It appears that when teachers offer tutoring, there are negative spillovers in the classroom that cause a decline in student test performance. I now turn to examining the hypothesized channel of teacher effort.

Effects of school-offered tutoring on teacher effort

To estimate effects on teacher effort, I use the same difference-in-differences approach but with the teacher's effort as the outcome—more specifically, the quantity he teacher during regular class.[25] The outcome variables are students' subjective assessments of the teacher.

Table 5 presents the results using two measures of teacher effort. Panel A shows the results when the outcome is whether the teacher completed the curriculum that is covered

[24] There are often competitive exams to be admitted to secondary schools, so a student only has the choice to attend the schools to which she can gain admission.

[25] One difference from the estimates of student achievement is that the rationale to condition on student take-up of tutoring does not apply here. The outcome is measuring the teacher's classroom behavior, which applies equally to tutees and non-tutees.

on the SLC exam. The prediction is that when the school offers tutoring, there should be differentially more negative effects on teacher effort in public schools, or the coefficient on *Offers*×*Public* should be negative. The coefficient in column 1 is -0.12 and statistically significant at the 1% level. In column 2, I show that the results are robust to adding the interaction of *Offers* and the propensity score. When the school offers tutoring, public school teachers cover less material in class.

Column 3 probes a potential concern about recall bias. Students were surveyed after they had their exam results, and they might rate their teacher more favorably if they did well on the exam. (This concern should be equally true for the placebo tests I run below, so those non-results cast doubt on this concern.) In column 3, I condition on the student's secondary school exam score. This outcome is endogenous, so the regressor serves only as a test of reverse causality. The coefficient on *Offers*×*Public* is not affected, suggesting that the results are not driven by warm-glow recall bias.

Column 4 examines the subsample in smaller towns and finds that, as hypothesized, the effect is larger in areas where schools face less competition. The final column restricts the sample to 2004 test takers, and the coefficient is also slightly larger in magnitude than in the full-sample results.

The outcome in Panel B is how often the teacher taught for the entire class period. The dummy variable equals zero if the student said the teacher taught the entire class period either "never" or "only sometimes." Again, the interaction coefficient is negative as predicted, and significant at the 10% level. The magnitude is similar across the specifications, though larger in magnitude with the subsample of schools outside the district center. In sum, the evidence points to teachers teaching less during the regular school day when the school offers tutoring in that subject.

Testing alternative hypotheses and robustness

I next test alternative interpretations of the results. One potential omitted variable concern is that schools are more likely to provide tutoring in a subject if the teacher's ability or *exogenous* quality is low. Using private schools as a comparison group helps address this concern, which applies to both types of schools. One might worry, though, that the pattern is especially true in public schools (though it is as plausible that the opposite is true), generating the negative association between test performance and *Offers*×*Public*. To rule out this story, I estimate an analogous model using measures of teacher ability rather than effort as the outcome.

The results are presented in Panel A of Table 6, using two teacher ability measures. The first is the teacher's command of the subject matter, which captures the teacher's knowledge, and the second is how clear and understandable the teacher is, which captures his pedagogical ability. The coefficient on *Offers*×*Public* is small and insignificant for the teacher's command of the subject in the main specification, as well as when one controls for the propensity score and when one restricts the analysis to the 2004 subsample. For the teacher's clarity, I also find no effect.

Another interpretation of the results is that they are indeed causal effects of offering tutoring, but the lower effort is not a strategic choice by the teacher to increase demand for tutoring. Instead, the effects on effort could be a mechanical fatigue effect; teachers who moonlight may not have the time and energy needed to teach well in class. Again, the difference-in-differences setup limits this concern, but the fatigue effect could differ between public and private schools. Panel B of Table 6 tests this possibility by examining teacher effort outside the classroom as the outcome.[26] The first measure is whether the teacher is well-prepared for class, and the second is how frequently the teacher assigns and then checks over homework assignments. For the first outcome, the coefficient is negative and marginally significant in column 1, so tutoring may lead to less teacher effort outside the classroom. This behavior could be either mechanical (tutoring crowds out preparation time) or a strategic choice. The coefficient is insignificant in the next two specifications, however. When the

[26]Another way to distinguish this story would be to have data on tutoring conducted by teachers for students other than those in their own school. For the exogenous effort explanation, it is immaterial whether teachers are specifically tutoring their own students. Unfortunately, I do not have data that enables me to pursue this test.

outcome is how often the teacher checks homework, there is no significant relationship with *Offers*×*Public*. Thus, the effects on teacher effort seem largely to be a choice by the teacher. In some ways, it might be surprising that there are not stronger effects on effort outside the classroom. However, many teachers report that they also help out with a family farm or business, so time spent conducting tutoring classes could crowd out other employment rather than preparation for class.

Next, I provide further evidence in support of the main identifying assumption. That is, I examine whether selection into offering tutoring is the same for public and private schools. The results on teacher ability suggest that there is no differential selection on teacher ability, but there could still be selection on, say, how well-prepared students are when entering secondary school. The pattern of selection that could explain the main results of this paper is if public schools are differentially more likely to offer tutoring in a subject where students' incoming knowledge is weak. I test for this pattern using the grade 9 test scores. The results, shown in Appendix Table 3, suggest that, if anything, there is *less* negative selection in public schools. The estimates are imprecise, but in private schools, there is a small degree of negative selection, and the interaction for public schools is positive, such that the net point estimate for public schools is essentially zero. Thus, the selection story works against the main results; any bias is toward zero.

I next show the robustness of the results to using different samples. I first vary which subjects are included in the analysis. Appendix Table 4, Panel A shows the results when English is dropped and only math and science are used. As seen in the descriptive statistics, math and science are the subjects that are most comparable on observables. The results with this restricted sample are similar to the main results and, in many cases, larger in magnitude and more statistically significant. Panel B shows the results when Nepali is included. This expanded sample is the one change to which the results are not robust. Recall that the characteristics of tutoring in Nepali are very different than for math, science, or English (the schools are wealthier, take-up is very low, and the exam is easier). It is perhaps not surprising that Nepali is not a valid comparison group to the other subjects in the estimation.

Finally, in Appendix Table 5 I show the results using the full survey sample, without restricting to the region of common support for the propensity score. The sample is less balanced on the propensity score, but I control for the interaction of *Offers* and the propensity score. The results for passing the SLC exam and for the exam score are similar to those for the main sample. For teacher effort, the results are not as strong as in the main sample. Further probing of the teacher effort results shows that the results remain strong if the low propensity score (rich) schools are included; it is the high propensity score (poor) schools to which the results are sensitive. Given that NGO-offered English tutoring is common at this end of the spectrum, I also examine the full sample of schools, restricting the subjects to math and science. The results are indeed significantly stronger when English is excluded.

To summarize, the estimated effects of school-provided tutoring on student test scores and teacher effort seem to be caused by teachers intentionally teaching less in school. Alternative stories are not borne out by the data. The results also hold up to various robustness checks. I now turn to exploring the effects of tutoring on inequality in academic achievement.

Effects of tutoring on inequality in test scores

The last empirical analysis assesses whether inequality in student achievement increases or decreases when the school offers tutoring. One effect of teacher-provided tutoring on inequality derives from take-up. Some students take tutoring and should gain relative to their peers, which could increase or decrease inequality, depending on whether the strong or weak students have higher take-up. For example, in the model, wealthier students have higher take-up. If family background matters for achievement and wealthier students are already stronger academically, then access to tutoring will increase inequality. Alternatively, if tutoring is remedial, then weaker students might have higher take-up, which enables them to close the gap with their peers.

A second channel through which school-offered tutoring could affect inequality is that the negative spillovers into the classroom could have heterogeneous effects on students. Again, the direction of this effect is theoretically ambiguous and depends on whether the marginal benefit of school instruction is increasing or decreasing in ability.[27]

To examine the effects of $Offers$ on inequality, I estimate the following equation where the unit of observation is a school-subject and the outcome is the standard deviation of student test scores with a school-subject:

$$StdDev(ExamScore)_{jk} = \beta \cdot Offers_{jk} + \delta_j + \rho_k \times Public_j + \epsilon_{jk} \tag{5.1}$$

The subscript j denotes the school and k denotes the subject. The regression includes school fixed effects and subject fixed effects that vary between public and private schools. The coefficient β is the effect of tutoring on the spread in test scores. The identification again comes from comparing subjects within a school in cases where the school offers tutoring in some but not all of the subjects.

The results are shown in Table 7. In column 1, the point estimate of 0.045 suggests that the standard deviation in test scores increases when tutoring is offered (by 6% relative to the sample average). Perhaps not surprisingly given the small number of observations, the estimate is imprecise. Column 2 controls for the average test score within a classroom so that the coefficient on $Offers$ is not driven by an effect on the level of test scores.

To examine in which direction take-up affects inequality, I add in column 3 the percent of students taking up tutoring within the school-subject. The coefficient on the take-up rate is very close to zero. Next, to examine how the negative spillovers of tutoring affect inequality, column 4 adds the interaction of $Offers$ and $Public$ (since, as shown earlier, the negative spillovers are stronger in public schools). The positive coefficient suggests that when the teacher teaches less during the school day, students in the bottom part of the distribution are hurt more, increasing the gap between them and their classmates.

The take-up effect of tutoring on inequality is negligible, and the externality effect makes the weak students fall further behind. The fact that, overall, the standard deviation of test

[27] For example, weaker students might suffer more when the teacher downgrades school instruction because they are not as good at learning the skipped material on their own. Or stronger students might suffer more if the teacher skips advanced material that weaker students would not have mastered anyway.

scores increases (column 1) is consistent with the lower tail of the test-score distribution shifting further down. To examine the effect on weaker students in another way, I estimate individual-level regressions with the exam result as the outcome. I test whether $Offers$ has, on net, differentially worse effects for weak students, measured as those who failed a grade in lower secondary school:

$$ExamScore_{ijk} = \beta \cdot Offers_{jk} \times FailedGrade_{ijk} + \eta_i + \rho_k \times Public_j + \epsilon_{ijk} \qquad (5.2)$$

If β is negative, then weaker students are hurt disproportionately when the school offers tutoring. Columns 5 and 6 show the results when the outcome is, first, whether the student passes the exam and, second, the exam score. Indeed, $Offers$ has especially negative effects on already weak students. The implication of this finding is that when the school offers tutoring, there is both a decrease in efficiency and an increase in inequality.

6 Conclusion

One reason identified in the literature for low quality of education in developing countries is that teachers lack strong performance incentives. This paper focuses on a widespread practice that may give teachers especially bad incentives, at least in some settings. It is common for government teachers to offer for-profit tutoring to their own students. Teachers have an incentive to teach *less* during school in order to increase demand for tutoring, if tutoring and school instruction are substitutes. I modeled and tested for this phenomenon using survey data and test scores from Nepal. The existence of teacher-provided tutoring was found to cause negative spillovers on teachers' effort in the classroom and on student achievement. Student performance on the national secondary exam falls by roughly 0.1 standard deviations when the school offers tutoring. The identification used within-school comparisons across different subjects and used private schools—where both the incentives and the latitude to downgrade teaching are less pronounced—as a comparison group. I also used assessments of teachers' classroom performance to show that teachers who offer tutoring teach less during the school day. There were no corresponding effects for measures of teacher ability, which helped rule out alternative explanations. In addition to reducing efficiency, tutoring also increases inequality in test scores among classmates. This inequality was due to the weaker students falling further behind, not from the top students getting better. Tutoring's negative externalities in the classroom seem to especially harmful to weak students.

An implication of the findings is that banning teachers from tutoring their own students or reducing entry barriers for third-party tutors could be welfare-improving. These policies could increase student achievement even for non-participants in tutoring. Whether such policies are well-advised also depends on how they would affect sorting into the teaching profession, an issue not addressed in this paper. In addition, many of the policy implications are reversed in situations where tutoring and school instruction are complements rather than substitutes, that is, when the way to induce more students to take tutoring is to teach more during school.

I conclude by speculating on a related phenomenon: government health care providers who have private practices on the side. As with education, government health care is plagued by low quality in developing countries (Banerjee, Deaton, and Duflo, 2004; Das and Hammer, 2007). Just as teachers might teach less during school, health care workers might steer patients who come to the government clinic to visit their private practice instead. A particular problem in the health setting is that workers might be at their private clinic during the hours when they are supposed to be at their government job (Chaudhury and Hammer, 2004; Chaudhury, Hammer, Kremer, Muralidharan, and Rogers, 2006). Tutoring by teachers during school hours is uncommon; doing so would be brazen given that tutoring usually takes place in the school's classrooms. As a result, moonlighting in the health care sector might have especially negative effects on the provision of government services.

However, another important difference between government teachers and health workers is that teachers selling their tutoring services have foot traffic, so to speak. Schoolteachers automatically meet and interact with their potential tutoring customers. In contrast, patients in need of health care often bypass the government health clinic and go straight to a third-party provider, particularly if they expect the clinic to be unstaffed (World Bank, 2001). Therefore, one way that private practice might improve a health worker's performance in his government job is if it gives him an incentive to show up in order to meet and attract clients for his private clinic (Chawla, 1997). This could hold even if public and private health care are substitutes at the individual level: A doctor might steer certain patients to his private clinic (e.g., wealthier ones) while serving others in the public clinic, which would be an improvement over his simply being a no-show at the public clinic. Another important difference between education and health is that, whereas third-party tutors are often as qualified as government teachers, many private health workers are unqualified, and the care they give can be detrimental (Banerjee, Deaton, and Duflo, 2004; Bennett, McPake, and Mills, 1997). A ban on private care by government doctors and nurses would quite likely do more harm than good if it shifted patient care toward untrained quacks.

Appendix 1: Modeling competition from third-party tutors

Consider an additional supplier in the tutoring market, a third-party tutor. The third-party tutor serves a market that encompasses several schools so that she sets her price P as a function of the average of the several teachers' choices of p and m, and for any one schoolteacher, P is exogenous.

The third-party tutor offers a higher quality service than tutoring by teachers. Third-party tutoring provides θ units of tutoring, where $\theta > 1$. It follows that $P > p$ in order for anyone to consume tutoring from the teacher. The higher quality service can be thought of as lower class size. In practice, third-party tutors are constrained to offer smaller classes (in their homes) than schoolteachers (in classrooms), and the value of tutoring declines with class size. In essence, I am for simplicity treating the cap on class size as a binding constraint on the third-party tutor that implies she offers a higher quality product and, in turn, sets a higher price than does the schoolteacher, who faces a less stringent and non-binding constraint.

Now the consumer has three mutually exclusive choices of tutoring: $t_i \in \{0, 1, \theta\}$. If the household chooses the new option of third-party tutoring, its utility is $u = s(m, \theta) + v(y_i - P)$. There will be a threshold $y^P > y^*$ above which households will choose third-party tutoring.

$$t_i = \begin{cases} 0 \ \text{(no tutoring)} & \text{if} \ \ y_i < y^* \\ 1 \ \text{(tutoring from teacher)} & \text{if} \ \ y^P > y_i \geq y^* \\ \theta \ \text{(third-party tutoring)} & \text{if} \ \ y_i \geq y^P \end{cases}$$

The teacher's problem is

$$\max_{p,m \geq 0} \ p \cdot \left[F\left(y^P(m,p)\right) - F\left(y^*(m,p)\right) \right] + \phi(m),$$

which gives the following result.

Proposition 3. *If tutoring and school instruction are substitutes, competition from third-party tutors raises the amount taught during school (m^*) and lowers the price of school-provided tutoring (p^*) relative to when the schoolteacher has a monopoly on tutoring.*

Proof. Compared to the maximand in (2.2), there is an extra term $-p[1 - F(y^P)]$ which is increasing in m and decreasing in p, and therefore m^* will be higher and p^* will be lower when there is competition. To see this, note that the cutoff y^P is decreasing in p since to the left of the cutoff, households pay price p. The cutoff y^P is increasing in m because $s_{mt} < 0$, and to the right of the cutoff the amount of tutoring $\theta > 1$ exceeds that on the left. $F(y^P)$ has the same derivatives with respect to p and m as y^P does, and $F'(y^P) > 0$. Therefore, the derivative with respect to m of the additional term is $pF_m > 0$, and the optimal m^* for the teacher will be higher than in the case without competition. The derivative with respect to p of the additional term is $-[1 - F(y^P)] + pF_p(y^P) < 0$, and the optimal p^* for the teacher is lower with competition. ■

Competition will lead to lower prices and higher quality which is welfare improving for households, for the case where tutoring and school instruction are substitutes. Teachers have less incentive to manipulate m when only some of those who are induced by lower m to purchase more tutoring will purchase tutoring from *them*, and in fact teachers will drive some of their customers away to third-party tutoring by lowering m. Third-party tutoring becomes relatively more valuable when m is lower, given the assumption that $s_{mt} < 0$.[28]

If tutoring and school instruction are complements, then competition would lead to lower p and lower m. The teacher would teach less during the school day, since doing so would raise the relative value of his tutoring compared to the third-party tutor's. One reason that this case seems less likely to pertain in practice is that m might also signal the quality of tutoring if there is heterogeneity across potential tutors (for example, in the cost of effort), an effect I do not model. This effect would give teachers an incentive to raise m, and competition might heighten this effect. This channel would reinforce the comparative static I derive for m for the substitutes case, but offset it for the complements case.

[28]Another possible effect arises if teachers also care about student achievement per se. Then the existence of third-party tutoring exclusively provided by others might lower teacher effort.

References

Banerjee, A. (1997): "A Theory of Misgovernance," *Quarterly Journal of Economics*, 112(4), 1289–1332.

Banerjee, A., A. Deaton, and E. Duflo (2004): "Wealth, Health, and Health Services in Rural Rajasthan," *American Economic Review*, 94(2), 326–330.

Bennett, S., B. McPake, and A. Mills (1997): *Private Health Providers in Developing Countries: Serving the Public Interest?* Zed Books, London.

Bhatta, S. D. (2005): "Determinants of Student Performance in the SLC Examinations," Research report, Ministry of Education, Nepal.

Biswal, B. P. (1999): "Private Tutoring and Public Corruption: A Cost-Effective Education System for Developing Countries," *The Developing Economies*, 37(2), 222–240.

Bray, M. (2003): "Adverse Effects of Private Supplementary Tutoring," Report, UNESCO International Institute for Educational Planning.

——— (2005): "Private Supplementary Tutoring: Comparative Perspectives on Patterns and Implications," Mimeo, University of Hong Kong.

Chaudhury, N., J. Hammer, M. Kremer, K. Muralidharan, and F. H. Rogers (2006): "Missing in Action: Teacher and Health Worker Absence in Developing Countries," *Journal of Economic Perspectives*, 20(1), 91116.

Chaudhury, N., and J. S. Hammer (2004): "Ghost Doctors: Absenteeism in Bangladeshi Health Facilities," *World Bank Economic Review*, 18, 423–441.

Chawla, M. (1997): "Economic Analysis of Dual Job-Holding in the Presence of Complementarities Between Jobs," Ph.D. thesis, Harvard University.

Dang, H.-A. (2007): "The Determinants and Impact of Private Tutoring Classes in Vietnam," *Economics of Education Review*, 26(6), 683–698.

Das, J., and J. Hammer (2007): "Money for Nothing: The Dire Straits of Medical Practice in Delhi, India," *Journal of Development Economics*, 83(1), 1–36.

Duflo, E., R. Hanna, and S. Ryan (2007): "Monitoring Works: Getting Teachers to Come to School," Mimeo, MIT.

Foondun, A. R. (2002): "The Issue of Private Tuition: An Analysis of the Practice in Mauritius and Selected South-East Asian Countries," *International Review of Education*, 48(6), 485–515.

Glewwe, P., N. Ilias, and M. Kremer (2003): "Teacher Incentives," National Bureau of Economic Research Working Paper No. 9671.

Glewwe, P., and S. Jayachandran (2008): "Effects of After-School Tutoring on Student Performance: Evidence from Sri Lanka," Mimeo, Stanford University.

Government of Nepal (2005): "Study on Student Performance in SLC," Research report, Ministry of Education and Sports.

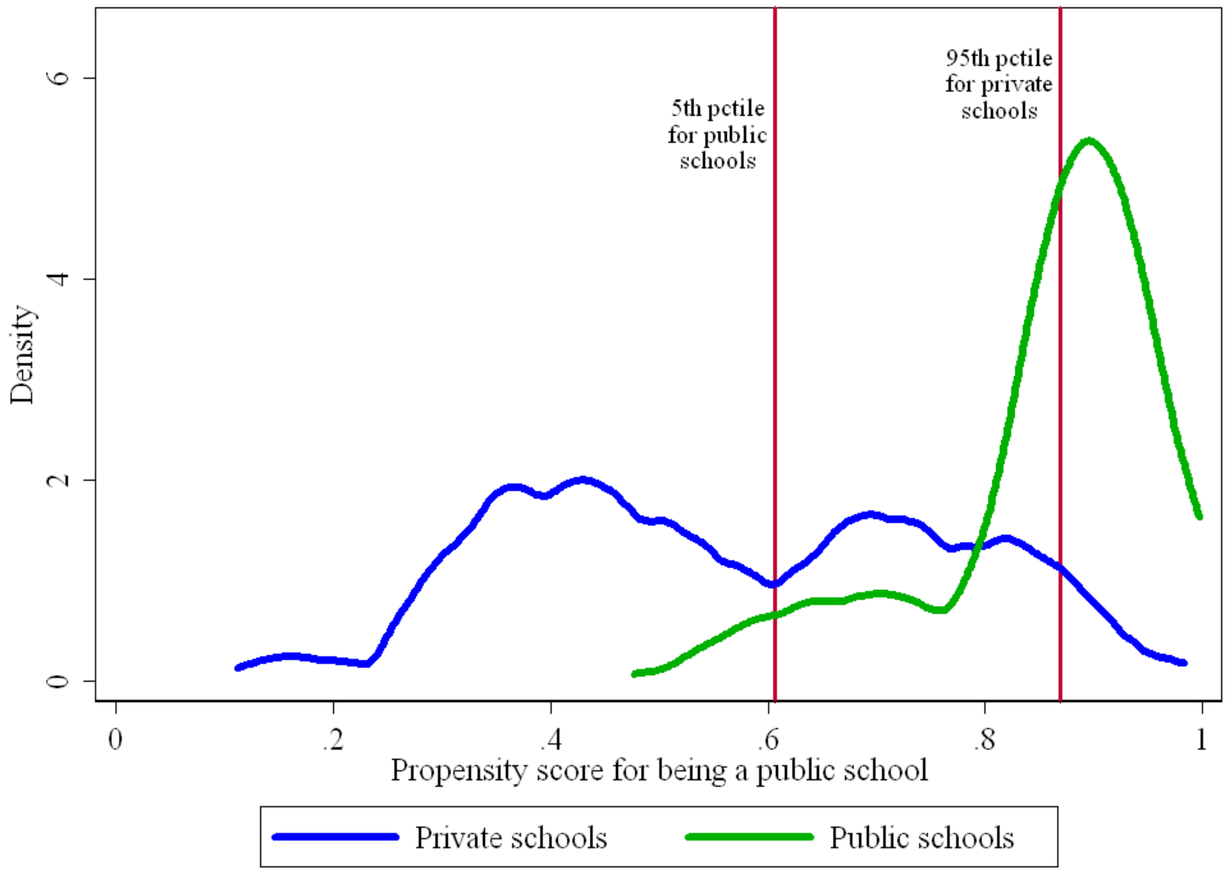
Ha, T. T., and T. Harpham (2005): "Primary Education in Vietnam: Extra Classes and Outcomes," *International Education Journal*, 6(5), 626–634.

Lavy, V. (2002): "Evaluating the Effect of Teachers' Group Performance Incentives on Pupil Achievement," *Journal of Political Economy*, 110(6), 1286–1318.

Muralidharan, K., and V. Sundararaman (2008): "Teacher Incentives in Developing Countries: Experimental Evidence from India," Mimeo, UCSD.

World Bank (2001): *India, Raising the Sights: Better Health Systems for India's Poor.* Health, Nutrition, Population Sector Unit, South Asia Region, Delhi.

Figure 1: Distribution of propensity score for being a public school



This figure plots the kernel density of the propensity score for being a public school. The propensity score is calculated using several school- and individual-level predictors of socio-economic status and characteristics that differ by type of school (listed in Appendix Table 1). Then a school-level propensity score is calculated by averaging across students within the school. The distribution for the entire survey sample is shown. The analysis restricts the sample to schools that have a propensity score above the 5th percentile of the distribution for public schools and below the 95th percentile for private schools, or those between the two vertical lines.

Table 1
Descriptive statistics by subject

	Math	Science	English	Nepali
School offers tutoring	0.69	0.63	0.57	0.11
	(0.46)	(0.48)	(0.50)	(0.31)
Student passes SLC exam	0.68	0.84	0.81	0.93
	(0.47)	(0.36)	(0.39)	(0.25)
Score on SLC exam	0.00	0.00	0.00	0.00
	(1.00)	(1.00)	(1.00)	(1.00)
Within-school std deviation in exam score	0.81	0.77	0.69	0.83
	(0.14)	(0.13)	(0.14)	(0.14)
Teacher completes curriculum	0.65	0.66	0.67	0.74
	(0.48)	(0.47)	(0.47)	(0.44)
Teacher teaches for entire class period	0.85	0.84	0.84	0.84
	(0.36)	(0.37)	(0.36)	(0.36)
Teacher has good command of subject	0.80	0.79	0.77	0.78
	(0.40)	(0.40)	(0.42)	(0.41)
Teacher is clear and understandable	0.80	0.82	0.78	0.83
	(0.40)	(0.39)	(0.42)	(0.38)
Teacher is well prepared for class	0.81	0.79	0.78	0.78
	(0.39)	(0.41)	(0.42)	(0.41)
Teacher assigns and checks homework	0.57	0.50	0.56	0.55
	(0.49)	(0.50)	(0.50)	(0.50)
Conditional on school offering tutoring…				
Private school	0.27	0.25	0.12	0.41
	(0.44)	(0.43)	(0.32)	(0.49)
Student takes coaching from school	0.62	0.53	0.58	0.32
	(0.49)	(0.50)	(0.49)	(0.47)
Wealth index	0.16	0.16	0.06	0.28
	(0.91)	(0.91)	(0.88)	(0.97)

Notes: Each observation is a student-subject. The exam score is the normalized score on the national secondary-school leaving certificate (SLC) exam in a subject. The variables assessing teachers are dummy variables based on survey questions asked of students. The wealth index is calculated using principal components analysis of proxies for socioeconomic status such as whether the household has electricity and parents' education. The sample for analysis is restricted using propensity score matching between public and private schools, as described in the text.

Table 2
Descriptive statistics by type of school

	Private schools	Public schools
School offers tutoring	0.62	0.63
	(0.49)	(0.48)
Student takes coaching from school	0.32	0.38
	(0.47)	(0.48)
Student passes SLC exam	0.92	0.74
	(0.27)	(0.44)
Score on SLC exam	0.84	-0.24
	(1.01)	(0.86)
Within-school std deviation in exam score	0.72	0.76
	(0.18)	(0.13)
Wealth index	0.55	0.03
	(0.89)	(0.88)
Female	0.42	0.46
	(0.49)	(0.50)
Failed a grade in lower secondary school	0.06	0.12
	(0.23)	(0.33)
Teacher completes curriculum	0.79	0.62
	(0.40)	(0.48)
Teacher teaches for entire class period	0.91	0.82
	(0.29)	(0.38)
Teacher has good command of subject	0.84	0.77
	(0.37)	(0.42)
Teacher is clear and understandable	0.87	0.78
	(0.33)	(0.42)
Teacher is well prepared for class	0.85	0.78
	(0.35)	(0.42)
Teacher assigns and checks homework	0.69	0.50
	(0.46)	(0.50)
Number of observations	4052	14265
Number of schools	45	82

Notes: Mean (standard deviation) of variables. Each observation is a student-subject.

Table 3

Selection into offering tutoring

Panel A: Effects of offering tutoring on exam performance

Dependent var.	Whether passed exam	Score on exam	Whether passed exam	Score on exam
	(1)	(2)	(3)	(4)
Offers Tutoring	-0.024	-0.160*	-0.011	-0.086
	[0.036]	[0.087]	[0.034]	[0.083]
Takes Tutoring			-0.025*	-0.145***
			[0.015]	[0.038]
Observations	18317	18317	18317	18317
R-squared	0.60	0.81	0.60	0.81

Panel B: Selection at the school-subject level and student-subject level

Dependent var.	Offers tutoring	Offers tutoring	Takes tutoring	Takes tutoring
	(1)	(2)	(3)	(4)
Passes 9th Grade Exam	0.000		-0.021*	
	[0.017]		[0.012]	
Score on 9th Grade Exam		-0.006		-0.020**
		[0.008]		[0.008]
Observations	10636	3310	10636	3310
R-squared	0.90	0.94	0.87	0.84

Notes: Each observation is a student-subject. There are 3 subjects: math, science, and English. All regressions include student fixed effects and subject*public school fixed effects. Standard errors are clustered within a school-subject.

Table 4

Effect of the school offering tutoring on test scores

Panel A:

Dependent variable: Whether passes secondary school exam

	Full sample	Full sample	Full sample	Outside of district center	Only 2004
	(1)	(2)	(3)	(4)	(5)
Offers Tutoring * Public	-0.174***	-0.181***	-0.165***	-0.213***	-0.188**
	[0.065]	[0.064]	[0.063]	[0.068]	[0.080]
Offers Tutoring	0.026	0.041*	0.086	0.019	0.018
	[0.023]	[0.023]	[0.161]	[0.026]	[0.032]
Takes Tutoring		-0.033**	-0.02	-0.011	0.006
		[0.015]	[0.014]	[0.016]	[0.018]
Takes Tutoring * Public		0.022			
		[0.025]			
Offers Tutoring * Propensity Score			-0.069		
			[0.221]		
Observations	18317	18317	18317	11606	10237
R-squared	0.60	0.60	0.60	0.61	0.60

Panel B

Dependent variable: Score on secondary school exam

	Full sample	Full sample	Full sample	Outside of district center	Only 2004
	(1)	(2)	(3)	(4)	(5)
Offers Tutoring * Public	-0.102	-0.188	-0.039	-0.219	-0.078
	[0.192]	[0.187]	[0.186]	[0.172]	[0.294]
Offers Tutoring	-0.131	-0.005	0.310	-0.089	-0.031
	[0.094]	[0.088]	[0.689]	[0.101]	[0.118]
Takes Tutoring		-0.276***	-0.141***	-0.131***	-0.147***
		[0.059]	[0.037]	[0.047]	[0.052]
Takes Tutoring * Public		0.216***			
		[0.073]			
Offers Tutoring * Propensity Score			-0.510		
			[0.923]		
Observations	18317	18317	18317	11606	10237
R-squared	0.81	0.81	0.81	0.82	0.80

Notes: Each observation is a student-subject. There are 3 subjects: math, science, and English. All regressions include student fixed effects and subject*public school fixed effects. Standard errors are clustered within a school-subject. Column 4 restricts the sample to schools not located in the district center, and column 5 restricts the sample to students who took the SLC exam in 2004. *** p<.01, ** p<.05, * p<.10.

Table 5

Effect of the school offering tutoring on teacher effort

Panel A

Dependent variable: Teacher completes the curriculum

	Full sample	Full sample	Full sample	Outside of district center	Only 2004
	(1)	(2)	(3)	(4)	(5)
Offers Tutoring * Public	-0.121***	-0.133**	-0.118***	-0.160***	-0.138***
	[0.041]	[0.052]	[0.040]	[0.049]	[0.039]
Offers Tutoring	0.004	-0.127	0.008	0.014	0.013
	[0.030]	[0.209]	[0.029]	[0.031]	[0.032]
Offers Tutoring * Propensity Score		0.178			
		[0.297]			
Score on SLC Exam			0.029***		
			[0.007]		
Observations	18317	18317	18317	11606	10237
R-squared	0.71	0.71	0.71	0.73	0.72

Panel B

Dependent variable: Teacher teaches for the entire class period

	Full sample	Full sample	Full sample	Outside of district center	Only 2004
	(1)	(2)	(3)	(4)	(5)
Offers Tutoring * Public	-0.048*	-0.051*	-0.048*	-0.072***	-0.041
	[0.027]	[0.028]	[0.026]	[0.020]	[0.045]
Offers Tutoring	0.002	-0.027	0.003	0.007	-0.005
	[0.011]	[0.073]	[0.011]	[0.011]	[0.019]
Offers Tutoring * Propensity Score		0.04			
		[0.094]			
Score on SLC Exam			0.003		
			[0.007]		
Observations	18317	18317	18317	11606	10237
R-squared	0.66	0.66	0.66	0.66	0.66

Notes: Each observation is a student-subject. There are 3 subjects: math, science, and English. All regressions include student fixed effects and subject*public school fixed effects. Columns 3 and 6 restrict the sample to students who took the SLC exam in 2004. Standard errors are clustered within a school-subject. *** p<.01, ** p<.05, * p<.10.

Table 6

Testing alternative hypotheses using teacher's ability and preparation as outcomes

Panel A: Teacher ability

	Dependent variable					
	Teacher's command of subject			Teacher is clear and understandable		
	Full sample	Full sample	Only 2004	Full sample	Full sample	Only 2004
	(1)	(2)	(3)	(4)	(5)	(6)
Offers Tutoring * Public	-0.002	-0.014	0.021	-0.005	-0.007	-0.055
	[0.043]	[0.042]	[0.046]	[0.036]	[0.044]	[0.040]
Offers Tutoring	-0.013	-0.134	-0.027	0.011	-0.011	0.022
	[0.017]	[0.119]	[0.026]	[0.021]	[0.154]	[0.025]
Offers Tutoring * Propensity Score		0.163			0.029	
		[0.156]			[0.208]	
Observations	18283	18283	10211	18245	18245	10199
R-squared	0.61	0.61	0.61	0.58	0.58	0.58

Panel B: Teacher preperation and effort outside the classroom

	Dependent variable					
	Teacher is well-prepared for class			Assigns and checks homework		
	Full sample	Full sample	Only 2004	Full sample	Full sample	Only 2004
	(1)	(2)	(3)	(4)	(5)	(6)
Offers Tutoring * Public	-0.058*	-0.048	-0.065	-0.017	0.038	-0.037
	[0.032]	[0.034]	[0.051]	[0.059]	[0.054]	[0.087]
Offers Tutoring	-0.006	0.106	-0.029	-0.04	0.542***	-0.077**
	[0.020]	[0.115]	[0.035]	[0.029]	[0.198]	[0.039]
Offers Tutoring * Propensity Score		-0.151			-0.789***	
		[0.152]			[0.258]	
Observations	18298	18298	10224	18252	18252	10194
R-squared	0.59	0.59	0.59	0.67	0.67	0.66

Notes: Each observation is a student-subject. There are 3 subjects: math, science, and English. All regressions include student fixed effects and subject*public school fixed effects. Columns 3 and 6 restrict the sample to students who took the SLC exam in 2004. Standard errors are clustered within a school-subject. *** p<.01, ** p<.05, * p<.10.

Table 7

Effect of the school offering tutoring on within-school inequality in test scores

	Dependent variable					
	Within-school-subject std dev of test scores				Passes exam	Score on exam
	(1)	(2)	(3)	(4)	(5)	(6)
Offers Tutoring	0.045	0.046	0.042	0.023	-0.017	-0.149*
	[0.033]	[0.032]	[0.044]	[0.040]	[0.033]	[0.085]
School-subject Avg Test Score		0.054				
		[0.033]				
Percent Taking Tutoring			0.006			
			[0.074]			
Offers Tutoring * Public				0.065		
				[0.069]		
Offers Tutoring * Failed an Earlier Grade					-0.104*	-0.193
					[0.062]	[0.126]
Observations	380	380	380	380	18225	18225
R-squared	0.67	0.68	0.68	0.67	0.60	0.80
Level of observation	school-subject	school-subject	school-subject	school-subject	student-subject	student-subject

Notes: In columns 1 to 4, each observation is a school-subject, and the regressions include school fixed effects and separate subject fixed effects for public and private schools. In columns 5 to 6, each observation is a student-subject, student fixed effects and separate subject fixed effects for public and private schools are included, and standard errors are clustered within a school-subject. There are 3 subjects: math, science, and English. *** p<.01, ** p<.05, * p<.10.

Appendix Table 1
Descriptive statistics by type of school

	All surveyed private schools	All surveyed public schools	Private schools in sample	Public schools in sample	Wealth index factor loading
Propensity score for Public=1	0.57	0.86	0.75	0.79	
	(0.20)	(0.10)	(0.07)	(0.08)	
Wealth index	0.79	-0.21	0.54	0.03	
	(0.94)	(0.91)	(0.90)	(0.88)	
Mother is literate	0.79	0.54	0.74	0.60	0.74
	(0.41)	(0.50)	(0.44)	(0.49)	
Father is literate	0.96	0.86	0.95	0.89	0.61
	(0.19)	(0.34)	(0.22)	(0.31)	
Mother's years of education	5.26	1.98	4.37	2.48	0.78
	(4.64)	(3.10)	(4.32)	(3.38)	
Father's years of education	9.11	5.82	8.37	6.65	0.80
	(4.27)	(4.38)	(4.36)	(4.29)	
Household has electricity	0.97	0.71	0.97	0.89	0.42
	(0.18)	(0.45)	(0.18)	(0.32)	
Mother is alive	0.98	0.97	0.97	0.97	0.12
	(0.14)	(0.17)	(0.17)	(0.16)	
Father is alive	0.96	0.93	0.96	0.94	0.17
	(0.19)	(0.25)	(0.20)	(0.25)	
Income category (1 to 10)	6.82	5.72	6.44	5.91	0.40
	(2.05)	(1.91)	(2.03)	(1.88)	
Household has computer	0.24	0.03	0.11	0.04	0.39
	(0.43)	(0.16)	(0.32)	(0.18)	
Student has long-term illness	0.06	0.08	0.07	0.08	-0.09
	(0.23)	(0.27)	(0.26)	(0.27)	
School is in district capital	0.57	0.20	0.13	0.43	n/a
	(0.50)	(0.40)	(0.34)	(0.50)	
Number of observations	10460	41500	4079	14543	
Number of schools	109	303	45	82	

Notes: The propensity score for being a public school is calculated with a probit regression using the variables in the first column from "mother is literate" on, and then averaging the score within a school. The first two columns of variable means (standard deviations) are for all schools surveyed. The second two columns are for the sample used in the analysis. The wealth index is calculated through principal components analysis of the same individual-level variables as used in the propensity score. The last column shows the factor loading for the principal components analysis.

Appendix Table 2
Additional descriptive statistics on tutoring

	Private schools	Public schools
Student takes any of math, science, or English tutoring from school	0.49	0.43
Conditional on student taking math, science or English…		
Student thinks that tutoring helped on SLC exam	0.92	0.86
Monthly tutoring fees - Median	300	300
Monthly tutoring fees - Mean	450	345
Monthly tutoring fees - Standard deviation	597	280
Student takes math tutoring from school	0.47	0.42
Student takes science tutoring from school	0.36	0.33
Student takes English tutoring from school	0.12	0.39
Number of non-missing observation for Grade 9 test score	902	2408
Grade 9 test score in subject - Mean	0.00	0.00
Grade 9 test score - Standard deviation	1.00	1.00
Number of non-missing observation for Passes Grade 9 test	2138	8498
Passes Grade 9 test in subject	0.94	0.88

Notes: Each observation is a student-subject. Students who reported taking any tutoring were asked their monthy tutoring expenses. This variable is not broken down by subject, and may include tutoring in expenses on subjects other than math, science, or English. The Grade 9 test scores are available for only a subset of the data. They are normalized to mean 0, standard deviation 1 for each school for comparability across schools.

Appendix Table 3

Testing for differential selection between public and private schools

Dependent variable = School Offers Tutoring		
	(1)	(2)
Passes 9th Grade Exam * Public	0.066	
	[0.067]	
Passes 9th Grade Exam	-0.057	
	[0.065]	
Score on 9th Grade Exam * Public		0.014
		[0.029]
Score on 9th Grade Exam		-0.016
		[0.029]
Observations	10636	3310
R-squared	0.90	0.94

Notes: Each observation is a student-subject. There are 3 subjects: math, science, and English. All regressions include student fixed effects and subject*public school fixed effects. The grade 9 test core is normalized to be mean 0 and standard deviation 1 within each school to make the variable more comparable across schools. Standard errors are clustered within a school-subject. *** p<.01, ** p<.05, * p<.10.

Appendix Table 4

Robustness to dropping and adding subjects

Panel A:
Math and Science only (English dropped)

	Whether passed exam	Score on exam	Teacher completes curriculum	Teaches entire class period
	(1)	(2)	(3)	(4)
Offers Tutoring * Public	-0.231***	-0.337*	-0.224***	-0.038
	[0.056]	[0.185]	[0.083]	[0.039]
Offers Tutoring	0.085	0.125	0.100	-0.005
	[0.052]	[0.172]	[0.076]	[0.014]
Takes Tutoring	0.007	-0.024		
	[0.019]	[0.042]		
Observations	12233	12233	12233	12233
R-squared	0.71	0.86	0.80	0.77

Panel B:
Nepali in addition to Math, Science, and English

	Whether passed exam	Score on exam	Teacher completes curriculum	Teaches entire class period
	(1)	(2)	(3)	(4)
Offers Tutoring * Public	-0.028	0.058	-0.010	0.028
	[0.037]	[0.115]	[0.033]	[0.024]
Offers Tutoring	-0.006	-0.176**	-0.003	-0.012
	[0.024]	[0.085]	[0.021]	[0.012]
Takes Tutoring	0.008	-0.079**		
	[0.014]	[0.038]		
Observations	24136	24136	24136	24136
R-squared	0.54	0.75	0.65	0.60

Notes: Each observation is a student-subject. There are 2 subjects per student in Panel A and 4 subjects per student in Panel B. All regressions include student fixed effects and subject*public school fixed effects. Standard errors are clustered within a school-subject. *** p<.01, ** p<.05, * p<.10.

Appendix Table 5

Results using full sample of schools

Panel A: Math, science, and English

	Whether passed exam	Score on exam	Teacher completed curriculum	Taught entire class period
	(1)	(2)	(3)	(4)
Offers Tutoring * Public	-0.136***	-0.082	-0.026	-0.024
	[0.040]	[0.108]	[0.041]	[0.022]
Offers Tutoring	0.044	-0.163	-0.018	-0.008
	[0.030]	[0.161]	[0.045]	[0.042]
Takes Tutoring	-0.023**	-0.105***		
	[0.010]	[0.020]		
Offers Tutoring * Propensity Score	-0.035	0.175	0.019	0.022
	[0.054]	[0.247]	[0.082]	[0.058]
Observations	51292	51292	51292	51292
R-squared	0.62	0.83	0.72	0.66

Panel B: Math and science only

	Whether passed exam	Score on exam	Teacher completed curriculum	Taught entire class period
	(1)	(2)	(3)	(4)
Offers Tutoring * Public	-0.212***	-0.284**	-0.168**	-0.015
	[0.058]	[0.134]	[0.074]	[0.030]
Offers Tutoring	0.055	-0.156	-0.242**	0.156
	[0.089]	[0.188]	[0.118]	[0.158]
Takes Tutoring	-0.007	-0.043*		
	[0.013]	[0.023]		
Offers Tutoring * Propensity Score	0.002	0.33	0.412**	-0.179
	[0.146]	[0.272]	[0.194]	[0.187]
Observations	34161	34161	34161	34161
R-squared	0.73	0.88	0.81	0.77

Notes: The sample is all schools in the survey, rather than a sample restricted based on propensity score matching between public and private schools. Each observation is a student-subject. In Panel A, there are 3 subjects per student (math, science, and English) and in Panel B, 2 subjects per student (math and science). All regressions include student fixed effects and subject*public fixed effects. Standard errors are clustered within a school-subject. *** p<.01, ** p<.05, * p<.10.