PRIVATE TUTORING AND ITS IMPACT ON STUDENTS' ACADEMIC ACHIEVEMENT, FORMAL SCHOOLING, AND EDUCATIONAL INEQUALITY IN KOREA

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ABSTRACT

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Over the last two decades, private tutoring has emerged as an important issue in education as its demand has been growing around the world. However, the evidence of the effectiveness of private tutoring is still mixed. Using the Korean Educational Longitudinal Survey, this dissertation explores the causal impact of private tutoring in Korea on three outcomes: students' academic achievement, the quality of the learning environment in formal schooling, and educational inequality.

The first set of empirical analyses explores how private tutoring in secondary schools affects students' academic achievement in both short-term and long-term aspects using Ordinary Least Squares, Instrumental Variable, and Propensity Score Matching methods. The results suggest that private tutoring in middle school, on average, has positive short-term effects on students' academic achievement in middle school, but minimal long-term effects on the university entrance examination scores. By subject area, English and math tutoring are effective in improving academic achievement in middle school, whereas verbal tutoring is not. Moreover, private tutoring in grade 7 is most beneficial for students in middle school. In terms of private tutoring in high school, only math tutoring is beneficial for high school students in improving scores on the university entrance examination.

The second set of the analyses employs Ordered Logit, Propensity Score Matching, and Difference-in-Differences methods to estimate the impact of private tutoring on the quality of formal schooling. The quality of the learning environment in formal schooling is measured by students' attention to lessons in class. On average, private tutoring shows a positive influence on students' attention to lessons in grade 8, but the magnitude of its influence is not substantial. However, when differentiating the results by ability group, positive effects are detected mostly in the low-ability group, which means that low achievers pay more attention to lessons in schools if they participate in private tutoring. These results imply that private tutoring improves the overall learning environment in formal schooling, which in turn increases the overall quality of schooling.

The third set of the analyses uses Quantile Regression, Two-Stage Least Absolute Deviation estimator, and Propensity Score Subclassification to estimate the heterogeneous effects of private tutoring between ability groups, which provides implications on educational inequality based on academic achievement. The overall results suggest that private tutoring in middle school exacerbates educational inequality between high and low achievers, which implies a widening of the achievement gap. In addition, enrolling in tutoring at an earlier grade level results in greater heterogeneity between high and low achievers in academic performance than enrolling in tutoring during later grade levels. However, private tutoring in high school contributes to reducing the achievement gap; low achievers benefit more from private tutoring in high school compared to high achievers. Moreover, three years of cumulative math tutoring and receiving a single year of math tutoring in grade 12 contribute to narrowing the achievement gap between low and high achievers in the university entrance examination scores.

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This moment of writing these last few words on my dissertation reminds me of the time when I wrote my statement of purpose for admission into this doctoral program. At that time, ideas about my research and future career were wide-ranging and somewhat vague, both of which needed more elaboration. While I was going through the four-year journey as a doctoral student, my ideas became more sophisticated and sheer by learning the professional skills and knowledge in education at Teachers College. The doctoral student experience taught me the importance of persistence, effort, and people around me to succeed in life.

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CHAPTER I: INTRODUCTION

1.1 Background and Motivation

Education has been widely considered as one of the important determinants of an individual's productivity and economic growth of countries. Theodore W. Schultz (1961) claimed in his article, *Investment in Human Capital*, that education is one of the major activities that increase human capital, which is tightly linked to individuals' earnings and growth of economy. In order to find evidence of the link connecting education to individual's productivity and economic growth, researchers have focused largely on formal education, i.e., primary, secondary, and tertiary schools in both public and private sectors. There is a breadth of studies that explore how increases in both quantity and quality of schooling are related to students' academic achievement and labor market outcomes as well as economic development. However, there is a lack of studies that investigate the effect of private tutoring, a form of supplementary education where students can acquire more skills and knowledge to increase their human capital. This is an important area in education as private tutoring becomes a growing phenomenon in many countries (Dang and Rogers, 2008).

The private tutoring sector has been expanding in many countries, so much so that it can be considered the third emerging education sector in addition to public and private school sectors (Dang and Rogers, 2008). Table 1 provides some statistics to show this growing phenomenon of private tutoring in the world. For example, in Azerbaijan, almost all senior students in secondary school received private tutoring; 92 percent of senior students in high schools reported that they received private tutoring. In Cyprus, 86 percent of students in secondary schools received additional education from private tutoring: 70 percent in Hong Kong, 88 percent in Kenya, 83

percent of students in primary schools in Republic of Korea (hereafter Korea), around 70 percent of pupils in secondary schools in Japan, and 91 percent in Mauritius.

Table 1 also conveys that private tutoring prevails in both developed and developing countries. The scale of private tutoring appears to be the highest in East Asian countries. However, it is also an important phenomenon in many countries of different sizes, level of economic development, political environment or geographical locations (Dang and Roger, 2008). For example, in Turkey, spending on private tutoring has approached the level of expenditures on the formal public system; expenditures on private tutoring are about 1.44 percent of Gross Domestic Product (hereafter GDP) while public education expenditures are about 2 percent (Tansel and Bircan, 2006). The situation is more severe in Korea; recent statistics from the Korean National Statistics Office (hereafter KNSO) showed that expenditures of private tutoring in Korea were about 3 percent of GDP in 2009. Thus, private tutoring is a widespread phenomenon in the world that is worth investigating.

It is also important to note that a substantial amount of demand for private tutoring appears at all levels of education. As Table 1 shows, a large proportion of students in upper-secondary schools participate in private tutoring to prepare for university entrance exams. In addition, students in primary and lower secondary schools display increasing demand for their academic achievement. Moreover, some countries like Japan and Korea reported a substantial amount of private tutoring expenditures by high school graduates who have not gained admission to the university that they wish to attend. These people are labeled *ronin* in Japan and *jaesusang* in Korea. For them, it is common to spend an additional year or more in exam preparation by enrolling in private tutoring institutes such as *yobiko* in Japan and *hakwon* in Korea in order to get into the university that they want. More explanations of different types of private tutoring

will be explained in Chapter III. Therefore, the private tutoring phenomenon is not limited to a specific level of education.

However, the definition of private tutoring varies in different countries and educational settings. For example, India and Israel consider tutoring that is financed by government and non-governmental organizations (hereafter NGO) as well as privately funded tutoring as private, while Korea does not include those publicly funded as private tutoring. In addition, many researchers interchangeably use shadow education when describing private supplementary tutoring because it mimics formal schooling. (Stevenson and Baker, 1992; Bray, 1999b; Lee at al., 2009). Dang and Rogers (2008) also used shadow education in the meaning of the dependency of private tutoring on the formal education system, which implies that the private tutoring industry does not stand alone as an independent educational activity apart from formal schooling. However, I am hesitant to use the word "shadow" since it carries negative connotations, such as unauthorized or dependent, which does not accurately describe the Korean private tutoring in current years. Therefore, it is important to specify the definition or scope of private tutoring that this dissertation discusses.

Table 1. The scale of private tutoring in selected countries

Country	Year	Level/Grade/Age	Percent of students tutored	Comment	Source
Azerbaijan	2004	Secondary school	57%		Silova & Kazimzade (2006)
		University	92%	These first-year university students received private tutoring in their last year of secondary school.	
Bangladesh	2004	Primary School	43%	This study found more boys receiving tutoring than girls.	Ahmed et al. (2005)
Cambodia	1997-1998	Primary School	31%	The proportion of students taking private tutoring was 60% among urban schools and 9% among rural schools.	Bray (1999)
Canada	1999	Student age 13 and 16	5%-17% for students age 13; 8%-20% for students age 16		CME (2000)
	1997	School age children	N/A	Over the past 30 years, the number of formal tutoring business in major Canadian cities has grown between 200%-500%.	Aurini & Davies (2004)
Cyprus	2003	College	86%	These students received private tutoring in lyceum.	Stylianou et al. (2003)
Egypt	2000	Children age 6-15	71%	This study used the Egypt Demographic and Health Survey.	Suliman & El-Kogali (2002)
Greece	2000	University	80% attended group (cram) preparatory schools, 50% received individual private tutoring and 33% received both group and individual tutoring.		Psacharopoulous & Papakonstantinou (2005)
Guinea	1995-1996	Grade 6	19%	Grade 6 pupils in two urban and four rural schools	Tembon et al. (1997)

Hong Kong	1996-1998	Secondary School	35% of Secondary 1-3 students; 47% of secondary 4-5 students; 70% of secondary 6-7 students.		Bray & Kwok (2003)
Japan	1995	Grade 8	64% of 8th graders received weekly tutoring in math and 41% in science.	This study used data from the 1995 TIMSS	NCES (1996)
Kenya	2000	Grade 6	88%	58% of the students attending private tutoring paid for it. The proportion of pupils who received private tutoring had gone up from 69% in 1998 to 88% in 2000.	Onsomu et al. (2005)
Republic of Korea	2003	Primary School	83%	In aggregate, 73% of all Korean students had private tutoring.	Kwak (2004)
		Middle School	75%		
		High School	56%		
Lithuania	2004-2005	University	62%		Budiene & Zabulionis (2006)
Malaysia	1990	Grade 3, 5, and 6	83%	In 1990, 8,420 students in grade 3, 5 and 6 were surveyed and respective proportions receiving tutoring were 59%, 53% and 31%. About 84% of students had received some form of tutoring by the time they reached upper secondary school.	Marimuthu et al. (1991)
Mauritius	2001	Grade 6	87%	91% of these students paid for private tutoring. The proportion of pupils who received private tutoring had gone up from 78% in 1995 to 87% in 2001.	Kulpoo & Soonarane (2005)
Morocco	1993	Secondary school	78%	A 1993 survey of 1,953 formal secondary science teachers indicated that 53% provided after-school tutoring. The lowest proportion (27%) was in the first year of secondary education; but the figure rose to 78% in the most	Caillods et al. (1998)

				senior grade.	
Romania	1994	Grade 12	32% in rural areas and 58% in urban areas received private supplementary tutoring.		UNESCO (2000)
Singapore	1992	Primary school	49%		George (1992)
		Secondary school	30%		
Sri Lanka	2003	Grade 5	78%		Glewwe & Jayachandran (2006)
Taiwan	1998	Secondary school	81% of 397 senior secondary school students		Tseng (1998)
Turkey	2001	High School	35%	The number of private tutoring centers in 2002 totaled 2,100 (up from only 174 in 1984) which is close to the number of 2,500 high schools in the whole country in the same year.	Tansel & Bircan (2006)
Ukraine	2004	University	68%	These students received private tutoring in their last year of secondary school.	Hrynevych et al. (2006)
United Kingdom	2003	Years 6 & 11	26%	In aggregate, 27% received private tutoring.	Ireson & Rushforth (2005)
		Year 13	30%		
United States	1990-1992	High School		To prepare for the SAT or ACT, 14% -21% took special courses at high school, 8%-14% took group private tutoring (commercial coaching classes), and 6%-8% took one-to-one private tutoring.	Briggs (2001)
	2000	Elementary school		It is estimated that almost 7 million elementary school students were likely to get tutoring and that	Gordon & Gordon (2003)

				tutoring has grown to be a professional-service industry of over $5-$8 billion.	
Vietnam	1997-1998	Primary school	31%	Around 34% of households with children in school sent their children to private lessons and the majority of them (90%) allocated between 1% and 5% of the total household expenditure on private tutoring.	Dang (2007b)
		Lower secondary school	56%		
		Upper secondary school	77%		
Zanzibar	2000	Grade 6	56%	38% of these students paid for private tutoring. The proportion of pupils who received private tutoring had gone up from 46% in 1995 to 56% in 2000.	Nassor et al. (2005)
Zimbabwe	1995	Grade 6	61%	The percentage varied from 36% to 74% across the regions.	Machingaidze et al. (1998)

Sources: This Table is largely based on Table 1 in Dang and Rogers (2008) and Table 1 in Bray (1999).

1.2 Definition of Private Tutoring

In order to help identify the nature of private tutoring in different contexts, it is useful to set the criteria as other researchers have in their studies. The criteria that this study uses are based on Bray's (1999) who adopted several criteria to help readers understand the context of private tutoring: *supplementation*, *privateness*, and *academicness*.

The first criterion is the matter of *supplementation*. Most countries where private tutoring prevails consider tutoring only for subjects that are already covered in formal schooling (Bray, 1999). In other words, subjects not taught in school, such as language or art, are often excluded in the category of private tutoring. This is one of the reasons why we encounter studies of private tutoring that often limit the scope of studies by observing supplementary tutoring. The other reason why it is common to analyze supplementary tutoring may be that those subjects covered by supplementary tutoring are tested in schools, which enables observing the effect of private tutoring. However, tutoring classes for subjects not taught in school are often taken by people who wish to satisfy their personal interests or development; therefore, we often have difficulties detecting the outcomes. Following the convention, this study investigates private tutoring that plays a supplementary role.

The second criterion is the dimension of *privateness*. Tutoring services are provided by different entities for different purposes. One of the most common forms of tutoring is the one that is provided by private entrepreneurs and individuals for profit-making purposes (Bray, 1999). This form of tutoring called *juku* and *hakwon* is common in Japan and Korea, respectively (Stevenson and Baker, 1992; Kim & Lee, 2010). More detailed information about the forms of private tutoring will be explained in Chapter III. In addition, there are other types of tutoring that are provided by governments and NGOs. As mentioned earlier, these forms of tutoring are

available in many countries, such as India and Israel, and they often include these forms into the category of "private" tutoring (Banerjee et al., 2007; Lavy and Schlosser, 2005). However, this study only considers tutoring lessons that are provided by private entities, without examining tutoring supplied by public entities. In addition, unpaid tutoring or voluntary help provided from family members is also not taken into account as private tutoring.

The third criterion is the *academicness* of the subjects for tutoring. Tutors are commonly perceived as people who help students carry the heavy academic load of formal classrooms (Bray, 1999). However, tutoring classes for non-academic subjects, such as musical, artistic or sporting skills, which are covered in school are also available although demand for these classes is limited. Due to this commonly accepted concept of tutors, studies of private tutoring often tend to focus on academic subjects taught in school, without taking non-academic subjects into account. Another possible explanation is that since academic subjects are more easily examinable than non-academic subjects, this characteristic facilitates to observe the outcomes of tutoring. This may be one of the reasons why researchers limit the scope of private tutoring only for academic subjects, which this study also follows[1].

The three criteria used by Bray (1999) help readers have a more concrete concept of private tutoring. Reflecting on these three criteria, in this paper, private tutoring is defined as *fee-based* tutoring provided by *private* entrepreneurs and individuals for profit-making purposes, which provides *supplementary* instruction to children in *academic* subjects that they study in the formal primary and secondary education system (Dang and Rogers, 2008). In other words, this study does not include tutoring activities that cover subjects that are not taught in formal

[1] Focus of this study is on private tutoring for academic subjects. There are studies such as Lipscomb (2007) and Barron et al. (2000) that examined how non-academic extracurricular involvement affects academic achievement.

schooling, are provided by public entities that do not require fees, or teach non-academic subjects.

1.3 Research Questions

This dissertation addresses the impact of private tutoring on three aspects: students' academic outcomes, formal schooling, and educational inequality. With respect to each aspect, this dissertation attempts to answer the following three questions.

(1) The impact on students' academic achievement:

Does private tutoring have a causal impact on students' academic achievement? What are the short- and long-term effects of private tutoring on students' academic achievement?

(2) The impact on formal schooling:

Does private tutoring influence students' behavior in schools that affect the learning environment in schools? In particular, how is participation in private tutoring associated with students' attention to lessons in schools?

(3) The impact on educational inequality:

Does private tutoring exacerbate educational inequality? Are there heterogeneous effects of private tutoring on student academic achievement? For whom are private tutoring effects significant, and how large might they be?

1.4 Endogeneity of Private Tutoring

When we estimate the effect of private tutoring on student outcomes, the simplest way of measuring the returns to private tutoring is to use the Ordinary Least Square (hereafter OLS)

statistical approach, which utilizes a set of covariates in order to control for differences between students who participate in private tutoring (the treatment group) and their peers who do not participate (the control group) as follows:

$$Y = \alpha_0 + \alpha_1 * PT + \alpha_k * X_k + \varepsilon$$

where Y is a student's outcome variable, PT is a private tutoring variable, which can be a student's participation in private tutoring, the number of hours per week that a student spends on private tutoring, or expenditure on private tutoring classes. In this study, PT means participation in any type of private tutoring. X is a vector of other student, household, school, and community characteristics; and ε is the error term. We are interested in the parameter, α_1, which is the estimated effect of participating in private tutoring.

However, it is risky to rely on this estimate because students who participate in private tutoring tend to be different in various unobservable ways from their peers who do not participate. For example, students who are in the private tutoring sector are more likely to be raised by parents who have higher aspiration or concerns with their children's education. Those parents would help their children succeed in school in numerous ways, such as by helping them with their homework, creating supportive home environments to promote their study, or spending money on getting supplementary education. In addition, students who receive private tutoring may have higher academic motivation than those who do not. However, we should also understand that students who have strong academic motivation and have parents with higher aspiration for their children's education tend to develop positive outcomes, such as solid academic performance without private tutoring. Therefore, these characteristics could affect

both students' decision to receive private tutoring and their academic performance. There will not be any problem if we could control these characteristics in the regression estimation. However, since these types of characteristics are rarely and inaccurately measured in practice, we cannot properly control for them in the regression analysis. Thus, this selectivity of students who take private tutoring and these unobserved variables cause biases in estimating the effect of private tutoring. The bias that is created by the selectivity of treated students is called the selection bias, and the bias caused by unobserved variables is called the unobserved variable bias. Without taking care of all the unobserved variables, these variables will end up in the error term, ε, and due to their correlation with a private tutoring variable, they will make the estimation results inconsistent and unreliable. Having this threat in mind, this study uses several quasi-experimental methods that reduce biases generated by the OLS estimation and help calculate precise estimates of the private tutoring effect.

1.5 Structure of the Study

This dissertation is organized as follows: Chapter II introduces the theoretical background of this study and a summary of existing literature on private tutoring; Chapter III introduces an overview of private tutoring in Korea; Chapter IV, V, and VI discuss three empirical analyses in terms of the effect of private tutoring on students' academic achievement, quality of formal schooling, and educational inequality, respectively; Chapter VII summarizes the findings and concludes with the discussion of policy implications, limitation of the study, and directions for future research.

As explained above, private tutoring is a worldwide phenomenon, which prevails not only in East Asian countries but also other regions in the world, and it can be considered the

third education sector as Dang and Rogers (2008) claimed. Therefore, the effectiveness of tutoring becomes an important area of research as the demand for private tutoring expands. This study investigates the impact of private tutoring on three aspects: students' academic achievement, the learning environment in formal schooling, and educational inequality. Taking methodological challenges that are caused by the selection bias and the unobserved variable bias into account, several quasi-experimental methods are introduced to accurately estimate the impact of private tutoring. Beforehand, Chapter II describes the theoretical background and existing literature on the topic of private tutoring, and discusses the gaps in the existing literature on private tutoring.

CHAPTER II: LITERATURE REVIEW

This chapter introduces three theories that are necessary to understand the private tutoring phenomenon: 1) human capital theory, 2) the standard microeconomic theory of supply and demand, and 3) educational production function. The next section summarizes the existing literature on the topic of private tutoring. Many studies have explored the micro and macro determinants of purchasing private tutoring and its impact on several student-related outcomes. After a critical overview of the literature, I will explain the gap in the existing literature, which this dissertation partially fills.

2.1 Theoretical Background

2.1.1 Human Capital Theory

The demand for private tutoring can be interpreted as a form of human decision making with the aim of increasing knowledge and skills motivated by the desire to build human capital that yields higher future earnings and success based on the theory of human capital. In order to understand the underlying context of private tutoring, understanding human capital theory is basic.

Treating human beings as capital goods was controversial among economists until the mid-20th century even though a few economists had started viewing human beings as a capital of nations[2] (Schultz, 1961). Due to more humanistic conceptions of human beings, the concept of human capital had to endure criticisms against it (Schultz, 1961). However, Theodore W.

[2] There were three distinguished people who have looked upon human beings as capital: Adam Smith, Johann Heinrich von Thünen, and Irving Fisher between 18th and mid-20th centuries (Schultz, 1961).

Schultz who was an economist in the 20th century undertook to criticize the classical notion of labor as simplistic in his article *Investment in Human Capital*. The classical notion is that labor should be considered as a capacity to do manual work requiring little knowledge and skill. Also, he argued that human beings should be treated as a form of capital of the country because of their important economic role. The improvement in the quality of human capital increases the productivity of workers, which is linked to real earnings as well as the economic growth of nations (Shultz, 1961; Becker, 1962; Lucas, 1988; Mankiw, Romer & Weil, 1992). Due to these important roles of human capital, Schultz (1961) believed that human capital should be promoted by investing in people through five important activities such as health services, on-the-job training, formal education, adult education, and migration of individuals and families.

After this formal introduction of human capital by Schultz, Gary Becker (1962) developed a theory of investment in human capital with an emphasis on empirical implications. More broadly than Schultz (1961), Becker (1962) defined human capital investments to be any "activities that influence future real income through the imbedding of resources in people." (Becker, 1962, pp. 9). Among various activities, Becker (1962) used on-the-job training and how it affects the earnings of trained workers. With the distinction between general and specific on-the-job training[3], he showed the age-earning profiles for trained and untrained workers, which showed different patterns in growth of earnings. For both general and specific on-the-job training, earnings of trained workers are lower than earnings of untrained workers in the period of training due to costs that workers bear for training[4]. However, earnings of trained workers surpass the earnings of the untrained in later ages due to increased productivity with skills and

[3] General training is training that is useful in many firms in addition to the firm providing it whereas specific training trains workers with skills and knowledge that are valuable in the firm providing it. Therefore, in case of specific training, productivity is raised more in the firm acquiring the knowledge than in other firms (Becker, 1962).
[4] Costs consist of direct outlays of training and foregone income that workers could have earned in other occupations (Becker, 1962).

knowledge that workers acquired during training. Becker (1962) also argued that the magnitude of returns to general training during the period of training is smaller compared to the returns to specific training because workers bear all the costs of general on-the-job training whereas firms share costs with workers who receive specific on-the-job training[5]. Because the training process requires costs and time to complete and because its benefits are born after a considerable time period, the value of the resources during training period is regarded as investment. Also, the higher earnings in the later years that result from the training are treated as its yield.

In addition to on-the-job training, other activities could also increase human capital. Becker (1962) defined a school as an institution specializing in the production of training. Through schooling, people absorb skills and knowledge (either general or specific) that they would need in the labor market. Therefore, schooling would have the same kind of implications as on-the-job training. Moreover, apart from the knowledge and skills that people could learn from training or schooling, other information such as economic, political, or social systems could help people choose patterns of consumption, employment, or allegiance to political parties, which could significantly raise real incomes of workers (Becker, 1962). Activities that promote emotional and physical health are other ways to improve human capital that have a significant influence on earnings.

Within the category of investment in human capital, private tutoring can be considered as one of the activities that help raise the quality of human capital. Similar to schooling, private tutoring aims to provide the necessary knowledge and skills that are required to succeed in formal schooling and the labor market in the future. In addition, students with access to private

[5] The reason why workers bear all the cost of general on-the-job training is that general training increases workers' marginal product in the firm providing it as well as other firms. Skills and knowledge that workers learned in general training can be used in different firms (Becker, 1962). However, specific training is useful in a specific firm, which affects productivity of the firm instead of workers, so firms are responsible for costs of specific training partially or entirely.

tutoring institutions often benefit from receiving other information about external academic resources, universities or future careers that are often provided by tutors or private tutoring institutions. These resources could strengthen the human capital of students, which is believed to have a strong connection with their success in the future labor market. Therefore, the theory of investment in human capital provides a critical background to explain the demand for private tutoring.

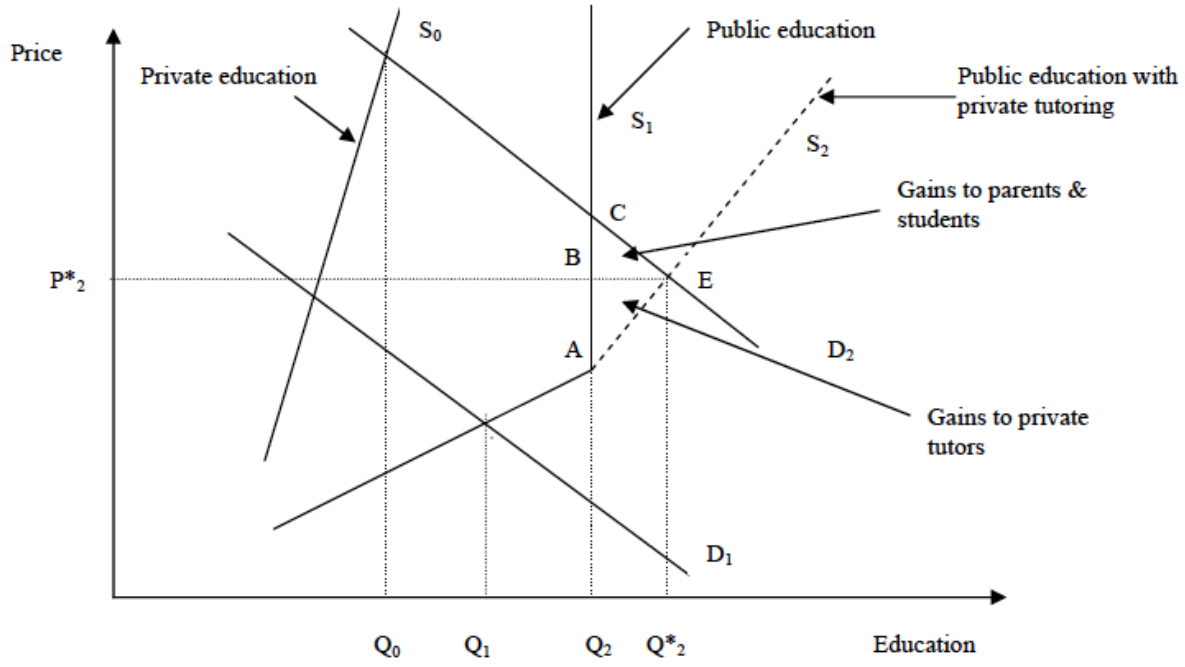
2.1.2 The Standard Microeconomic Theory of Supply and Demand

The standard microeconomic theory of supply and demand can be used to interpret the private tutoring phenomenon. This theory explains how the quantity of education, including private tutoring, is determined by the interaction between supply and demand for education in the market. Dang and Rogers (2008) presented the supply and demand for education for a typical household in the case where private tutoring is available as shown in Figure 1.

In Figure 1, there are three supply curves that represent the different types of education provided. The three supply curves S_0, S_1, and S_2 represent 1) private education, 2) public education, and 3) public education with private tutoring, respectively. S_0 is placed farther up in the left corner compared to S_1 and S_2 because of the high costs of private education. S_0 is also more inelastic in price because parents who send a child to a private school are less sensitive to the price of education and more sensitive to the quality of education. S_1 shows an upward-sloping curve ending at point A, and the line becomes vertical rising from point A (perfectly inelastic supply). The vertical slope of S_1 means, regardless of consumer demand, after a certain point, public schools may reach their capacity limit, preventing them from offering as much

education—in terms of both quantity and quality—as parents or students want[6]. S_2 shares a common solid upward-sloping curve with S_1, but it includes a dashed diagonal line staring from point A. This dashed line is less steep than the vertical curve of S_1, implying that private tutoring can meet students' and parents' demand for education as opposed to public education. In addition, this dashed line is steeper than the solid part of S_2, indicating that the cost of private tutoring is higher than the cost of public education.

Figure 1. Demand and supply of education with private tutoring



The household demand for education is represented by either the demand curve D_1 or D_2. Even though schooling is provided free of tuition, a household always bears certain costs to send a child to school, such as school fees or foregone earnings by being at school instead of working

[6] The capacity constraint of public education may be a better description of the short run than of the long run. In the long run, the vertical part of S1 would become more elastic because government may invest to increase the quality of effective public education by expanding school capacity or increasing teacher quality.

(opportunity costs). With these costs of education, D_1 is the demand curve for a representative household, and D_2 represents another household that is assumed to have either a higher income, stronger preferences in education, or higher expectations about a child's returns to education. Due to these differences, at each price, a household in D_2 would spend more on education than a household in D_1.

The quantity of education is determined by the intersection between the supply and demand curves (equilibrium). If the representative household's demand for education is represented by the demand curve D_2, the amount of private education the household consumes is Q_0, and the amount of public education consumed is Q_2. In the presence of private tutoring, the same household can consume Q^*_2, which is a larger amount of education than Q_2.

This standard framework explains a household's different behaviors in different settings of education. Availability of private tutoring promotes households to consume more education than when they have formal education only. However, this framework fails to explain several other aspects of private tutoring. For example, as Figure 1 shows, parents and students face different prices in each setting (S_0, S_1, and S_2). The price that a household shoulders in the setting of public education with private tutoring (P^*_2) is lower than the price that a household takes on when only public education is available to them, which may not be true in many cases. In addition, this framework fails to explain the demand of private tutoring by students in private schools.

The failure of capturing all aspects of private tutoring using this framework may be due to certain assumptions that this framework incorporates (Dang & Rogers, 2008). This framework assumes that 1) the market for private tutoring is perfectly competitive, 2) public education reaches a strict capacity constraint after a certain point, and 3) an increase in education

units through private tutoring increases students' human capital. However, these assumptions may not always be valid in practice and may differ from setting to setting within a country and among different countries. The market for private tutoring is not always perfectly competitive because of teacher corruption. In a perfectly competitive market of private tutoring, households independently make decisions on whether to spend money on private tutoring for their children. However, in many developing countries, it is often the case that public school teachers offer private tutoring for their students after regular classroom hours and they make it mandatory by providing a part of curriculum during tutoring hours (Dang & Rogers, 2008; Buchmann, 1999; Silova & Bray, 2006). Even though some countries such as Ukraine and Korea prevent teachers in formal schools from tutoring outside of schools, it is still common in other developing countries. In addition, public education does not necessarily have a capacity constraint in the long run because governments can try to increase the quality of public education by allowing longer school hours or increasing teacher quality. Lastly, private tutoring may aim for test preparation instead of accumulation of human capital. Even though this framework has several limitations that do not allow us to explain every aspect of private tutoring, it delivers a broad picture of an education market with private tutoring and explains how its introduction in the market can increase households' consumption of this type of education.

2.1.3 Educational Production Function

In order to estimate the effect of private tutoring on various student outcomes, this dissertation employs an educational production function approach. An educational production function is analogous with industry production functions in economics, which explain the relationship between the inputs, such as labor and capital, into the production process using

existing technology and the resulting output of firms including goods and services (Pindyck & Rubinfeld, 2000). In education, test scores, graduation rates, or dropout rates are used as outputs, and inputs are typically factors like students, family, and school. The statistical relation between these inputs and outputs is mathematically represented as follows (Hanushek, 1986).

(2.1) $A_t = f(F_t, T_t, OS_t)$

A_t represents the achievement of a student at period t; F_t represents the family inputs, such as parental education, income, race, and home language, that affect student achievement; T_t represents teacher inputs for a student such as the education level of teachers, teaching experience, and other teacher qualifications; and OS_t represents other school inputs such as class size, location of schools, library, curriculum and so on. Many researchers modify this function by including other inputs such as students' innate ability, peer factors, and neighborhood factors. Using the various types of educational production functions, this dissertation investigates the relationship between private tutoring participation and student academic outcomes.

2.2 Determinants of Private Tutoring

2.2.1 Micro factors

There are several studies that explored the determinants or drivers of private tutoring. Based on related studies, Dang and Rogers (2008) accumulated the results in existing studies regarding what kinds of micro and macro factors influence the demand for private tutoring. In terms of micro factors, many studies show a consensus that the most influential micro factors are household income, parental education, and urban location (Assaad & El-Badawy, 2004;

Stevenson & Baker, 1992; Tansel & Bircan, 2006; Dang, 2007b). Specifically, students whose parents live in an urban area with higher income and education levels have a higher probability of receiving private tutoring than their peers who live in a rural area with parents with lower income and education levels. Similar patterns have been found in Korea (Choi et al., 2003; Kim, 2004; Kim & Lee, 2010; Lee, 2003; Won, 2001; Yun, 1997).

In addition, a student's grade level and household size explain the pattern of demand for private tutoring in some countries. In Egypt and Vietnam, students in higher grade levels, especially the ones in the last grade of their current school level or in diploma-granting years, showed a higher demand for private tutoring (Assaad & El-Badawy, 2004; Dang, 2007b). And in Korea, Turkey, and Vietnam, the number of children in households showed a negative relationship with private tutoring expenditures (Kim & Lee, 2010; Tansel & Bircan, 2006; Dang, 2007b). However, the household size variable is likely to be endogenous. For example, parents who have several children may have a lower level of parental concern for their children's education or different educational beliefs. In addition, resources such as government subsidies and corporate benefits for people with multiple children may affect parents' decision on how much they spend money on private tutoring. However, since these different characteristics of parents with multiple children are difficult to measure and unobserved, it would create bias in estimating its effect.

Baker et al. (2001) also argued that student academic performance is one of the factors that determine the private tutoring expenditures of households. However, this factor plays out differently in different countries. For example, using data from the Third International Mathematics and Science Study (TIMSS) in 1995 for 41 countries, Baker et al. (2001) showed that in three-fourths of these countries, low-performing students spent more money on private

tutoring, whereas one-fourth of them exhibited an opposite pattern. This implies that some countries use private tutoring as a remedial strategy, while other countries consider it as an enrichment strategy (Baker et al, 2001; Won, 2001). In this study, Baker et al. (2001) used the OLS estimation to explore the determinants of private tutoring with several control variables including a composite measure of socioeconomic status of students, their gender, type of community, at-school remedial resources, and whether there is a difference between the language used at home and the language used in school instructions. However, there were many unobserved variables that the authors failed to control such as student academic motivation and parent academic aspiration for their children, which make estimates biased.

Stevenson and Baker (1992) used a logistic regression equation to find the determinants of the shadow education in Japan. In addition to the micro factors mentioned above, student's gender, student curriculum track (academic track vs. vocational track), and high school reputation seem to explain the pattern of students' shadow education in Japan. They found that male students, students in the academic track, and students in high schools that have a higher reputation spent more money on shadow education than their counterparts.

2.2.2 Macro factors

In addition to micro factors, the literature on private tutoring has cited several macro factors that seem to foster the demand for private tutoring. First, Bray (1999) argued that as some of underdeveloped countries have transitioned to a market economy, the demand and supply of private tutoring have substantially increased. As the economy improves, increasing the real income of households, households would start spending more money on their children's education and other goods, an income effect in economics. Bray (1999) used cases in China,

Vietnam, and Eastern Europe to show the emergence of supplementary tutoring, which previously did not exist in these countries.

Stevenson and Baker (1992) introduced another macro factor that would affect people's decisions on private tutoring. If there is a tight linkage between education and future success in the labor market, they argued that this linkage would stimulate the competition for more education, and thus private tutoring. Given this tight linkage, the existence of high-stakes formal examination, a prerequisite to acquire more education in higher education institutions, increases the demand for education even more (Stevenson & Baker, 1992; Bray, 1999). In the case of Taiwan, the view is pervasive that students participate in shadow education to prepare for university entrance examinations because getting into prestigious universities determines their success in the labor market (Lin, 1983). Also, in Hong Kong, there is high demand for shadow education as a preparation for the secondary-school-certification examinations because performance on the exam is the most crucial factor that determines their job and salary level (Mitchell, 1968; Sweeting, 1983). However, Baker et al. (2001) found the opposite result in terms of the influence of high-stakes testing. They analyzed 41 countries using the 1994-95 TIMSS data and found no relationship between the existence of high-stakes testing and the use of shadow education.

Cultural values are also emphasized to explain the pattern of private tutoring in many countries. Bray (1999) argued that supplementary tutoring is especially prevalent in cultures that stress effort. Many Asian cultures, which show a high demand for tutoring, are influenced by Confucian traditions that stress effort as a factor for future success, whereas a person's ability is more emphasized in European and North-American cultures (Rohlen & LeTendre, 1996). In addition, "many Asian cultures value disciplined study and are both competitive and status-

conscious," which influence people's need for private tutoring (Bray, 1999). In terms of competition, the intensive competition among students for college entrance in Korea is analyzed as one of the important determinants of private tutoring (Hyun et al., 2002; Kim, 2004; Lee, 2005).

The ineffectiveness of the public education system is found as one of the determinants of private tutoring (Kim & Lee, 2010; Buchmann, 1999; Silova & Bray, 2006). In Korea, the public education system is regulated strictly by the government especially after the introduction of the Middle School and High School Equalization Policy (Lee & Hong, 2001). Due to this rigidity, it is completely insulated from the market forces and local parents' demand for education (Kim & Lee, 2010). To meet this high demand, parents and students who are not satisfied with education provided by the public school system find other ways to meet their needs by participating in the private tutoring sector or by studying abroad (Chun et al., 2003; Kim, 2004). Several Korean researchers have conducted studies to analyze whether the High School Equalization Policy is one of the factors fanning the increasing demand for private tutoring, and they argued that this policy has played a significant role (Lee & Hong, 2001; Kim et al., 2003; Kim et al., 2003). Buchmann (1999) and Silova and Bray (2006) expressed concerns that low pay levels and weak monitoring of teachers in the public system may create a private tutoring market for teachers who wish to reap more rewards from teaching outside the public schools. Private supplementary tutoring may become more necessary in systems that are teacher-centered rather than child-centered, and are intolerant of slow learners (Bray, 1999). However, most of these studies are speculative and anecdotal and do not indicate the causal link between the nature of education systems and demand for private tutoring.

The degree to which mass education is institutionalized within a nation is also related to the national use of shadow education (Baker et al., 2001). Baker et al. (2001) used two variables as indicators for the degree of mass education in a nation: public expenditures on education as percentage of GNP and gross enrollment ratio at elementary and secondary levels from the UNESCO Statistical Yearbooks. This study found that the expanded provision of mass education does not generate a higher prevalence of shadow education use. In other words, families in a less funded and less enrolled system use more shadow education than families in a fully developed, mass-education system.

As explained above, many researchers have introduced these macro factors that may determine the demand for private tutoring. However, there is little formal empirical research to test the above-described hypotheses, so it is still uncertain whether there are causal relationships between these macro factors and the prevalence of private tutoring.

2.3 Empirical Literature on the Effect of Private Tutoring on Outcomes

Empirical studies have found positive effects of private tutoring on students' educational outcomes. Stevenson and Baker (1992) investigated whether the participation in high school shadow education increased the likelihood of university attendance in Japan. Overall, they found that students who reported that they have participated in certain types of shadow education during high school years showed a higher probability of attending universities in their first year following graduation from high school. For students in the first year out of high school, practice examinations and correspondence courses improved the probability of entering college by 16 percent and 25 percent, respectively, whereas having a private tutor significantly reduced this probability, which reflects the remedial character of this form of private tutoring in Japan. In addition, after-school classes (*juku*) had only a small and insignificant effect on attendance,

probably because students in better high schools who tend to be high-performing use their high school's after-school program instead of *juku*. For students in the second year out of high school, attending special tutoring school increased the probability of entering college by 80 percent. However, using the logistic regression, Stevenson and Baker (1992) failed to remove the bias caused by selectivity of private tutoring participants. In addition, the student academic performance variable used in all regression models is problematic because it is likely to be endogenous, which means that it is correlated with unobserved student innate ability or motivation.

Buchmann (2002) also found positive impacts of private tutoring on student academic performance in Kenya. For 13- and 19-year-old students, private tutoring reduced the chance of grade repetition and increased student academic performance. Similarly, Briggs (2001) looked at commercial private tutoring courses in the United States and tried to measure its effectiveness using the OLS method. He found that coaching increased SAT math scores by 14-15 points, SAT verbal scores by 6-8 points, and ACT math and English scores by 0-0.6 points, but decreased ACT reading scores by 0.6-0.7 points. Park, Park, and Kim (2001) and Yang and Kim (2003) also argued that private tutoring contributed to the improvement of the math and science scores in TIMSS 1999 using Hierarchical Linear Modeling (HLM). Using the multiple regression, Lee (2001) claimed that private tutoring is one of the important factors for academic achievement. Using path analysis, Kulpoo (1998) and Polydorides (1986) also found the positive correlations between private tutoring and academic achievement in Mauritius and Greece, respectively. However, significant caveats of these studies are that either they do not control for school characteristics, which may bias the estimation results, or they do not use an appropriate method to observe the causal relationship.

As opposed to positive effects, several studies found negative or no effect of private tutoring on student outcomes. Han, Sung, and Gil (2001) and Ban, Jung, and Yang (2005) provided counter-evidence in which private tutoring is not statistically significant in explaining academic achievement using regression analysis. Lee et al. (2004) investigated the effect of pre-class tutoring on academic achievement of students who were enrolled in secondary schools in Korea. Pre-class tutoring is defined as private tutoring that teaches a school's curriculum at least one month ahead of its schedule. This study concluded that pre-class tutoring has no short- or long-term effects on student academic performance in Korean language, English and mathematics. However, this study also has several weaknesses in the analysis. The sampling procedure raises many doubts whether it ensured a perfectly random sample. The authors seemed to have failed to account for differences in regional characteristics and student motivation, which affect both participation decision of private tutoring and academic achievement. In addition, for the long-term analyses, the sample size was too small, which tends to lead to biased estimates.

Cheo and Quah (2005) and Ha and Harpham (2005) also found insignificant effects of tutoring on student achievement. Cheo and Quah (2005) conducted an analysis using multiple regression with students in grade 8 in three schools in Singapore and found negative and insignificant effects of having a paid home tutor. Similarly, using logistic regression, Ha and Harpham's (2005) results showed an insignificant effect of taking extra after-school classes on writing and numeracy for eight-year-old children in Vietnam, whereas children with extra classes were more than twice as likely to be able to read correctly compared to children who didn't take extra classes. Although the authors controlled for many confounding factors, such as region,

household wealth, parents' education, household size, child ethnicity, and mental health, they did not control for school characteristics, which are important confounding factors.

Some studies investigated the effect of private tutoring based on the subjective answers of perceived academic improvement. Korean parents showed strong trust in the effect of private tutoring (Paik, 1999; Yun, 1997). In addition, studies have shown that German and Japanese parents believed that private tutoring plays a positive role in increasing academic achievement of their children (Kramer & Werner, 1998; MEXT, 1994).

All studies introduced so far have mixed evidence on the effect of private tutoring on student academic performance. However, the results from these studies should be received with caution because they are not successful in controlling for endogeneity of private tutoring. By contrast, there are many studies that have tried to control for endogeneity of private tutoring in some credible ways as follows.

The ideal setting of the study in order to control for endogeneity is the Randomized Control Trial (RTC). Banerjee et al. (2007) used a randomized experiment of a remedial education program called the Balsakhi Program conducted in schools in urban India. This program provided government schools with a teacher to work with third and fourth graders who have been identified as falling behind their peers. Typically, a teacher meets with a group of these students (15-20 students) and holds a class for two hours a day. The participating schools were randomly divided into two groups. Schools in group A provided remedial education only to third graders, whereas schools in group B provided it to fourth graders, and vice versa in the following year. Therefore, children in grade 3 in schools that received the program for grade 4 form the comparison group for children who received the program for grade 3. Given this design of the program, Banerjee et al. (2007) found a larger improvement in average test scores for the

treated group than the comparison group (0.28 standard deviations increase in average test scores). This study seems successful in minimizing possible biases of the estimates caused by selectivity of the program participation. Even though this remedial education program is somewhat different from private tutoring programs since the Balsakhi Program is financed by a non-governmental organization and free of charge for families, it is exemplary of a study design that could control for endogeneity of tutoring.

Using observational data, researchers have also been trying to use quasi-experimental methods in order to explain the effect of private tutoring. Mischo and Haag (2002) conducted the study to observe the effect of private tutoring for students in grades 5 to 11 in Luxembourg. This study used a form of matching, in which 122 students receiving tutoring (treatment) identify a match using subject matters and performance in the subjects. Using this procedure, 122 non-tutoring pupils were recruited as a comparison group. This study concluded that receiving private tutoring "causes" a larger improvement in academic performance. Out of six school marks in the school system (1=very good to 6=insufficient), school marks for student receiving tutoring improved by 0.97, 0.77, 1.18, and 0.72 for mathematics, English, Latin, and French, respectively, whereas school marks for non-tutoring students showed a smaller improvement in these subjects. These differences were statistically significant. Mischo and Haag (2002), however, failed to match students in the treatment and control groups in terms of their unobserved characteristics, such as student academic motivation or family background, which also have an influence on their decision of participating in private tutoring and their academic performance.

The instrumental variable method seems popular in the studies of private tutoring in order to control for endogeneity. Lavy and Schlosser (2005) observed the effect of a remedial

education program on matriculation rate and participation in the matriculation exam in Israel. As an instrument for the proportion of students participating in the program (treatment intensity), authors used the interaction terms of schools size with the year dummy variable and treatment status. Instead of using school size itself as an instrument, which has an independent direct effect on school achievements, i.e., the matriculation rate and the number of students who participated in the matriculation exam, the authors overcame the difficulty by estimating the direct effect of school size on school achievements based on data from the untreated cohorts in order to partial out the direct effect of school size on school achievements. Also, to allow more flexibility, they split the instrument into three variables based on the distribution of school size. Using this instrument, they found that a remedial education program increased the mean matriculation rate for schools and the number of participating students in the matriculation exam by 3-4 percent and 11-12 percent, respectively. Suryadarma et al. (2006) used proportion of classmates taking extra courses as an instrument of private tutoring to observe whether taking extra courses explains student academic achievement in Indonesia. They found no impacts on mathematics or dictation scores for the fourth graders. In this study, the authors argued that this instrument fulfills the requirement of being highly correlated with the instrumented variable, i.e., participation in extra courses, and exogenous to a student's score, which is the dependent variable. However, the authors did not consider peer effects, which could occur when there are many classmates who receive tutoring and they have an influence on students who do not take tutoring. In addition, the authors did not provide tests to check the validity of the instrument. As opposed to the results in Suryadarma et al. (2006), Dang (2007b) found positive effects on student academic performance using per hour private tutoring fees charged in the commune as instruments for participation of private tutoring in Vietnam. The author claimed that the

instrument is exogenous because the fees are regulated by government rules based on local living standards. However, the study explained that students could also attend other tutoring classes outside the commune. In this study, the author failed to prove that this instrument is exogenous to students' academic performance. He concluded that, for both primary and lower secondary students, higher spending on private tutoring decreased the probability that the student falls into either the poor or average performance categories, but increased the probability that the student enters the good and excellent performance categories. However, the influence was larger for lower secondary schools.

However, we should be critical about whether instruments meet certain assumptions to be appropriate. As one of the most important assumptions for the instrumental variable method, instruments have to fulfill the requirement of being highly correlated with the instrumented variable, which is the decision on whether to participate in private tutoring in this study, and exogenous to the dependent variable, which is called exclusion restriction. However, the proportion of classmates taking extra courses, which was used as an instrument in Suryadarma et al. (2006), seems to have effects on student performance explained by peer effects and is not clearly predictive of selection. If the proportion of classmates who take extra courses is high, it may create positive externalities to students who do not take extra courses, a factor that can have an impact on their academic achievement.

Besides the instrumental variable method, other quasi-experimental methods were used as identification strategies. Briggs (2001) applied the Heckman model to correct for the effects of selection bias and found identical estimates for the couching variable to those produced by the linear regression. Jacob and Lefgren (2004) investigated summer remedial programs in Chicago using a regression discontinuity method. From 1997-1998, students who made below the cutoff

scores for mathematics and reading should participate in summer remedial programs, whereas students who scored above the cutoff scores were not subject to take remedial programs. In order to identify the effect of these summer remedial programs, they compared students who scored just below and just above the cutoff assuming that the unobservable characteristics of students do not vary discontinuously around the cutoff. This study found that the programs increased math and reading achievement for third graders by about 12 percent of the average annual learning gains whereas 6 percent for sixth graders. However, this study did not provide evidence whether other characteristics of students are continuous around the cutoff even though it is one of the important assumptions for the validity of the regression discontinuity method.

Korean researchers have also put in much effort to uncover the effect of private tutoring in various ways. In the effort to uncover a causal relationship between private tutoring and academic achievement, Kang (2007) and Choi (2007) applied the instrumental variable method to correct for endogeneity. Using the birth order as the exogenous instrumental variable of the expenditures of private tutoring, they claimed that the effect of private tutoring was not statistically significant on academic achievement and college attendance. Kang (2007) claimed that being a first-born significantly and positively affected private tutoring expenditures for a student; parents spend 30 percent more money on private tutoring for first-born children than for later-born children. In addition, he argued that being a first-born has no direct association with students' academic performance. However, as mentioned earlier, there is a lack of Korean studies that used causal inference methods; therefore, the true effect of private tutoring is still unknown.

2.4 Gaps in the Existing Empirical Literature

As listed above, most of empirical studies on the effect of private tutoring focus on educational outcomes such as student's academic achievement and college attendance. Educational outcomes have been considered the focus of interest of students, parents, and policymakers because the main reason for participating in private tutoring is to improve learning and educational results. However, private tutoring not only generates an educational impact but also an impact on 1) formal schooling, 2) society, and 3) economy (Bray, 1999).

In terms of the impact on formal schooling, many qualitative studies have argued that tutoring is reported to have several effects on formal schooling. For example, tutoring can take away students' interest and attention from lessons in schools since they have already covered the topics with tutors (Hussein, 1987; Nanayakkara & Ranaweera, 1994; Sawada & Kobayashi, 1986). In addition, tutoring can decrease the effectiveness of teachers, especially in a situation where teachers are allowed to be tutors. This is because teachers might have an incentive to design the curriculum as too full and might deliberately slow down their pace of delivery in order to ensure that they have a market for supplementary classes that generate additional income for themselves (Hargreaves, 1997; Caillods et al., 1998; Bray, 1999).

Private tutoring has several social implications such as consequences of pressure on students, the impact on social relationships, and the implications for social inequalities (Bray, 1999). Some researchers argued that children who attend both formal and private tutoring classes deal with more academic pressures and depression than those who only attend formal classes (Tsukada, 1991; Wijetunge, 1994), and it exacerbates pressures and depression in a setting where high-stakes tests take place (UNICEF, 1994). De Silva (1994) also pointed out that participation in private tutoring can weaken family bonds of affection because children are away from home and their parents most of the time. Adversely, Paiva et al., (1997) and Russell

(1997) claimed that supplementary tutoring would also provide a healthy framework within which young people can develop and meet many peers, which improve their social relationship. Moreover, private tutoring may create a mechanism that increases social inequality (Bray, 1999). Since most forms of private tutoring is more easily accessible to students from high-income families, it can create greater inequality in access of supplementary education that widens the achievement gap among income or racial groups. Yang (2007) also argued that private tutoring widens the education inequality in terms of college entrance, whereas Choi (2007) provided a counter-argument on the relationship between expenditures on private tutoring and college entrance.

Lastly, in terms of the economic implications of private tutoring, private tutoring as a form of education can increase students' human capital, which increases labor market earnings in the future, according to the human capital theory (Schultz, 1961; Becker, 1962). Advocates of the human capital theory might consider private tutoring to be more tightly connected to individuals' economic enhancement than formal schooling because it is closely tied to the demands of the market place and because enhanced economic return is among the chief reasons why students and their parents invest in it (Bray, 1999). Alternatively, private tutoring might contribute to suppressing creativity, which can adversely affect future economic productivity, because most of private tutoring is focused on preparation of traditional examinations that largely focused on memorization (Bray, 1999). While there is substantial literature on the rates of returns to formal education (Pschoaropoulous, 1994; Carnoy, 1997; Bennell, 1998), a lack of empirical literature exists on this subject.

Although some studies take into account the social and economic outcomes of private tutoring, they are mostly speculative and anecdotal without appropriate quantitative evidence.

Thus, the most significant gap in the existing literature on private tutoring is that there is a lack of empirical studies to investigate these external returns to investment in private tutoring. This study seeks to fill this gap and explores these unknown research areas in order to explain the impact of private tutoring to a greater extent beyond student academic achievements that are already used in many studies.

Moreover, even though there a number of Korean studies about private tutoring as previously stated, studies that control for endogeneity of private tutoring are lacking. Thus, it is still not conclusive whether there is a causal link between private tutoring and outcomes in Korea. Using quasi-experimental methods, this study aims to uncover the casual effect of Korean private tutoring on several outcomes. Before empirical analyses, Chapter III will explain a detailed picture of Korean private tutoring. Chapter III will help understand the situation of private tutoring in Korea in terms of its purpose, intensity, providers, contents, and expenditures.

CHAPTER III: OVERVIEW OF KOREAN PRIVATE TUTORING

The characteristics of the private tutoring market differ by country. Among many countries that have a sizable demand for private tutoring, the Korean private tutoring market is predominant. Therefore, it is worth investigating its characteristics. To understand the detailed characteristics, Chapter III provides detailed information on the major purposes of taking private tutoring, participation rate by level of schooling, forms of private tutoring, numbers of providers, size of the private tutoring market, tutor salaries, contents, and expenditures on private tutoring, etc. This chapter will help readers understand how important private tutoring is in the Korean society.

3.1 Purposes

There are several purposes of participating in private tutoring. The most popular purpose is to use private tutoring as an enrichment strategy (Baker et al., 2001). This strategy is used among high-achieving students who wish to further increase their performance through private tutoring. Some of the factors that fulfill this enrichment purpose include the tight linkage between education and future success, and people's concern for the deterioration of public schooling. In Korea, enrichment seems to be one of the major purposes of private tutoring as reflected in Table 2. According to the KNSO (2010), participation in private tutoring is the highest among high-achieving students. About 85 percent of students placed higher than the 90th percentile report that they participate in at least one form of private tutoring activities, and this participation rate is twice the rate for students placed lower than the 20th percentile.

Table 2. Participation rate and monthly expenditure on private tutoring by academic percentile

Academic Percentile	Participation Rate (%)	Monthly Expenditure (USD)
Higher than 90th	85.3	317
90th - 70th	83.9	282
70th - 40th	73.8	233
40th - 20th	59.8	182
Lower than 20th	48.8	136

Source: Korea National Statistics Office (2010)
Note: Average rates and expenditures with respect to students in primary and secondary schools

Table 2 also shows a gradual decrease in participation as students' academic standing falls. It is consistent with findings from Baker et al. (2001) using cross-national data from the Third International Mathematics and Science Study (TIMSS). Baker et al. (2001) found that the role of private tutoring in Korea is classified as predominantly enrichment because almost twice as many high-scoring students regularly use private tutoring than low-scoring students. However, Baker et al. (2001) argued that most of countries used private tutoring for a different purpose.

Private tutoring in many countries is also classified as a remedial strategy (Baker et al., 2001; Dang & Rogers, 2008). Baker et al. (2001) found the dominant remedial strategy in nations such as Cyprus, Israel, Belgium, and Demark. Compared to students who scored in the top one-third, two to more than three times as many students used private tutoring among those in the lowest one-third. Similar but less dominant patterns were revealed in the U.S., Germany and Kuwait. This indicates that in these nations private tutoring is mostly used for a remedial purpose among low-achieving students in order to meet certain academic thresholds. Even though enrichment is the modal trend of its use in Korea as explained, there are a substantial number of students who use private tutoring as a remedial strategy. As Table 2 shows, on average, 54.3 percent of students who are placed lower than the 40th percentile participate in private tutoring. Even though this rate of participation is much lower than the one from high-

achieving students, this proportion is still substantial and meaningful. However, Bray and Lykins (2012) claimed that private tutoring is much less used for remedial help in current years.

Students also decide to receive private tutoring in order to prepare for examinations that are required to move to a higher level of schooling. This phenomenon is prevalent in many Asian countries, such as Japan, Korea, and Taiwan, where high-stakes tests exist (Stevenson & Baker, 1992; Baker et al., 2001). In Japan, a form of private tutoring that is exclusively focused on practicing the university entrance exam is the most popular type among high school students (Stevenson & Baker, 1992). Similarly, in Korea, preparing for the university entrance exam is one of the most common objectives of private tutoring (KNSO, 2008). According to the 2008 survey from the KNSO, about one-quarter of students reported that preparation for the university exam is their intention of doing private tutoring.

The survey from the KNSO (2008) also found that about 15 percent of participants reported that their major purpose of private tutoring is to reduce anxiety from peer pressure. Since a large number of students are engaged in private tutoring in Korea, as explained in the following section, students who do not participate tend to feel pressure to be part of it. Several studies about private tutoring from the Korean Educational Development Institute (2001, 2003, and 2005) showed that some students participate in private tutoring because most of their classmates do. Or they report that they would become anxious or fall behind if they don't participate.

Lastly, some students use private tutoring for their personal development in subjects that are not taught in schools such as foreign languages, fine arts, or music. There is a small proportion of students who wish to develop their personal interests in music, fine arts, athletics, or skills required for their future career through private tutoring (KNSO, 2010). This purpose of

private tutoring is more linked to students' leisure and personal development apart from academic purposes.

3.2 Intensity

Table 3 shows private tutoring participation rates by the level of school based on a national survey of private tutoring conducted by the KNSO since 2007. On average, in 2010, about three-quarters of students (73.6 percent) in the formal school system participate in at least one kind of private tutoring. Specifically, about eight out of 10 elementary school students (86.8 percent) were enrolled in private tutoring activities. Among middle school students, 72.2 percent reported that they are currently participating in at least one form of private tutoring in 2010. In terms of high school students, about half (52.8 percent) use private tutoring for their study. Interestingly, the rate of participation in private tutoring decreases as the level of education increases. In other words, the intensity of private tutoring participation is the highest at an elementary school level compared to middle and high school levels. This decreasing trend has several implications. It may imply parents' strong belief in the importance of education at the elementary level. Or it may explain that higher levels of formal schooling are better at meeting parents' or students' academic needs so that students in high schools participate less in private tutoring and rely more on formal schooling than students in elementary or middle schools.

Table 3. Participation rate by education level in Korea

	Average	Elementary School (Grade 1 – 6)	Middle School (Grade 7 – 9)	High School (Grade 10 – 12)
2007	77.0	88.8	74.6	55.0
2008	75.1	87.9	72.5	53.4
2009	75.0	87.4	74.3	53.8
2010	73.6	86.8	72.2	52.8

Unit: in percentage
Source: Korea National Statistics Office (2007, 2008, 2009, 2010)

3.3 Providers

3.3.1 Forms of Private Tutoring

Students and families can choose different forms of private tutoring. Generally, there are five forms of private tutoring based on the situation in Japan and Korea, which have the two largest private tutoring markets in the world (Dawson, 2010).

First, there is individual tutoring in which one instructor provides private lessons to one student, typically at a student's home. In Korea, instructors are usually college or graduate students, or professional tutors who are not employed at private learning institutes. It is called *gwaoe* in Korea. Also in Japan, it is also common that private tutors (*katei kyosi*) work with students on a one-on-one basis. Private tutors tend to be more focused on helping students' regular schoolwork instead of examination preparations in Japan (Stevenson & Baker, 1992). However, in Korea, tutors teach the academic contents in formal schooling in advance to prepare students as well as help students' homework. Like school teachers, tutors teach new subjects at the same time, providing examples related to the subjects in order to maximize the effectiveness of tutoring. Tutors also provide homework and help tutees' schoolwork if needed. This form of

private tutoring was the most popular in the 1970s when competition for university entrance was fierce in Korea. In the effort to reduce the demand for private tutoring, the military government issued "The July 30 Education Reform," which prohibited students and teachers from taking and giving private one-to-one or one-to-many lessons. Thus, the demand decreased temporarily in the 1980s.

Second, students receive educational materials such as self-study sheets that are regularly prepared and delivered by private companies. There are three subcategories under this form of private tutoring. First, students are provided with answers and additional explanations for questions in order to help them study independently. Second, after students submit the finished self-study sheets, they are returned to students with comments and instructions for further study. Lastly, after students finish the self-study materials by themselves, a tutor who is employed by private companies that make the educational materials visits a student's home and provides additional lessons related to the materials. All these categories are generally called *haksupji*, which is popular for students at any level of education in Korea. In Japan, this form is called correspondence course (*tsushin tensaku*), which is popular for students who plan to take the university entrance exam. Students receive mock tests by mail and send them back to private providers in order to get their grades. There is a practice examination (*mogi shiken*), which is similar but slightly different from the correspondence course. Instead of receiving mock tests by mail, students visit private companies and take the test that the companies generate. After a few days, students receive a report by mail that informs students and parents of their chances of being admitted to university by comparing their performance with national norms as well as their standing in each subject area (Stevenson & Baker, 1992).

Third, the most common and substantial form of private tutoring is the one provided by private for-profit institutes (*hakwon*) in Korea (often called cram schools in the U.S.). It has classrooms and instructors, and the instruction is given in a classroom-like setting. After formal schooling, students attend *hakwon* that they choose and review what they learned in formal schools or learn school materials in advance (learning-in-advance[7]) similar to one-to-one tutoring. However, there is a large discrepancy between *hakwon* in Korea and test preparation centers in the U.S. While the centers provide mostly test preparation courses for the SATs and ACTs, *hakwon* mimics classrooms and provides more advanced study than formal schools in order to meet the needs of students and parents. This is also why students neglect public school education (Kim et al., 2003; Stevenson & Baker, 1992).

The Korean government has maintained a strong control over *hakwon*, requiring those who want to establish one to acquire a government-issued permit. Instructors at *hakwon* have to meet certain academic qualifications, and school teachers are prohibited from participating in any form of private tutoring including *hakwon*. Also, there are strict requirements for facilities in order to establish a *hakwon* (Kim & Lee, 2001; Kim & Chang, 2010). Similarly, primary and secondary Japanese students also participate in similar private after-school classes (*juku*). This group tutoring comes in five different types: (1) *shingaku juku* (university entrance exam preparation), (2*) hoshu juku* (remedial study), (3) *kyosai juku* (for school refusers and drop-outs), (4) *doriru juku* ("drill" work, e.g. Kumon), and (5) *sogo juku* (comprehensive type which includes elements of the other four) (Roesgaard, 2006). *Juku* is for students in grades 1 through 9 (Lee, Park & Lee, 2009).

[7] Private tutoring institutes (*hakwon* in Korea and *juku* in Japan) teach formal education curriculum in advance of public schools. They teach students for 2 months during the vacation before the beginning of the academic year, during the school term, they teach the curriculum at a more rapid pace than the school, and then they review materials during the exam period (Kim, 2003). This becomes a problem because school becomes a place for review and it threatens the authority of public education (Russell, 2002).

Fourth, online tutoring services are rapidly growing as an alternative form of private tutoring in Korea. Private tutoring institutes not only provide in-house tutoring, which was already explained, but also make lessons and materials available online. Students can purchase these online courses and materials provided by instructors employed by private tutoring institutes. There is also a public online tutoring called the Educational Broadcasting Station (EBS), which started in the mid-1990s. In order to decrease the demand for private tutoring, the courts supported a new and less expensive government-funded educational tutoring model. Quality teachers in formal schools or private tutoring institutions participate and make their lectures available on EBS, enabling all students to benefit from them without bearing any financial burden.

Lastly, as briefly explained above, high school graduates who do not gain admission to any university or the one they wish may participate in full-time preparation institutes. Those students are called *ronin* and *jaesusang* in Japan and Korea, respectively. They often attend a private examination preparation school, which is typically considered a bigger version of *hakwon*, requiring at least a year to prepare solely for the university entrance examination. In Japan, the private examination preparation school is called *yobiko*, which is very similar to a formal school (Stevenson & Baker, 1992). In this study, this form of private tutoring will not be studied because people in this category are not enrolled in the formal school system. This study will limit the scope to private tutoring that is available to students who are enrolled in formal schools.

Table 4 shows the participation rate in each form of private tutoring by Korean students at each level of education. Among forms of private tutoring, participation in private tutoring institutes (*hakwon*) is the highest in all levels of education (50.8 percent in elementary schools; 53.8 percent in middle schools; 28.3 percent in high schools). Using self-study materials

(*haksupji*) is also common for elementary school students (35.6 percent), but participation in this form decreases dramatically as the level of education increases. Table 5 shows the participation rate in private tutoring by Japanese students during high school years using a nationally representative data. In Japan, more than half of high school students (54 percent) in the sample participate in practice examination (*mogi shiken*), followed by private tutoring institutes (*juku)* (35 percent).

Table 4. Participation rate in each type of private tutoring by school level in Korea

	Total	Elementary School	Middle School	High School
Private Tutoring	64.8	74.4	68.5	44.9
Private tutor (one-to-one tutoring)	10.6	7.3	12.4	14.4
Private tutor (group tutoring)	11.7	14.7	10.7	7.8
Private tutoring institute (*hakwon*)	45.5	50.8	53.8	28.3
Self-study materials (*haksupji*)	19.5	35.6	10.5	1.5
Online tutoring	3.7	2.5	4.2	5.1

Unit: in percentage
Source: Korean National Statistics Office (2010)
Note: This table shows private tutoring participation for core subjects only (reading, writing, English, mathematics, science, social science, foreign language (besides English), computer)

Table 5. Participation rate in each type of private tutoring by school level in Japan

	Total Sample of Students (%)	Students with College Plan[a] (%)
Practice examination (*mogi shiken*)	54	68
Correspondence course (*tsushin tensaku*)	30	43
Private tutor (*katei kyoshi*)	8	11
Private tutoring institute (*juku*)	35	46
Plans to be a *ronin* after high school	29	32
N	7,240	5,352

Unit: in percentage
Source: Stevenson and Baker (1992), p.1646
[a] students with college plans represent 75 percent of base-year sample.
Data: longitudinal study of high school seniors in Japan conducted by the Youth Research Institute of Tokyo in 1980 and 1982 (nationally representative dataset)

3.3.2 Number of Providers

The number of private tutoring providers by type is shown in Table 6. According to the Survey of Private Tutoring Providers administered by the Ministry of Education, Science and Technology (hereafter MEST) in Korea, in 2008, there were 55,834 tutors for one-to-one tutoring, 40,202 tutors for group tutoring, 192 online tutoring companies, and 81 companies for self-study materials that are registered at the local ministries of education. The number of private tutoring institutes (*hakwon*) has increased tremendously from 14,043 in 2000 to 65,810 in 2008 even though they are under a regulatory environment (Kim & Lee, 2001). In addition, a large number of graduates from the humanities and social sciences studies enter the private tutoring sector (Kim & Park, 2012). Table 6 captures the popularity of private tutoring in Korea.

Table 6. Number of private tutoring providers by type in Korea

	Number of private tutoring providers
Private tutor (one-to-one tutoring)	55,834
Private tutor (group tutoring)	40,202
Private tutoring institute (*hakwon*)	65,810
Self-study materials (*haksupji*)	81(341)*
Online tutoring	192(550)*

Source: Survey of private tutoring providers by Ministry of Education, Science and Technology (MEST) in 2008
* number of private tutoring companies that serve more than one type of private tutoring

3.3.3 Size of Private Tutoring Market

Table 7 shows the annual gross sales of each form of private tutoring in 2008. Private tutoring institutes' (*hakwon*) gross sales was about 10 billion U.S. dollars (hereafter USD) in 2008, which is the highest compared to other forms of private tutoring. About half of gross sales came from elementary school students, followed by middle and high school students. One-to-one tutoring generated the second-largest gross sales (about 5 billion USD) among these forms of private tutoring. The largest proportion of the total sales came from high school students. The gross sales for self-study material companies is also substantial (about 1.9 billion USD), and as explained above, students in kindergarten and elementary schools take up the majority of people who consume this form of private tutoring. Group tutoring with a private tutor represented about 886 million USD of their total sales in 2008, and it is more common for elementary school students. These total gross sales reflect the size of the private tutoring market in Korea.

Table 7. Annual gross sales of private tutoring by type and education level in 2008

	Private tutor (one-to-one tutoring)	Private tutor (group tutoring)	Private tutoring institute (*hakwon*)	Self-study materials (*haksupji*)	Online tutoring
Total	5,051.9	886.6	10,281.4	1,983.9	411.1
Before elementary	-	8.9	261.7	589.2	-
Elementary School	1,744.3	662.3	4,540.6	1,095.1	117.2
Middle School	1,374.2	80.9	3,394.5	190.5	133.6
High School	1,933.4	134.5	1,230.6	111.1	160.3
After secondary	-	-	854.0	-	-

Unit: 1 million USD
Source: Korea National Statistics Office (KNSO), 2009; Ministry of Education, Science and Technology, 2008
Note: Won is translated in USD based on that 1,000 Korean won equal approximately 1 U.S. dollar.

3.3.4 Annual Salary of Tutors

As Table 8 shows, average annual salaries for tutors employed by private tutoring institutes and self-study material companies are about 18,876 and 18,980 USD, respectively. These salaries are similar to an average starting annual salary for a school teacher who graduated from college and has a teacher certificate (19,083 USD)[8]. Tutors employed by companies are paid much higher than self-employed tutors. However, average salaries for those tutors are much lower than average annual salary of school teachers, which is about 29,459 USD[9] in Korea.

Table 8. Average annual salary by type of tutors in Korea

Type of tutors	Average annual salary
Tutors in *hakwon*	18,876
Tutors in self-study material companies	18,980
Individual tutors	
College or graduate students	5,540
Professional tutors	12,020

Unit: 1 USD
Source: Survey of private tutoring providers administered by Ministry of Education, Science and Technology (MEST) in 2008
Note: Won is translated in USD based on that 1,000 Korean won equal approximately 1 USD.

[8] Monthly salary schedule for K-12 teachers in 2011 is listed in Table A in Appendix
[9] Formula = [(sum of all average monthly salaries in Table A in Appendix)*12]/40

3.4 Contents of Private Tutoring

Contents of private tutoring can be divided into two groups. First, there is private tutoring that utilizes contents covered in formal schooling. In Korea, popular subjects for private tutoring are reading, writing, English, mathematics, social studies, science (biology, physics, chemistry, and earth science), foreign languages (besides English), and computer. The participation rate by each subject is shown in Table 9. On average, among students who participate in private tutoring activities, English and mathematics are the most popular subjects for private tutoring. The popularity of the two subjects is largely explained by the importance of these two subjects in the university entrance exam. This dominant share of private tutoring on English and mathematics is consistent in each level of education. Tutoring for reading is also substantial in all levels of education (40.6 percent in elementary school; 34 percent in middle school; and 13.5 percent in high school). However, private tutoring for writing, foreign languages, and computer skills is not substantial compared to other subjects. As mentioned above in terms of intensity, the participation rates for private tutoring decrease as the level of education increases.

Table 9. Private tutoring participation rate by subject (covered in formal schooling) and by education level in Korea in 2010

	Average	Elementary School	Middle School	High School
Reading	31.4	40.6	34.0	13.5
Writing	7.9	13.0	4.7	2.5
English	52.5	60.2	61.9	29.9
Mathematics	53.6	58.1	63.2	36.2
Social Science & Natural Science	20.5	22.4	30.5	7.4
Foreign languages and Computer	10.7	16.7	9.2	1.9

Unit: in percentage
Source: Korea National Statistics Office (2010)

Second, there are private tutoring activities that cover contents not taught in formal schools. This category can be divided into 1) contents related to students' personal interests or leisure and 2) contents related to career preparation. Examples of contents for personal interest and leisure are fine arts, music, dance, and athletics. Examples for career preparation are classes for the Test of English for International Communication (TOEIC) or certificates for skills that employers look for in a recruiting process. Participation rates for these contents are presented in Table 10. On average, music and athletics are the two most popular subjects (18 percent in music and 15.5 percent in athletics). Tutoring fine arts is also noticeable in elementary schools. Students start tutoring for career preparation in their high school years, but its share of tutoring is minimal.

Table 10. Private tutoring participation rate by subject (not covered in formal schooling) and education level in Korea in 2010

	Average	Elementary School	Middle School	High School
Music	18.0	33.9	6.0	3.5
Fine Arts	6.9	12.6	1.8	2.6
Athletics	15.5	28.9	5.8	2.7
Career preparation	0.4	-	-	1.5
Other	3.9	6.4	1.8	1.8

Unit: in percentage
Source: Korea National Statistics Office (2010)

3.5 Expenditure on Private Tutoring

3.5.1 Total Expenditure

It is well known that Korean parents spend a substantial proportion of household income to pay for children's private tutoring. A study by Choi et al. (2003) estimated the trend of households' expenditures on private tutoring. As Table 11 shows, spending on private tutoring has been substantial since 1998 and amounted to 12.4 billion USD in 2003. Choi et al. (2003) reported that it is equivalent to about 56 percent of the national budget on education and about 2 percent of GDP in 2003, which is less than 3.3 percent of GDP in 1998. A recent survey on private tutoring conducted by the KNSO reported that in 2007 total expenditure on private tutoring added up to about 20 billion USD, which is about 1.9 percent of GDP in Korea (Table 12). The average annual and monthly expenditure per student is about 2,664 and 222 USD, respectively. More detailed information about household's private tutoring expenditure by level of education is presented in Table 12.

Table 11. Total household's expenditure on private tutoring

	1998	2001	2003
Current Price	11,132,249,000	9,964,015,000	12,407,731,000
Constant Price	11,427,795,000	10,040,230,000	12,407,731,000
% of National Education Budget	67%	53.2%	55.9%
% of GDP	3.3%	1.9%	1.9%

Unit: 1 USD
Source: Choi et al. (2003)

Table 12. Total, annual, and monthly expenditure on private tutoring and expenditure by school level in 2007

	Total Expenditure on Private Tutoring	Average annual expenditure per student	Average monthly expenditure per student	
			Total	Among participants [a]
Total	20,040,000,000	2,664	222	288
Elementary	10,209,800,000	2,726	227	256
Middle School	5,612,000,000	2,810	234	314
High School	4,218,100,000	2,368	197	359

Unit: 1 USD
Source: Korea National Statistics Office (2008)
[a] : average monthly expenditure per student calculated among the participants of private tutoring
Note: 1,000 Korean won equal approximately 1 U.S. dollar.

Nam (2007) also provided time-series estimates of household expenditure on private tutoring as well as expenditure on formal education from 1985 to 2006 as shown in Table 13. Nam's (2007) estimates on private tutoring are generally higher than estimates presented above from Choi et al. (2003) and the KNSO (2008). For example, in 2003, according to Choi et al. (2003), households paid about 12.4 billion USD (1.9 percent of GDP) on private tutoring, whereas Nam (2007) estimated the figure at 18.3 billion USD (2.5 percent of GDP). In addition, Nam (2007) reported that households spent about 25 billion USD in 2006, which is about 2.7 percent of GDP. It is also surprising to see that expenditures on private tutoring have been higher than expenditures on formal schooling since 1995. Even though these estimates from several studies are slightly different from each other, all show continuously increasing private tutoring expenditures. Recent statistics from the KNSO reported that spending on private tutoring again reached 3 percent of GDP in 2009.

Table 13. Household expenditure in primary and secondary education, 1985-2006

	Tuitions and fees for formal schools	School Supplies	Textbooks	Private Tutoring
1985	1.4 (1.72)	0.1 (0.16)	0.3 (0.31)	0.5 (0.54)
1990	2.8 (1.51)	0.3 (0.14)	0.8 (0.41)	2.7 (1.45)
1995	6.1 (1.54)	0.4 (0.11)	1.9 (0.48)	7.6 (1.91)
2000	10.2 (1.76)	0.6 (0.10)	3.2 (0.56)	10.9 (1.89)
2001	11.3 (1.81)	0.5 (0.09)	3.6 (0.58)	12.3 (1.97)
2002	11.3 (1.65)	0.6 (0.08)	3.8 (0.56)	13.4 (1.96)
2003	11.0 (1.52)	0.6 (0.07)	2.3 (0.31)	18.3 (2.53)
2004	12.1 (1.55)	0.6 (0.07)	1.3 (0.17)	21.7 (2.61)
2005	12.2 (1.50)	0.5 (0.07)	1.3 (0.15)	23.7 (2.77)
2006	13.3 (1.56)	0.5 (0.06)	1.3 (0.16)	25.0 (2.79)

Unit: 1 billion USD; numbers in parentheses are percentages of GDP.
Source: Nam (2007)
Note: Expenditure on textbooks for private tutoring has been reclassified from the "Textbooks" column to "Private Tutoring" column beginning in 2003.

3.5.2 Expenditure by Region

According to a survey by the KNSO (2010), the average monthly payment for private tutoring per student is about 240 USD in 2010 as Table 14 shows. However, the average monthly private tutoring expenditure per student in Seoul is about 321 USD, which is the highest among all metropolitan and smaller cities. An average expenditure in Seoul is more than twice the spending in small towns in Korea. Table 14 demonstrates monthly expenditure on private tutoring per student by size of region.

Table 14. Monthly expenditure on private tutoring per student by size of region

	Total	Seoul	Metropolitan Cities	Small and Medium-sized Cities	Eup/ Myun [a]
Private Tutoring Expenditure	240	321	227	244	160
Participation Rate (%)	73.6	77.5	74.1	74.7	65.4

Unit: 1 USD
Source: Korea National Statistics Office (2010)
[a]: Eup and Myun are administrative units similar to towns

3.5.3 Monthly Expenditure by Income Group

According to the KNSO (2010), on average, monthly spending on private tutoring per household is about 240,000 won, which is about 6.5 percent of their monthly income[10]. When looking at the monthly expenditure by income group as shown in Table 15, the higher the family's income, the more they spend on private tutoring (Lee, 2005). For example, households in the lowest income group spend about 63 USD per month, whereas households in the highest income group spend about 484 USD a month on their children's private tutoring. In other words, wealthy families spend about eight times more than poor families. In addition, poor families spend about 12.6 percent of their monthly income on children's private tutoring, whereas wealthier families spend about 6 percent of their income, which indicates a heavier burden for lower income families (Choi et al., 2003; Lee, 2005).

Table 15. Monthly private tutoring expenditure per household by income group

Income Group	Monthly Private Tutoring Expenditure	Percentage of monthly income
Less than 1,000 USD	63	12.6
1,000 - 2,000 USD	103	6.8
2,000 - 3,000 USD	170	6.8
3,000 - 4,000 USD	240	6.8
4,000 - 5,000 USD	298	6.6
5,000 - 6,000 USD	362	6.5
6,000 - 7,000 USD	404	6.2
More than 7,000 USD	484	6.4

Unit: 1 USD
Source: Korea National Statistics Office (2010)

[10] Average monthly household's income in 2010 is about 3,666 USD (KNSO, 2010).

As previously described, private tutoring is prevalent in Korea, which has been an important social issue. The high demand for private tutoring has been steady for decades with strong parental beliefs on the effectiveness of private tutoring. In the next chapter, I will explain how I constructed the estimation models in order to quantify the parental beliefs on how much private tutoring affects students' academic achievement. Moreover, I will describe the dataset and variables, which will be used in the empirical analyses.

CHAPTER IV: THE IMPACT ON STUDENTS' ACADEMIC ACHIEVEMENT

Students and parents decide to participate in private tutoring for various reasons as reviewed in Chapter III. However, the overarching goal is to further improve academic performance through private tutoring, and this goal has not changed. In order to qualitatively and quantitatively prove whether this goal is achievable through private tutoring and to what extent private tutoring affects academic performance, many scholars have done research using a number of statistical methods that were introduced in the literature review. Due to methodological challenges to control for the selectivity of students who participate in private tutoring, however, there are only a few studies that successfully observed a causal link between private tutoring and students' academic achievement, especially in the Korean context. As previously explained, students who participate in private tutoring tend to be different in many unobservable ways from their peers who do not participate; students who take tutoring tend to have higher academic motivation, a more supportive home environment to promote their study, or parents who have higher academic aspiration for their children. This selectivity of students would create problems in estimation since these characteristics are often unobserved, which make impossible to control for. Since these unobserved characteristics affect academic achievement of students who participate in private tutoring, the estimates of private tutoring effects tend to be biased. In order to correct for this selectivity of students in the treatment group, this study employs the instrumental variable method and the propensity score matching to explore the casual impact of private tutoring for secondary school students' academic achievement in Korea. Under this main research question, I addressed cumulative and single-year effects of private tutoring to estimate the effect of years of private tutoring and the most

effective time or grade to start private tutoring. In addition, short-term and long-term effects of private tutoring are observed using different types of variables that indicate academic achievement.

Before conducting analyses using the instrumental variable method, I also used the Heckman model (Heckman, 1978; 1979; Greene, 2003) to correct for the problem of selection bias. Using similar specification functions to those employed in Briggs's study (2004) on observing the effect of commercial coaching programs on the SAT, I compared the estimates obtained from the OLS and Heckman models. In the selection function, I included several variables that are not used in the response function, such as the educational goal of students and parents, parental support in education, students' academic standing, and parental pressure. In addition, I also included several covariates that were statistically significant in private tutoring cross-tabulations, such as socio-economic status, gender, students' intrinsic motivation, and regional characteristics, into the selection function. The reason why I chose the similar variables that were used in Briggs's study (2004) is to check whether I obtain similar results as Briggs did. With different combinations of these variables in the selection function, I tried to estimate the effect of tutoring. However, after many trials, I concluded that two approaches produced relatively similar estimates of the effects of private tutoring as opposed to Briggs's results, which found the different estimates with different specification functions. Therefore, I decided not to report estimation results of the Heckman model in this study because the Heckman model does not improve the precision of the estimates of private tutoring effects.

Having this goal of uncovering a causal link between private tutoring and academic achievement in mind, first, I will describe the data that I utilized for this analysis followed by estimation models, variables, empirical results, and discussion.

4.1 Data Description

The dataset used in this dissertation is the Korean Educational Longitudinal Survey (KELS) administered by the Korean Educational Research Institute (hereafter KEDI). The KEDI is the nation's most prestigious research institute in education, which devotes itself to developing quality research and innovative solutions for policy-makers and stakeholders in education. Starting in 2005, 6,908 students in grade 7 (the first year in middle school in Korea) were selected using stratified and cluster random sampling; schools were randomly selected within strata[11] of cities, and students were randomly selected within schools. In terms of the Korean school configuration, middle school education starts in grade 7 and finishes in grade 9, and high school education is from grades 10 to 12. This nationally representative sample of students has been followed and surveyed each year since 2005. This dissertation used all students in the KELS data without restricting analyses to a sub-sample of the data.

Students in the data were asked questions about a wide range of topics including experiences in school and home, educational resources and support, and expectations on their future life. Moreover, the survey has also been administered to parents, teachers, and principals[12] of students in order to collect a wider range of information about students' families, classrooms, and schools.

One of the biggest advantages of this dataset is that it contains the most sophisticated information about private tutoring relative to other existing datasets in Korea, such as type of private tutoring that a student participates in, the subject of private tutoring, duration of participation, hours spent per week, and monthly expenditure devoted to private tutoring by type

[11] There are four stratums categorized by the size of cities.
[12] Surveys for principals were administered for the first three years only. From the 4th wave, KEDI directly collected information about schools that respondents attended.

and subject, as reported by parents. Students were also asked whether they are satisfied with private tutoring if they are participating.

There are also various measures of students' academic achievement. The KEDI administered achievement tests to all students in the data in verbal, English, and mathematics for the first three years of data collection in 2005, 2006 and 2007, and results of these tests—Item Response Theory (IRT) scores—are available for these three years. In addition, results of the university entrance examination in the form of decile rank are available in the sixth wave of the dataset. This university entrance examination is the College Scholastic Aptitude Test (hereafter CSAT), which is a standardized test for all students during their senior year in high school. The CSAT is administered by the Korea Institute for Curriculum and Evaluation (KICE), which is a government-funded educational research institute. These test results allowed me to investigate the short- and long-term effects of private tutoring that are received in middle school years. Moreover, there is information about how much students understand in each subject—reported by both students and teachers—and the degree of students' attention to lessons in classrooms for each subject measured by minutes. These measures can be used as alternatives of students' academic performance.

As mentioned earlier, the KELS is longitudinal data, which has considerable advantages over cross-sectional data. Whereas cross-sectional data observe a different group of people in each year, longitudinal studies follow the same people over time. Therefore, in the longitudinal data, researchers are free from considering different characteristics by different cohorts, which makes estimates more precise. Also, this type of data enables researchers to collect information about individual change. Another advantage is that the KELS has low sample attrition. Sample attrition is a big challenge for many analysts because it may make the interpretation of estimates

problematic. It is more problematic when attrition is high and selective on characteristics (non-random), which is often the case in practice. However, in the case of the KELS, there is no sample attrition in the first three waves of data, and about 91 percent, 83 percent, and 77 percent of the total sample remained in the fourth, fifth, and sixth wave, respectively. Therefore, it is less likely that sample attrition causes problems in the estimation using the KELS.

4.2 Estimation Models

4.2.1 Ordinary Least Square

As mentioned in Chapter II, this analysis employs the educational production function in order to estimate the effect of private tutoring on students' academic achievement. Among the various estimation methods, OLS with rich controls is applied. The OLS method assumes that there is a linear relationship between inputs and outputs. The equations of the OLS estimation are as follows.

Cumulative Effect:

(4.1) $$Y_{ih(a)} = \alpha_0 + \alpha_1 * TOTALPT_{ih(a)} + \alpha_2 * X_{ih} + \varepsilon_{ih}$$

Equation 4.1 is derived to explain the cumulative effect of taking private tutoring. This equation represents two different model specifications. The first model uses $Y_{ih(a)}$, which is an achievement score of student *i* in education level *h* (middle or high school) in a subject *a*; the second model observes Y_{ih}, which is an average achievement score (using scores in three subjects) of student *i* in education level *h*. $TOTALPT_{ih(a)}$, a variable of interest, indicates years of private tutoring that student *i* has participated in education level *h* in subject *a* or any subjects.

$TOTALPT_{ih(a)}$ indicates a set of dichotomous variables that indicate one, two, or three years of private tutoring. In equation 4.1, α_1 is the main coefficient of interest that is interpreted as the effect of total years of private tutoring on academic achievement. X_{ih} is a vector of control variables that consist of student background characteristics (e.g. gender, household's income, parental education, academic motivation, level of a student's self-esteem, and previous academic achievement, etc.), characteristics of a school that a student attends (e.g. public vs. private, general vs. technical, and student-teacher ratio), and regional characteristics (e.g. urban vs. rural, and region with a school choice scheme), and ε_{ih} is an error term that captures unmeasured variables.

Single-year Effect:

(4.2) $$Y_{ij(a)} = \beta_0 + \beta_1 * PT_{ij(a)} + \beta_2 * X_{ij} + \eta_{ij}$$

Unlike equation 4.1, equation 4.2 is designed to observe the single-year effect of private tutoring. The analysis of single-year effects uncovers the effect of taking private tutoring in each grade in suggesting implications about when taking private tutoring is most effective to raise academic achievement. Equation 4.2 follows a similar pattern with equation 4.1, but *j* represents school grade of student *i*. However, instead of using a cumulative variable of private tutoring, $PT_{ij(a)}$ is a dichotomous variable of private tutoring taking the value 1 if a student *i* participates in any form of private tutoring in subject *a* or any subjects in grade *j*, 0 otherwise. The single-year effect of private tutoring is captured in β_1, which is the main coefficient of interest. In order to isolate the effect of the single-year, I also controlled for participation in private tutoring in previous years. Again, X is a vector of control variables that is identical in equation 4.1, and η_{ij}

is an error term. Detailed descriptions of all explanatory variables are provided in the later part of this chapter.

4.2.3 Instrumental Variables

Relying on results from the OLS estimations may be risky due to the selectivity of students who participate in private tutoring, as previously mentioned in Section 1.4. Students who participate in private tutoring may be different from those who do not participate in many observable and unobservable ways. Even though the OLS estimation uses a set of controls to account for these observable differences, it is still impossible to control for unobserved differences between these two groups, which may distort the estimate of the private tutoring effect. In order to address this selectivity problem and unobserved variable bias, the literature suggests the use of the instrumental variable approach.

Instrumental variable estimation should enable the assumptions of exogenous variation in the treatment (Murnane & Willett, 2010). After scrutiny, this analysis uses a student's monthly cost of private tutoring as a proportion of monthly household income as an instrument of private tutoring. The validity of this instrument is tested in several ways as explained in Section 4.5. Using this instrumental variable, the first stage in the two-stage least square (2SLS) is given by:

Cumulative Effect (first stage):

(4.3) $$TOTALPT_{ih(a)} = \gamma_0 + \gamma_1 * Z_{ih(a)} + \gamma_2 * X_{ih} + \theta_{ih}$$

Single-year Effect (first stage):

(4.4) $$PT_{ij(a)} = \delta_0 + \delta_1 * Z_{ij(a)} + \delta_2 * X_{ij} + \vartheta_{ij}$$

where $TOTALPT_{ih(a)}$ is a dichotomous variable that indicates total years of private tutoring, and $PT_{ij(a)}$ is also a dichotomous variable that represents the private tutoring participation. In equation 4.3, $Z_{ih(a)}$ is an instrumental variable, which is a proportion of student i's costs of private tutoring on subject a or overall in monthly household income during education level h. Similarly, $Z_{ij(a)}$ in equation 4.4 is a proportion of student i's costs of private tutoring on subject a or overall in grade j. θ_{ih} and ϑ_{ij} are random error terms associated with the reduced form equation. From equations 4.3 and 4.4, the predicted values of two variables of private tutoring are calculated.

Instead of using actual dichotomous variables of private tutoring, the predicted values are used in the second stage as follows.

Cumulative Effect (second stage):

(4.5) $$Y_{ih(a)} = \lambda_0 + \lambda_1 * \widehat{TOTALPT}_{ih(a)} + \lambda_2 * X_{ih} + \rho_{ih}$$

Single-year Effect (second stage):

(4.6) $$Y_{ij(a)} = \mu_0 + \mu_1 * \widehat{PT}_{ij(a)} + \mu_2 * X_{ij} + \varrho_{ij}$$

where ^ represent predicted values, and λ_1 and μ_1 are the main coefficients of interest that imply the cumulative effect and single-year effect of private tutoring after accounting for endogeneity bias.

4.2.4 Propensity Score Matching

This study also used Propensity Score Matching (PSM) method to check whether the results are consistent with the PSM estimates. PSM is also one of the quasi-experimental methods, which is used with observational data in order to detect a causal mechanism. In PSM,

rather than controlling for all the covariates, students in a treatment group (i.e., students who participate in private tutoring) are matched with students in a control group (i.e., students who do not participate in private tutoring) using the propensity score, e(X), which is a numerical summary of $X_{i,k}$. We can estimate e(X) using logistic or probit regression where the dependent variable is the treatment (a dichotomous variable that indicates participation in private tutoring) and the predictors are all confounding covariates as follows. In the process of matching, simple one-to-one nearest neighbor matching with replacement is used among various types of matching (Dehejia &Wahba, 2002). In this method, each treatment unit can be matched to the nearest comparison unit, even if a comparison unit is matched more than once. Researchers claim that this method helps in reducing the bias because it minimizes the propensity score distance between the treatment unit and the matched comparison unit. Using this method of matching, I constructed a counterfactual to measure the outcome, i.e., academic achievement, which students would have obtained, had they not participated in private tutoring.

(4.7) $e(X) = Pr(PT_i=1|X_{i,k})$

This propensity score, e(X), is a predicted probability for each person that he or she receives the treatment. Using these two groups that are similar in various ways except for the treatment, the mean of dependent variable (i.e., students' academic achievement) for a treatment group is compared to the one for a control group to observe the treatment effect. This effect is called the average treatment effect on the treated (ATT). The mathematical representation of difference-in-means in PSM is as follows.

(4.8) $\tau = E[Y(1)|Z=1,e(X)] - E[Y(0)|Z=0,e(X)] = \overline{Y}_{Z=1,e(X)} - \overline{Y}_{Z=0,e(X)}$

where τ is the treatment effect. In addition to this method of difference-in-means, I also conducted regression-adjusted matched estimation, which is running a regression of outcome on treatment indicator and confounding covariates using weights to construct the sample to represent matched groups. The regression-adjusted matched estimation also provides a sensitivity check for estimates obtained from difference-in-means.

Two estimation methods derive τ, which is the average treatment effect on the treated (ATT). This average treatment effect on the treated represents the effect of private tutoring among students who participate in private tutoring by comparing with a counterfactual that I constructed by matching.

It should be noted that correctly calculating standard errors in PSM is a problem for several reasons. After matching, the observations are no longer independent of each other even with regular matching. In other words, if there are correlations between matched pairs, standard errors are subject to be biased. In addition, matching with replacement creates the additional complication of including some units multiple times. In order to correct for standard errors, standard errors are calculated by bootstrapping with 1,000 replications.

However, PSM also bears methodological drawbacks that should be stated explicitly. Several researchers have criticized that this method still has potential problems that are caused by unobserved variables because only observed characteristics of the sample are used in the process of matching (Michalopoulos, Bloom & Hill, 2004). In addition, the method is sensitive to choices of confounding covariates to calculate propensity score, e(X). Even though this

method carries these methodological disadvantages, it can help reduce large biases compared to OLS.

4.3 Variables

Treatment variables. The purpose of this analysis is to estimate the effect of private tutoring on students' academic achievement. As I already mentioned in the section of estimation models, I used two types of private tutoring variables: dichotomous variables that indicate 1) total years of private tutoring and 2) private tutoring participation in general. The purpose of using variables that indicate years of private tutoring is to observe if there is any cumulative effect of taking private tutoring. I constructed several dichotomous variables, which indicate years of tutoring using education level (I separated middle school and high school in terms of years of participation in private tutoring) and subject area (verbal, English, math, or all three subjects). For example, the variable, one year of private tutoring in middle school (PT1yr_ms) takes the value of 1 if a student takes one year of private tutoring in middle school and 0 if a student does not take tutoring in middle school. The variable, two years of private tutoring in middle school (PT2yr_ms), takes the value 1 if a student takes two years of private tutoring in middle school and 0 if a student does not take any tutoring in middle school. As mentioned earlier, this set of dichotomous variables are subdivided by education level (middle school and high school) and academic subject (verbal, English, and math). Also, there is the other set of dichotomous variables taking the value 1 if a student participates in any form of private tutoring, 0 otherwise. Several of these dichotomous variables are also constructed using the grade level of participation and subject area of private tutoring. The use of these variables aims to observe the single-year effect to detect when taking private tutoring is most effective for increasing students'

academic achievement in middle school and high school, separately. All treatment variables used are presented in Table B.1 in Appendix.

Dependent Variables. Two types of dependent variables are used in order to estimate the effect of private tutoring on students' academic achievement: students' scores on the KEDI test and the CSAT. As previously described in the section of data description, the KEDI test was annually administered by the KEDI to all students in the KELS data during middle school. With the KEDI test, an average score of three subjects, verbal (Korean language), English, and mathematics, and a score of each subject is used to observe the private tutoring effects on overall achievement and achievement by subject. The KEDI tests were administered only during middle school years (grades 7, 8, and 9) and the KEDI stopped administering the test from the fourth year of survey. Therefore, the KEDI scores are used to assess the private tutoring effect on academic achievement in middle school. Since the KEDI scores are available in raw format, I transformed them into z-scores. Regarding the CSAT scores, an average score and a score in verbal, English, and math are used for the purpose of looking at the effect of private tutoring on achievement on the university entrance exam, which is one of the major purposes of taking private tutoring in Korea. However, since the CSAT results are available in the unit of decile rank, estimating the effect of private tutoring on the university entrance exam is less precise than the estimation using percentiles or actual scores. Thus, the decile rank of the CSAT, the only variable that indicates students' high school academic achievement in the KELS data, does not capture small differences in the CSAT scores, which determine admission into the most competitive institutions. The decile measures are also imprecise when translating the effects at the tails of the distribution where the distribution is skewed. Moreover, this decile measure will be more problematic when estimating the tutoring effects for students in the highest decile due to

ceiling effects. Since students in the highest decile cannot move into a higher decile, but can only stay in the highest or fall to a lower one, this decile measure will understate the effects for this particular group of students. All the dependent variables used in the analysis are presented in Table B.2 in Appendix.

Control Variables. To control for observed differences between treatment and control groups, I chose various explanatory variables in a vector X as shown in all the equations. Based on the existing literature on the determinants and the effects of private tutoring, which were summarized in Chapter II, I chose variables that were analyzed as important predictors of private tutoring. The first set of controls includes students' background characteristics. I included a student's gender taking the value 1 if a student is female, 0 male (GENDER) and a student's socio-economic status (SES). I constructed a scale for a student's socio-economic status by using monthly household income and parental educations levels. First, I standardized the three variables, monthly household income, father's education, and mother's education, and averaged the three standardized variables to create the SES scale variable. I also included a student's hours of self-study per week taking the value 1 if a student spends more than 10 hours per week for his or her self-study without assistance, 0 otherwise (SELF-STUDY). Self-study would include homework, reviewing, or previewing academic contents. The reason why I included this variable as a control is that the variable can be a proxy for students' academic motivation, which is unobserved. Students who have higher academic motivation would spend more time on self-study than their peers with lower academic motivation. In addition, the level of a student's self-esteem (SELF-ESTEEM) is also used as one of the student's background characteristics. Similar to the SES variable, I constructed a scale that indicates the level of a student's self-esteem using 15 variables that measure a student's self-esteem. Among survey questions, there are 15

questions that were designed by the KEDI to measure students' self-esteem. All students in the KELS dataset were asked in terms of their self-esteem, and examples of actual questions are listed in Figure 2. Lastly, average academic score achieved one year prior to the treatment (PRESCORE) is included to control for students' academic ability since the influence of private tutoring on high achievers would be different from the one on low achievers.

Figure 2. Examples of survey questions to measure students' level of self-esteem

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I am confident that I can understand advanced concepts in a math textbook.	○	○	○	○
2. I am confident that I can solve complicated problems that a math teacher provides.	○	○	○	○
3. I am confident that I can complete math homework.	○	○	○	○
4. I am confident that I can do well on a math test.	○	○	○	○
5. I am confident in applying math concepts that I learned in a math class.	○	○	○	○

There are several variables that indicate school characteristics in the vector X to control for different school characteristics that could influence students' academic performance. First, I included the type of school that a student attends taking the value 1 if a school is private, 0 public (SCH_TYPE). Research showed that the private school effect on a students' academic achievement is different from the public school effect; therefore, different characteristics between private and public schools need to be controlled. I also included high school track (SCH_TRACK), taking the value 1 if a high school follows a general track, 0 if a high school

follows a technical track. General track indicates college preparatory high schools, and technical track is used by vocational schools for students who plan to work after graduation from high school. Students in a high school that follows a general track are more likely to participate in private tutoring than their peers in a technical high school; therefore, high school track is an important predictor of the treatment. Student-teacher ratio (ST_RATIO) is controlled as a proxy for education quality. The existing literature showed that education quality is one of the important determinants of private tutoring. Students in schools with lower student-teacher ratio would have more interaction with their teachers, which allows students to fulfill their educational needs in schools since they have a low demand for private tutoring compared to students in schools with higher student-teacher ratio. The student-teacher ratio is calculated by dividing the total number of students by the number of teachers excluding administrators in a school. The last set of controls contains regional characteristics. Urban residence (URBAN), which takes the value 1 if a student lives in urban area, 0 otherwise, is chosen because students who live in an urban area have better access to private tutoring than students in a rural area. I included a variable indicating the district with a school choice scheme (SCH_CHOICE), which takes the value 1 if a student lives in a district with a school choice scheme, 0 otherwise. The existing literature argued that living in a district with a school choice scheme is one of the macro determinants of participating in private tutoring. I tried to include characteristics of students, schools, and regions as controls, which were analyzed as important determinants of private tutoring in the exiting literature summarized in Chapter II. These control variables are also listed in Table B.3 in Appendix.

4.4 Descriptive Statistics of the Sample

For the control variables used in estimations, Table 16 shows descriptive statistics for grade 7 and grade 10 by participation in private tutoring. I chose variables measured in grade 7 and grade 10 for control variables because these two grades are the beginning grades of middle school and high school, respectively. As already explained, the Korean school configuration is different from the school configuration in the U.S.; middle school education starts in grade 7 and finishes in grade 9, and high school education is from grades 10 to 12. Another reason is that since I divided the analyses by education level (middle school and high school), I used variables measured in grade 7 and grade 10 as control variables in the analysis of middle school and high school, respectively. This dissertation used all students in the KELS data without restricting the analysis to a certain sub-sample. The data is comprised of 48 percent females and 52 percent males. Female students are less likely to take private tutoring than male students; on average, 46 percent of female students report that they have participated in private tutoring in any subject and type, while 52 percent of female students among students have not participated in private tutoring. As previous research has shown, students with higher socio-economic status, academic motivation (hours of self-study), self-esteem, and previous academic achievement are more highly represented in private tutoring. Interestingly, among students who take private tutoring, 15 percent of students in grade 7 and 40 percent of students in grade 10 report that they study by themselves more than 10 hours per week, but only 7 percent of 7th graders and 12 percent of 10th graders report to do so among students who do not take private tutoring. Students who participate in private tutoring show higher self-esteem than those who do not. The average z-scores of self-esteem for students who participate in private tutoring are 0.08 in grade 7 and 0.11 in grade 10, but the average scores for students who do not participate in private tutoring are -0.19 and -0.24 in grades 7 and 10, respectively. Students who participate in tutoring show

higher academic achievement than students who do not participate. Pre-score used in grade 7 is the academic ranking from 1 to 9 reported by teachers, and there are 0.92 differences in ranking between two groups. In grade 10, the academic achievement measured in grade 9, which is a raw score, is used as a pre-score for students in grade 10. Like in grade 7, the average academic achievement for students who take tutoring is 16.41 points higher than the average achievement for students who do not take tutoring.

In terms of school characteristics, students assisted by private tutoring are more likely to attend private schools, come from a school that has a higher student-teacher ratio, and attend a school that follows a general track. Specifically, there is no statistically significant difference in school type in grade 7, but in grade 10, tutored students are more likely to attend private schools than non-tutored students; 49 percent of tutored students report that they attend private schools, while 44 percent of non-tutored students report as such. On average, schools of tutored students have about two students more per teacher compared to schools of students who do not take tutoring. In terms of school track, 85 percent of tutored students come from schools that follow a general track, whereas 49 percent of non-tutored students come from a general track.

Lastly, regarding regional characteristics, students who receive private tutoring are more likely to live in urban areas than those who do not receive tutoring. About half of students in the tutored group report that they live in an urban area, whereas only about 35 percent of students report as such. Students in the tutored group are less likely to live in a district with a school choice scheme than students in the control group; only 35 percent of students with private tutoring can choose their schools, but 49 percent of students without tutoring can select their schools.

Table 16. Descriptive statistics of control variables

Variables	Average	Private Tutoring		Difference	t-value[3]
		yes[1]	no[2]		
Gender (1=female)	0.48	0.46	0.52	-0.06	-3.78
Socio-economic status (z-score)					
Grade 7	-0.02	0.12	-0.40	0.52	21.05
Grade 10	-0.01	0.11	-0.35	0.46	22.07
Hours of self-study (1= >10hrs)					
Grade 7	0.13	0.15	0.07	0.08	7.72
Grade 10	0.31	0.40	0.12	0.28	23.13
Self-esteem (z-score)					
Grade 7	-0.00	0.08	-0.19	0.27	14.31
Grade 10	0.00	0.11	-0.24	0.35	20.20
Pre-score					
Grade 7	5.96	6.24	5.32	0.92	16.16
Grade 10	54.03	59.49	43.08	16.41	27.27
School Type (1=private)					
Grade 7	0.20	0.20	0.18	0.02	1.56
Grade 10	0.47	0.49	0.44	0.05	3.36
Student/Teacher Ratio					
Grade 7	20.30	20.74	19.16	1.58	11.44
Grade 10	15.88	16.40	14.75	1.65	21.43
School Track (1=general)					
Grade 10	0.74	0.85	0.49	0.36	32.38
Urbanicity					
Grade 7	0.46	0.49	0.36	0.13	8.53
Grade 10	0.45	0.49	0.37	0.12	9.35
School Choice (1=choice)					
Grade 7	0.40	0.35	0.49	-0.14	-9.49
Grade 10	0.39	0.35	0.49	-0.14	-11.00

[1] N=4,884 (Grade 7); 4,228 (Grade 10)
[2] N=1,341 (Grade 7); 1,909 (Grade 10)
[3] t-value for [diff= mean(1) - mean(0)]

Table 17 shows summary statistics of the dependent variables based on tutoring status. In all grades in middle school, on average, test scores of students who receive private tutoring in

all subjects are higher than the average scores of the sample as well as scores of students who do not receive tutoring. The same pattern is shown in the CSAT results.

Table 18 presents summary statistics of variables related to private tutoring. Regarding participation in private tutoring, more than 70 percent of students report that they receive private tutoring in middle school, and participation rate decreases after students enter high school. On average, students take 2.32 years of private tutoring in middle school and 1.67 years of tutoring in high school. About 87 percent of students report that they receive three years of private tutoring during middle school, and about 60 percent of students receive three years of tutoring during high school years. A more detailed description on the participation in private tutoring by subject is provided in Table 18. On average, there are higher participation rates in English and math tutoring compared to verbal tutoring. The participation rate decreases as students move to upper grade levels.

The average monthly cost of private tutoring varies by grade. The average monthly cost of private tutoring is the highest in grade 9 (last year of middle school) followed by grade 10. About 250 USD and 240 USD per month are spent for a child's private tutoring in grades 9 and 10, respectively, whereas about 130 USD per month is allocated to private tutoring in grade 7. Among the average monthly cost of private tutoring, parents spend more money on English and math tutoring than verbal tutoring. In addition, parents place similar importance on English and math tutoring when their child is in middle school; the monthly cost of English and math tutoring is similar during middle school years. However, parents invest more on math tutoring when their child is in high school. In terms of the proportion of a household monthly income, four to eight percent of monthly household income is spent solely on private tutoring for one child.

In order to see the different amounts of private tutoring per grade and per subject, Table 18 also presents the weekly hours spent on private tutoring by grade and subject. I provided the weekly hours of private tutoring during middle school years only because variables that show this information during high school years have a large number of missing observations. On average, students spent about 5.72, 6.87, and 8.11 hours per week for private tutoring lessons in grades 7, 8, and 9, respectively. Among these hours, about 40 percent is spent on English and math tutoring each, and about 20 percent is spent on verbal tutoring.

This dataset does not have information about the quality of private tutoring, which is also an important aspect of private tutoring. By dividing the monthly cost of private tutoring by monthly hours of private tutoring, I constructed a quality measure for private tutoring by grade and subject. According to the quality measure, which is the hourly cost of private tutoring, on average, the quality of private tutoring in grade 9 is the highest compared to the quality of private tutoring in grades 7 and 8; the hourly cost of private tutoring in grades 7, 8, and 9 is about 7 USD, 8 USD, and 10 USD, respectively. This pattern is also shown in private tutoring in each subject. Among the three subjects, the hourly cost of English tutoring is the highest, followed by math and verbal tutoring.

These explorations of variables provide an overview of the data that I dealt with and an opportunity to understand the data. Also, this description gives a detailed picture on the pattern of private tutoring in Korea. Having this in mind, I proceed further to an in-depth analysis.

Table 17. Descriptive statistics of dependent variables

Variables	Description	Average	Private Tutoring		Difference	t-value[3]
			yes[1]	no[2]		
Dependent Variables						
Grade 7						
G7VEM_S	KEDI test; average score of Verbal, English and Math in grade 7	59.99	63.77	50.97	12.80	22.70
G7VER_S	KEDI test; Verbal score in grade 7	65.49	67.96	60.47	7.49	13.52
G7ENG_S	KEDI test; English score in grade 7	56.18	60.62	45.42	15.20	22.70
G7MAT_S	KEDI test; Math score in grade 7	58.06	62.65	46.80	15.85	22.51
Grade 8						
G8VEM_S	KEDI test; average score of Verbal, English and Math in grade 8	55.33	58.86	44.57	14.29	24.24
G8VER_S	KEDI test; Verbal score in grade 8	59.49	61.79	52.88	8.91	15.56
G8ENG_S	KEDI test; English score in grade 8	55.59	59.84	42.71	17.13	23.72
G8MAT_S	KEDI test; Math score in grade 8	50.88	54.90	38.21	16.69	23.02
Grade 9						
G9VEM_S	KEDI test; average score of Verbal, English and Math in grade 9	54.03	57.66	41.87	15.79	23.24
G9VER_S	KEDI test; Verbal score in grade 9	56.96	59.07	49.58	9.49	13.89
G9ENG_S	KEDI test; English score in grade 9	53.98	58.19	39.46	18.73	22.32
G9MAT_S	KEDI test; Math score in grade 9	51.13	55.78	36.50	19.28	24.12
Grade 12						
CSAT_avg	CSAT; average decile rank of Verbal, English, and Math in grade 12	5.59	6.08	5.23	0.85	16.94
CSAT_V	CSAT; decile rank of Verbal achievement in grade 12	5.81	6.11	5.60	0.51	9.19
CSAT_E	CSAT; decile rank of English achievement in grade 12	5.55	6.11	5.15	0.96	16.87
CSAT_M	CSAT; decile rank of Math achievement in grade 12	5.40	6.00	4.98	1.02	16.73

Table 18. Descriptive statistics of variables related to private tutoring

Variable	Description of Variable	Obs.	Mean	Std. Dev.	Min	Max
Participation in Overall PT						
PT_G7	Participation in PT in grade 7 (1=yes; 0=no)	6225	0.78	0.41	0	1
PT_G8	Participation in PT in grade 8 (1=yes; 0=no)	6285	0.78	0.41	0	1
PT_G9	Participation in PT in grade 9 (1=yes; 0=no)	4984	0.73	0.44	0	1
PT_G10	Participation in PT in grade 10 (1=yes; 0=no)	6208	0.68	0.46	0	1
PT_G11	Participation in PT in grade 11 (1=yes; 0=no)	5664	0.59	0.49	0	1
PT_G12	Participation in PT in grade 12 (1=yes; 0=no)	5384	0.35	0.47	0	1
TOTALPT_MS	Total years of PT in middle school	4211	2.32	0.99	0	3
TOTALPT_HS	Total years of PT in high school	4814	1.67	1.11	0	3
PT1yr_ms	1=1 year of private tutoring in middle school; 0= 0 year	834	0.53	0.49	0	1
PT2yr_ms	1=2 years of private tutoring in middle school; 0= 0 year	1158	0.66	0.47	0	1
PT3yr_ms	1=3 years of private tutoring in middle school; 0= 0 year	3001	0.87	0.34	0	1
PT1yr_hs	1=1 year of private tutoring in high school; 0= 0 year	2077	0.52	0.49	0	1
PT2yr_hs	1=2 years of private tutoring in high school; 0= 0 year	2267	0.56	0.49	0	1
PT3yr_hs	1=3 years of private tutoring in high school; 0= 0 year	2444	0.60	0.49	0	1
Participation in Verbal PT						
VERPT_G7	Participation in verbal PT in grade 7 (1=yes; 0=no)	6240	0.55	0.50	0	1
VERPT_G8	Participation in verbal PT in grade 8 (1=yes; 0=no)	6270	0.52	0.50	0	1
VERPT_G9	Participation in verbal PT in grade 9 (1=yes; 0=no)	5203	0.56	0.50	0	1
VERPT_G10	Participation in verbal PT in grade 10 (1=yes; 0=no)	6217	0.43	0.49	0	1
VERPT_G11	Participation in verbal PT in grade 11 (1=yes; 0=no)	5670	0.25	0.43	0	1
VERPT_G12	Participation in verbal PT in grade 12 (1=yes; 0=no)	5384	0.11	0.31	0	1
TOTALVERPT_MS	Total years of verbal PT in middle school	4405	1.67	1.14	0	3
TOTALVERPT_HS	Total years of verbal PT in high school	4825	0.79	0.88	0	3
VERPT1yr_ms	1=1 year of verbal PT in middle school; 0= 0 year	1909	0.49	0.50	0	1
VERPT2yr_ms	1=2 years of verbal PT in middle school; 0= 0 year	2050	0.53	0.50	0	1
VERPT3yr_ms	1=3 years of verbal PT in middle school; 0= 0 year	2384	0.59	0.49	0	1
VERPT1yr_hs	1=1 year of verbal PT in high school; 0= 0 year	3854	0.43	0.49	0	1
VERPT2yr_hs	1=2 years of verbal PT in high school; 0= 0 year	2927	0.25	0.43	0	1
VERPT3yr_hs	1=3 years of verbal PT in high school; 0= 0 year	2450	0.10	0.30	0	1
Participation in English PT						
ENGPT_G7	Participation in English PT in grade 7 (1=yes; 0=no)	6242	0.73	0.44	0	1
ENGPT_G8	Participation in English PT in grade 8 (1=yes; 0=no)	6281	0.72	0.45	0	1
ENGPT_G9	Participation in English PT in grade 9 (1=yes; 0=no)	5744	0.73	0.44	0	1
ENGPT_G10	Participation in English PT in grade 10 (1=yes; 0=no)	6218	0.58	0.49	0	1

Variable	Description of Variable	Obs.	Mean	Std. Dev.	Min	Max
ENGPT_G11	Participation in English PT in grade 11 (1=yes; 0=no)	5683	0.46	0.50	0	1
ENGPT_G12	Participation in English PT in grade 12 (1=yes; 0=no)	5385	0.22	0.42	0	1
TOTALENGPT_MS	Total years of English PT in middle school	4893	2.25	1.03	0	3
TOTALENGPT_HS	Total years of English PT in high school	4837	1.29	1.05	0	3
ENGPT1yr_ms	1=1 year of English PT in middle school; 0= 0 year	1076	0.51	0.50	0	1
ENGPT2yr_ms	1=2 years of English PT in middle school; 0= 0 year	1501	0.65	0.48	0	1
ENGPT3yr_ms	1=3 years of English PT in middle school; 0= 0 year	3364	0.84	0.36	0	1
ENGPT1yr_hs	1=1 year of English PT in high school; 0= 0 year	2790	0.50	0.50	0	1
ENGPT2yr_hs	1=2 years of English PT in high school; 0= 0 year	2681	0.47	0.50	0	1
ENGPT3yr_hs	1=3 years of English PT in high school; 0= 0 year	2176	0.35	0.48	0	1
Participation in Math PT						
MATHPT_G7	Participation in math PT in grade 7 (1=yes; 0=no)	6243	0.72	0.45	0	1
MATHPT_G8	Participation in math PT in grade 8 (1=yes; 0=no)	6283	0.72	0.45	0	1
MATHPT_G9	Participation in math PT in grade 9 (1=yes; 0=no)	5772	0.74	0.44	0	1
MATHPT_G10	Participation in math PT in grade 10 (1=yes; 0=no)	6217	0.64	0.48	0	1
MATHPT_G11	Participation in math PT in grade 11 (1=yes; 0=no)	5690	0.53	0.50	0	1
MATHPT_G12	Participation in math PT in grade 12 (1=yes; 0=no)	5385	0.27	0.44	0	1
TOTALMATPT_MS	Total years of math PT in middle school	4921	2.26	1.02	0	3
TOTALMATPT_HS	Total years of math PT in high school	4844	1.47	1.09	0	3
MATHPT1yr_ms	1=1 year of math PT in middle school; 0= 0 year	1063	0.51	0.50	0	1
MATHPT2yr_ms	1=2 years of math PT in middle school; 0= 0 year	1523	0.66	0.47	0	1
MATHPT3yr_ms	1=3 years of math PT in middle school; 0= 0 year	3377	0.84	0.36	0	1
MATHPT1yr_hs	1=1 year of math PT in high school; 0= 0 year	2439	0.51	0.50	0	1
MATHPT2yr_hs	1=2 years of math PT in high school; 0= 0 year	2518	0.52	0.50	0	1
MATHPT3yr_hs	1=3 years of math PT in high school; 0= 0 year	2281	0.47	0.50	0	1
Monthly cost on private tutoring[1]						
PTcost_G7	Monthly cost on PT in grade 7	6909	13.33	17.62	0	250
PTcost_G8	Monthly cost on PT in grade 8	6909	16.90	21.46	0	240
PTcost_G9	Monthly cost on PT in grade 9	6909	25.22	40.02	0	1460
PTcost_G10	Monthly cost on PT in grade 10	6909	24.39	37.39	0	542
PTcost_G11	Monthly cost on PT in grade 11	6909	21.83	37.54	0	900
PTcost_G12	Monthly cost on PT in grade 12	6909	16.11	33.03	0	630
VERPTcost_G7	Monthly cost on verbal PT in grade 7	6909	2.52	5.33	0	100
VERPTcost_G8	Monthly cost on verbal PT in grade 8	6909	2.97	5.51	0	60
VERPTcost_G9	Monthly cost on verbal PT in grade 9	6909	4.26	9.68	0	300
VERPTcost_G10	Monthly cost on verbal PT in grade 10	6909	3.23	9.22	0	171

Variable	Description of Variable	Obs.	Mean	Std. Dev.	Min	Max
VERPTcost_G11	Monthly cost on verbal PT in grade 11	6909	2.50	8.03	0	160
VERPTcost_G12	Monthly cost on verbal PT in grade 12	6909	2.49	9.16	0	210
ENGPTcost_G7	Monthly cost on English PT in grade 7	6909	5.68	8.79	0	140
ENGPTcost_G8	Monthly cost on English PT in grade 8	6909	6.95	10.21	0	130
ENGPTcost_G9	Monthly cost on English PT in grade 9	6909	10.18	17.67	0	730
ENGPTcost_G10	Monthly cost on English PT in grade 10	6909	9.58	16.81	0	290
ENGPTcost_G11	Monthly cost on English PT in grade 11	6909	8.12	17.57	0	500
ENGPTcost_G12	Monthly cost on English PT in grade 12	6909	5.61	14.41	0	210
MATHPTcost_G7	Monthly cost on math PT in grade 7	6909	5.13	8.26	0	150
MATHPTcost_G8	Monthly cost on math PT in grade 8	6909	6.97	10.45	0	116
MATHPTcost_G9	Monthly cost on math PT in grade 9	6909	10.78	18.90	0	730
MATHPTcost_G10	Monthly cost on math PT in grade 10	6909	11.58	18.92	0	354
MATHPTcost_G11	Monthly cost on math PT in grade 11	6909	11.21	20.51	0	400
MATHPTcost_G12	Monthly cost on math PT in grade 12	6909	7.99	18.19	0	300
Proportion of PT cost *(=Monthly PT cost/Monthly household income)*						
G7PT_c	Proportion of PT cost in monthly income in grade 7	6195	0.04	0.06	0	2.52
G8PT_c	Proportion of PT cost in monthly income in grade 8	5652	0.06	0.07	0	1.14
G9PT_c	Proportion of PT cost in monthly income in grade 9	5414	0.08	0.27	0	18.25
G10PT_c	Proportion of PT cost in monthly income in grade 10	5197	0.07	0.11	0	1.73
G11PT_c	Proportion of PT cost in monthly income in grade 11	5362	0.08	0.40	0	24
G12PT_c	Proportion of PT cost in monthly income in grade 12	4605	0.07	0.74	0	50
Hours of private tutoring in middle school[2]						
PThour_G7	Weekly hours of PT in grade 7	6909	5.72	6.77	0	90
PThour_G8	Weekly hours of PT in grade 8	6909	6.87	8.01	0	63
PThour_G9	Weekly hours of PT in grade 9	6909	8.11	13.04	0	450
VERPThour_G7	Weekly hours of verbal PT in grade 7	6909	1.30	2.45	0	60
VERPThour_G8	Weekly hours of verbal PT in grade 8	6909	1.51	2.50	0	24
VERPThour_G9	Weekly hours of verbal PT in grade 9	6909	1.75	3.68	0	90
ENGPThour_G7	Weekly hours of English PT in grade 7	6909	2.21	2.88	0	51
ENGPThour_G8	Weekly hours of English PT in grade 8	6909	2.64	3.25	0	31
ENGPThour_G9	Weekly hours of English PT in grade 9	6909	3.09	5.25	0	225
MATHPThour_G7	Weekly hours of math PT in grade 7	6909	2.20	2.96	0	55
MATHPThour_G8	Weekly hours of math PT in grade 8	6909	2.72	3.40	0	43
MATHPThour_G9	Weekly hours of math PT in grade 9	6909	3.26	5.55	0	225

Variable	Description of Variable	Obs.	Mean	Std. Dev.	Min	Max
Quality measure of private tutoring: cost per hour *(=monthly cost on private tutoring/(weekly hours of private tutoring*4))*						
PTq_G7	Cost per hour of PT in grade 7	4055	0.79	0.91	0	15
PTq_G8	Cost per hour of PT in grade 8	4012	0.84	0.88	0	18.75
PTq_G9	Cost per hour of PT in grade 9	4132	1.08	1.17	0	20.28
VERPTq_G7	Cost per hour of verbal PT in grade 7	2584	0.56	0.70	0	12
VERPTq_G8	Cost per hour of verbal PT in grade 8	2627	0.61	0.68	0	8.75
VERPTq_G9	Cost per hour of verbal PT in grade 9	2589	0.79	0.90	0	12.5
ENGPTq_G7	Cost per hour of English PT in grade 7	3651	0.77	0.85	0	8.75
ENGPTq_G8	Cost per hour of English PT in grade 8	3787	0.83	0.86	0	10
ENGPTq_G9	Cost per hour of English PT in grade 9	3806	1.07	1.17	0	20.28
MATHPTq_G7	Cost per hour of math PT in grade 7	3592	0.67	0.71	0	7.5
MATHPTq_G8	Cost per hour of math PT in grade 8	3800	0.77	0.78	0	8.33
MATHPTq_G9	Cost per hour of math PT in grade 9	3891	1.05	1.11	0	20.27

Notes: (1) [1] Unit = 10,000 won (approximately 10 USD); (2) [2] hours of tutoring in high school are not presented due to large missing observations

4.5 Validity Check for Instrumental Variable

As mentioned in the estimation model, I used an instrumental variable to correct for the endogeneity problem in estimating the effect of private tutoring on students' academic achievement. I chose the proportion of private tutoring cost in monthly household income as an instrument. The monthly cost of private tutoring is reflected by the monthly fees of tutoring, which is determined by the market and regulated by government rules based on local living standards. In addition, the fee for private tutoring is an important determinant whether to participate in private tutoring. Due to data limitations, instead of using the average fee of private tutoring, which is exogenously determined, the cost of private tutoring as a proportion of a monthly household income is used as an alternative because it is largely determined by the private tutoring fee. However, since this instrument is subject to many criticisms, I will discuss the assumptions for the instrumental variable to check whether these are met with this instrument. In addition to the assumptions, I conducted several tests to check the power of the instrument.

To test whether the instrument for private tutoring is valid for this analysis, it is important to test several assumptions of the instrument. The first assumption is whether the instrument is randomly assigned to students (Angrist, Imbens & Rubin, 1996). This assumption is important because if the instrument is not randomly assigned, it is likely to be correlated with particular observed and unobserved characteristics of students, which create bias in estimation. This assumption can be tested by looking at the degree of association between the instrument and personal characteristics of students to see whether there is any selectivity of the instrument. Since there are several versions of the instrument depending on grade, education level, and subject, I present the result of correlation analysis using one of the instruments as an example as shown in Table 19. The association between a proportion of private tutoring costs in monthly

household income and personal characteristics used in X_k is less than 0.1, which is low. The correlation between other versions of the instrument and covariates is also minimal (the results are not provided in the text).

Table 19. Correlation coefficients between the instrument and covariates

	Instrument (Proportion of PT cost in monthly household income)
URBANICITY	0.076
GENDER	-0.003
SES	0.049
SCHOOL TYPE	-0.010
STU-TEA RATIO	0.061
SCHOOL CHOICE	-0.072
PRESCORE	0.073
SELF-STUDY	0.042
SELF ESTEEM	0.069

Secondly, the instrument must only affect the outcome through the treatment, which is often called the exclusion restriction. In other words, there should be a non-zero correlation between the instrument and the treatment variable, and the instrument should be uncorrelated with the post-treatment outcome and error term to be a valid instrument. Table 20 shows results from the first-stage equation that indicates the high correlation between the instrument and the treatment. The coefficient of the instrument is positive and significant at 0.1 percent with a coefficient of 7.98 and a standard error of 0.27. Even after including the control variables in the first-stage equation, the coefficient is significant at the 0.1 percent level. This indicates that there is a statistically significant correlation between the instrument (the proportion of private tutoring costs in a monthly household income) and the participation in private tutoring. I also checked the correlation between the instrument and the dependent variable to test whether the instrument has a small or zero correlation with the dependent variable. I found that there is almost zero

correlation between them (0.09). Therefore these statistics confirm that this instrument meets the exclusion restriction.

Table 20. The first-stage equation in 2SLS

	Without covariates	With covariates
Instrument (PT cost as a proportion of a monthly household income)	2.23***	2.06***
	(0.076)	(0.074)
R-squared	0.13	0.21
Observations	5,755	5,491
F-statistics	852.44	146.82

*** p<0.001, ** p<0.01, * p<0.05

Moreover, the instrument also should meet monotonicity assumption, which means that there should be no defiers (Angrist, Imbens & Rubin, 1996). In other words, no students would have received private tutoring if they cannot afford the costs of private tutoring but would not have received it if they could afford it. It is impossible to directly test this assumption. However, this assumption seems to be quite plausible because private tutoring is often categorized as normal goods that are defined as goods for which demand increases as consumer income rises.

The last assumption is the Stable Unit Treatment Value Assumption (SUTVA). The SUTVA implies that potential outcomes for each person should not be related to the treatment status of other people (Angrist, Imbens & Rubin, 1996). A possible scenario would be that a student's private tutoring participation would encourage his or her peer's participation in private tutoring, which may indirectly affect the peer's academic achievement (Kim, 2007b). This possibility would generate problems in estimation when a large number of students in the sample are gathered in the same classroom. However, it is impossible to test this scenario using the KELS data because one or two students in a classroom are sampled, on average.

This study performed the Durbin and Wu-Hausman tests to check the superiority of using 2SLS over the OLS method. The null hypothesis is the regressor is in fact exogenous, which means that the OLS estimator is more efficient. The Durbin chi-square is 27.24 with p-value of 0.000, and the Wu-Hausman F-statistic is 27.32 with p-value of 0.000. As shown, both test statistics are highly significant, so I reject the null of exogeneity, which means that the regressor is endogenous. These test confirmed that the IV estimate is more superior than the OLS estimate in this study.

Tests for a Weak Instrument

To test the power of the instrument variable, I conducted "*estat firststage"* in STATA, which provides several statistics to measure the relevance of the excluded exogenous variable. The R-squared and adjusted R-squared of the first-stage regression[13] are 32.9 and 32.7, respectively, which are large enough. Also, the F-statistics[14] is 719.41, which far exceeds 10 for inference based on the 2SLS estimator to be reliable when there is one endogenous regressor. The F-statistic is also statistically significant at the 0.1 percent level. The minimum eigenvalue statistic (Cragg & Donald, 1993) is a further test of a weak instrument. Since the minimum eigenvalue statistic is 719.41, which exceeds the critical value (16.38), I can reject the null hypothesis of a weak instrument. Based on these several tests, the instrument, the proportion of a student's private tutoring cost in monthly household income, is proved as an appropriate instrument for this analysis.

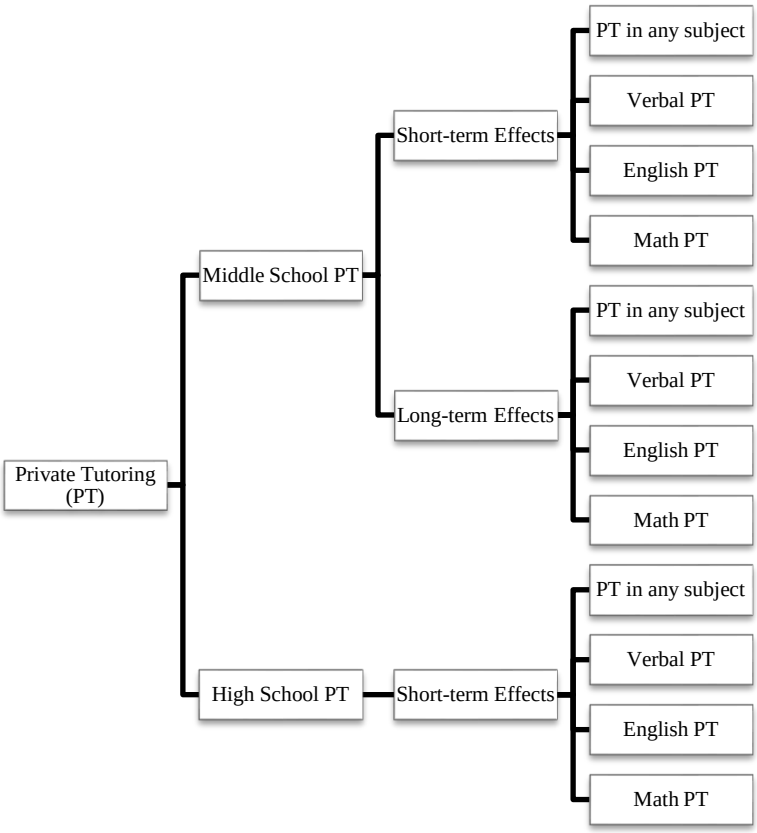
[13] Higher values purportedly indicate stronger instruments, and instrumental-variables estimators exhibit less bias when the instruments are strongly correlated with the endogenous variable.

[14] The F statistic is the joint significance of α_1, α_2, α_3, …, α_k in the equation 4.2, the coefficients on the additional instruments.

4.6 Empirical Results

This section is broadly divided into two parts: private tutoring in middle school and high school years. The results on the effects of private tutoring during middle school years consist of two sub-sections, which are 1) short-term effects (effects within one to three years after private tutoring participation) using the scores of the KEDI achievement tests and 2) long-term effects (effects within four to six years after the participation) using the results from the CSAT. In each sub-section, the results for participating in private tutoring in any subject are reported, followed by the results of private tutoring by academic subject using two types of private tutoring variables as described in Section 4.3. The second part regarding the effects of private tutoring in high school follows a similar structure to the first part, but only the results of short-term effects are available in the absence of long-term effects because the KELS data used in this study does not provide information after high school graduation. There are two reasons why I separated analyses by education level instead of combining tutoring in middle and high schools as a whole. First, as previously described, the characteristics of private tutoring in middle school are somewhat different from the characteristics of private tutoring in high school. Private tutoring in middle school mimics formal schooling, whereas private tutoring in high school is largely focused on preparation for the CSAT. Secondly, due to data limitation, the CSAT decile rank is the only achievement measure in high school level in the dataset and there are no other achievement measures during high school years. Therefore, it is impossible to observe the cumulative effect (combining middle and high school private tutoring) of private tutoring on academic achievement in high school. Figure 3 may help understand the structure of this section. The results of analysis are presented based on this structure.

Figure 3. Structure of empirical analyses



Private Tutoring in Middle School: Short-term Effects

Cumulative Effects

Using a set of dichotomous measures of private tutoring, which represents years of private tutoring in middle school, I begin by reporting the effects of one year of tutoring on students' academic achievement in middle school as presented in Table 21. The result from the OLS method suggests that taking one year of private tutoring does not have a statistically significant relationship with academic achievement in grade 9 (the last year in middle school) after controlling for students' family, school, and regional characteristics. In other words, there is no statistically significant difference in average academic achievement between students with

one year of tutoring and those who do not receive tutoring. The results from the IV and PSM approaches also suggest that one year of private tutoring does not affect students' academic achievement. Thus, these results suggest that one year of tutoring is not effective in increasing students' academic achievement.

Table 21. Effects of one year of private tutoring on academic achievement in grade 9

			PSM	
VARIABLES	OLS	IV	Difference-in-means	Regression-adjusted Matching
1 year of PT in middle school	-0.03	0.16	0.059	0.06
	(0.046)	(0.131)	(0.079)	(0.062)
Covariates	✓	✓	✓	✓
Observations	778	521	778	615
R-squared	0.261	0.294	0.029	0.258

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9VEM_Z (average score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared. (3) Complete table for OLS and IV are provided in Table C.1 in Appendix.

Table 22. Effects of two years of private tutoring on academic achievement in grade 9

			PSM	
VARIABLES	OLS	IV	Difference-in-means	Regression-adjusted Matching
2 years of PT in middle school	0.19***	0.25	0.12	0.15*
	(0.048)	(0.132)	(0.070)	(0.060)
Covariates	✓	✓	✓	✓
Observations	1,084	763	1,084	968
R-squared	0.240	0.257	0.082	0.308

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9VEM_Z (average score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared. (3) Complete table for OLS and IV are provided in Table C.2 in Appendix.

However, taking two years of private tutoring show a positive and significant impact on academic achievement in grade 9, according to the OLS estimate as presented in Table 22. The achievement score for students with two years of tutoring is higher by 0.19 standard deviations than the score for non-tutored students. Using the IV method, even though the magnitude of the

estimate is larger than the OLS estimate, the estimate is no longer statistically significant. The result from the PSM method (difference-in-means) is consistent with the one from the IV method, but the effect size is half of the IV estimate. The regression-adjusted matching approach, however, draws a similar result with OLS; taking two years of private tutoring increases academic achievement by 0.15 standard deviations, and this estimate is statistically significant at the 5 percent level. The four estimates are not consistent in terms of both significance and the magnitude of the estimate; therefore, the impact of two years of private tutoring is inconclusive using three approaches.

Table 23. Effects of three years of private tutoring on academic achievement in grade 9

			PSM	
VARIABLES	OLS	IV	Difference-in-means	Regression-adjusted Matching
3 years of PT in middle school	0.38***	0.54***	0.29**	0.31***
	(0.045)	(0.133)	(0.109)	(0.094)
Covariates	✓	✓	✓	✓
Observations	2,854	2,252	2,854	2,749
R-squared	0.294	0.267	0.260	0.350

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9VEM_Z (average score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared. (3) Complete table for OLS and IV are provided in Table C.3 in Appendix.

Table 23 presents the effect of three years of private tutoring on student's academic achievement. According to the OLS estimate, students with three years of tutoring show higher achievement by 0.38 standard deviations than non-tutored students. This estimate is statistically significant at the 0.1 percent level. Also, the size of the effect is almost twice as large as the one for two years of private tutoring. Taking account of the IV approach, the effect of three years of private tutoring is still significant with a larger effect size. Taking three years of tutoring increases academic achievement by 0.54 standard deviations compared to no tutoring. The

estimates from PSM also show positive and statistically significant effects of three years of private tutoring. However, the effect sizes are much smaller than the ones from the IV and OLS methods. According to difference-in-means, students with three years of tutoring show higher achievement score by 0.29 compared to their peers who have similar characteristics but no tutoring. The regression-adjusted matching shows a similar result. Based on these results, it is conclusive that taking three years of private tutoring has a positive and significant impact on students' academic achievement, but the magnitude of the effect is inconclusive.

Instead of using the overall private tutoring as a treatment, I also explored the effect of private tutoring in each academic subject (verbal, English, and math). In terms of verbal tutoring, Table 24, 25, and 26 present the effects of taking one, two, and three years of verbal private tutoring, respectively. The OLS estimate suggests that taking one year of verbal tutoring has a negative and significant effect on verbal score in grade 9. Students with one year of verbal tutoring show 0.17 standard deviations lower verbal achievement than students without verbal tutoring, and it is statistically significant at the 0.1 percent level. Taking account of the IV approach, the estimate is no longer significant even though it is still negative. The PSM results are similar to the OLS results. The results in Table 25 and 26 suggest that two and three years of verbal tutoring do not have statistically significant influence on verbal achievement in grade 9. Even though all estimates are not significant, almost all are negative, which indicates a negative relationship between verbal tutoring and verbal achievement. This result is striking because verbal private tutoring (reading and writing) is one of the popular subjects for students who take private tutoring as presented in Table 9.

Table 24. Effects of one year of verbal tutoring on verbal achievement in grade 9

VARIABLES	OLS	IV	PSM	
			Difference-in-means	Regression-adjusted Matching
1 year of Verbal PT in middle school	-0.17***	-0.07	-0.22***	-0.22***
	(0.043)	(0.121)	(0.066)	(0.058)
Covariates	✓	✓	✓	✓
Observations	1,768	1,304	1,768	1,345
R-squared	0.249	0.259	0.021	0.256

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9VER_Z (verbal score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared. (3) Complete table for OLS and IV are provided in Table C.4 in Appendix.

Table 25. Effects of two years of verbal tutoring on verbal achievement in grade 9

VARIABLES	OLS	IV	PSM	
			Difference-in-means	Regression-adjusted Matching
2 years of Verbal PT in middle school	-0.05	-0.11	-0.064	-0.062
	(0.042)	(0.087)	(0.065)	(0.058)
Covariates	✓	✓	✓	✓
Observations	1,900	1,394	1,900	1,497
R-squared	0.215	0.207	0.053	0.227

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9VER_Z (verbal score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared. (3) Complete table for OLS and IV are provided in Table C.5 in Appendix.

Table 26. Effects of three years of verbal tutoring on verbal achievement in grade 9

VARIABLES	OLS	IV	PSM	
			Difference-in-means	Regression-adjusted Matching
3 years of Verbal PT in middle school	0.02	-0.12	-0.06	-0.01
	(0.040)	(0.083)	(0.063)	(0.057)
Covariates	✓	✓	✓	✓
Observations	2,207	1,714	2,207	1,821
R-squared	0.203	0.194	0.095	0.198

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9VER_Z (verbal score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared. (3) Complete table for OLS and IV are provided in Table C.6 in Appendix.

The cumulative effects of English tutoring are different from the ones of verbal tutoring as presented in Table 27, 28, and 29. One year of English tutoring does not have statistically significant effects on English achievement in grade 9 based on all three approaches. However, according to the OLS estimate, two years of English tutoring increases English achievement by 0.23 standard deviations compared to no tutoring. This estimate is statistically significant at the 0.1 percent level. While the estimates from the PSM methods are similar to the OLS estimates in terms of significance and magnitude, the IV estimate is much smaller and insignificant. Table 29 presents the effects of three years of English tutoring. The OLS estimate for three years of English tutoring is larger than the estimate for one year and two years of English tutoring. Students with three years of English tutoring have 0.41 standard deviations higher English achievement compared to those without English tutoring, and it is statistically significant at the 0.1 percent level. The results from the PSM are similar to the ones from the OLS, while the IV estimate is more than twice as large as the OLS and IV estimates. The IV results suggest that three years of English tutoring increases English achievement by 1.06 standard deviations. Even though the magnitude of the estimates is not consistent using the three methods, it is concluded that three years of English tutoring has positive and significant effects on English achievement.

Table 27. Effects of one year of English tutoring on English achievement in grade 9

			PSM	
VARIABLES	OLS	IV	Difference-in-means	Regression-adjusted Matching
1 year of English PT in middle school	0.05	0.24	0.04	0.04
	(0.050)	(0.156)	(0.082)	(0.067)
Covariates	✓	✓	✓	✓
Observations	993	687	993	781
R-squared	0.231	0.274	0.036	0.291

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: G9ENG_Z (English score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared. (3) Complete table for OLS and IV are provided in Table C.7 in Appendix.

Table 28. Effects of two years of English tutoring on English achievement in grade 9

VARIABLES	OLS	IV	PSM	
			Difference-in-means	Regression-adjusted Matching
2 years of English PT in middle school	0.23***	0.11	0.33***	0.34***
	(0.049)	(0.293)	(0.083)	(0.073)
Covariates	✓	✓	✓	✓
Observations	1,377	993	1,377	1,197
R-squared	0.274	0.270	0.111	0.269

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9ENG_Z (English score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared. (3) Complete table for OLS and IV are provided in Table C.8 in Appendix.

Table 29. Effects of three years of English tutoring on English achievement in grade 9

VARIABLES	OLS	IV	PSM	
			Difference-in-means	Regression-adjusted Matching
3 years of English PT in middle school	0.41***	1.06***	0.37***	0.42***
	(0.046)	(0.137)	(0.101)	(0.085)
Covariates	✓	✓	✓	✓
Observations	3,142	2,492	3,142	2,996
R-squared	0.310	0.252	0.249	0.374

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9ENG_Z (English score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared. (3) Complete table for OLS and IV are provided in Table C.9 in Appendix.

The cumulative effects of math tutoring are similar to the ones of English tutoring. The results in Table 30 suggest that there is no statistically significant effect of one year of math tutoring on math achievement in grade 9. However, the OLS results in Table 31 show that two years of math tutoring increases math achievement by 0.29 standard deviations and it is statistically significant at the 0.1 percent level. Similarly, the PSM estimates are 0.21 standard deviations and they are statistically significant at the 1 percent level. Adversely, the IV estimates indicate that there is no significant difference in math achievement between students with two years of math tutoring and non-tutored students. All estimates for the effects of three years of

math tutoring are positive and statistically significant as presented in Table 32. According to the OLS estimate, students with three years of math tutoring show 0.46 standard deviations higher math achievement than students with no math tutoring. Taking account of the IV approach, the effect size is almost twice of the OLS estimate; there are 0.88 standard deviations differences in math achievement between students with three years of math tutoring and those without math tutoring. However, the estimates from the PSM methods are similar to the OLS estimates but much smaller than the IV estimates. Similar to the cumulative effects of English tutoring, it is evident that there are positive and significant effects of three years of math tutoring on math achievement, but the magnitude of the effects is inconclusive. In summary, it is concluded that there are positive cumulative effects of taking three years of English and math private tutoring on students' achievement in English and math, respectively, whereas one year and two years of English and math tutoring do not show consistent results. Moreover, verbal private tutoring does not show statistically significant cumulative effects.

Table 30. Effects of one year of math tutoring on math achievement in grade 9

			PSM	
VARIABLES	OLS	IV	Difference-in-means	Regression-adjusted Matching
1 year of Math PT in middle school	0.05	0.21	0.09	0.07
	(0.048)	(0.128)	(0.081)	(0.061)
Covariates	✓	✓	✓	✓
Observations	992	693	992	779
R-squared	0.242	0.272	0.032	0.278

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9MAT_Z (Math score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared.
(3) Complete table for OLS and IV are provided in Table C.10 in Appendix.

Table 31. Effects of two years of math tutoring on math achievement in grade 9

VARIABLES	OLS	IV	PSM	
			Difference-in-means	Regression-adjusted Matching
2 years of Math PT in middle school	0.29***	0.01	0.21**	0.21**
	(0.049)	(0.307)	(0.076)	(0.065)
Covariates	✓	✓	✓	✓
Observations	1,423	1,031	1,423	1,253
R-squared	0.244	0.245	0.095	0.253

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9MAT_Z (Math score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared.
(3) Complete table for OLS and IV are provided in Table C.11 in Appendix.

Table 32. Effects of three years of math tutoring on math achievement in grade 9

VARIABLES	OLS	IV	PSM	
			Difference-in-means	Regression-adjusted Matching
3 years of Math PT in middle school	0.46***	0.88***	0.31***	0.35***
	(0.048)	(0.136)	(0.084)	(0.081)
Covariates	✓	✓	✓	✓
Observations	3,198	2,531	3,198	3,050
R-squared	0.254	0.215	0.223	0.314

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9MAT_Z (Math score in grade 9); (2) R-squared for difference-in-means is Pseudo R-squared.
(3) Complete table for OLS and IV are provided in Table C.12 in Appendix.

Single-Year Effects

The use of measures of private tutoring participation provides information about the most effective time to take private tutoring to increase students' academic achievement. This analysis may uncover the extent of effect of taking private tutoring at each grade level. Many parents believe that early exposure to private tutoring helps students understand school curriculum in a better and faster way and increases academic confidence, which directly affects academic performance (Lee at al., 2004). In order to quantify this belief, I investigated the effect of private tutoring at each grade level. In a vector of control variables in the estimation equations, I

included private tutoring experience in a previous year and a year after the participation to isolate the effect of private tutoring in a particular grade that I estimated.

Table 33, 34, and 35 present empirical results on the effects of private tutoring in grades 7, 8, and 9, respectively. The OLS estimates in column 1, 4, and 7 of Table 33 explain that taking private tutoring in grade 7 has a positive effect on their overall academic achievement in the first three years after taking private tutoring. A student who participates in private tutoring during the first grade in middle school scores 0.22 standard deviations higher than a student who does not participate in private tutoring in the same grade. Even though the effect remains in grade 8 as presented in column 4, the extent of the effect is minimal (0.09 standard deviation increase in overall academic achievement). Moreover, the effect of private tutoring in grade 7 disappears in the second year after the participation. However, the story is different when the IV estimation method is used. Taking account of the IV approach, the size of the IV estimates is more than twice as large as the OLS estimates. In the year of participation, a student with private tutoring scores more than half of a standard deviation (0.53) higher than a student with no private tutoring. In the first and second year after the participation, the effect sizes decrease but they are still sizable: 0.33 and 0.22 standard deviations differences between a student with private tutoring and his or her counterpart in year 1 and 2, respectively. All these IV estimates are statistically significant. When analyzing with the PSM method (difference-in-means), on average, the PSM estimates are larger than the OLS estimates, but smaller than the IV estimates. However, there is a consistent pattern in the IV and PSM estimations, where private tutoring in grade 7 has positive and statistically significant influence on academic achievement in middle school, but the magnitude of the influence decreases as time passes. Since there is a large

difference in the size of the estimates between the IV and PSM estimates, the magnitude of the effects is still inconclusive.

Table 33. Effects of private tutoring in grade 7 on academic achievement for 3 years

	Year 0			Year 1			Year 2		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
PT in grade 7	0.22***	0.53***	0.21***	0.09**	0.33***	0.19***	0.05	0.22*	0.12*
	(0.022)	(0.066)	(0.035)	(0.026)	(0.076)	(0.044)	(0.033)	(0.094)	(0.059)
Student Characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓
Family Characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓
School Characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓
Regional Characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓
Private tutoring in G8				✓	✓	✓	✓	✓	✓
Private tutoring in G9							✓	✓	✓
Observations	5,895	5,473	5,895	5,380	5,022	5,380	3,990	3,716	3,990
R-squared	0.444	0.419	0.105	0.364	0.351	0.206	0.315	0.307	0.246

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variables: G7VEM_Z for Year 0; G8VEM_Z for Year 1; G9VEM_Z for Year 2; (2) Complete table for OLS and IV are provided in Table C.13 in Appendix.

In terms of private tutoring in grade 8 in Table 34, taking tutoring also increases the overall academic achievement in grade 8 by 0.27 standard deviations when estimating with the IV method, but the extent of effect is much smaller than the one for private tutoring in grade 7. In addition, the effect does not last in the next year, according to the IV estimation. However, the PSM estimates suggest that even though the estimate (0.18) is smaller than the IV estimate (0.27), the significant effect stays for two years and the effect size in year 1 (0.21) is larger than the one in year 0 (0.18). Lastly, as shown in Table 35, participating in private tutoring in grade 9 increases achievement by about one-fifth of a standard deviation (0.19), according to the IV estimation, which also implies that its effect is much smaller than the effects of tutoring in earlier grades. The PSM estimate also suggests that students who take tutoring in grade 9 show 0.22 standard deviations higher academic achievement than those who do not take. Therefore, the

effect size is consistent using three methods. In summary, on average, private tutoring in middle school has a sizable impact on average academic achievement in middle school. In addition, both the IV and PSM estimates agree that private tutoring in grades 7 and 9 is effective to increase an average score in grade 9, which is often considered as a barometer for academic success in high school. Therefore, parents' belief of the effectiveness of private tutoring is somewhat true.

Table 34. Effects of private tutoring in grade 8 on academic achievement for 2 years

	Year 0 (Grade 8)			Year 1 (Grade 9)		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM
PT in grade 8	0.12***	0.27***	0.18**	0.09**	0.13	0.21**
	(0.020)	(0.066)	(0.059)	(0.028)	(0.097)	(0.083)
Student Characteristics	✓	✓	✓	✓	✓	✓
Family Characteristics	✓	✓	✓	✓	✓	✓
School Characteristics	✓	✓	✓	✓	✓	✓
Regional Characteristics	✓	✓	✓	✓	✓	✓
Private tutoring in G7	✓	✓	✓	✓	✓	✓
Private tutoring in G9				✓	✓	✓
Observations	5,501	4,953	5,501	4,077	3,657	4,077
R-squared	0.633	0.623	0.231	0.540	0.530	0.318

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variables: G8VEM_Z for Year 0; G9VEM_Z for Year 1; (2) Complete table for OLS and IV are provided in Table C.14 in Appendix.

Table 35. Effects of private tutoring in grade 9 on academic achievement in grade 9

	Year 0 (Grade 9)		
	(1)	(2)	(2)
VARIABLES	OLS	IV	PSM
PT in grade 9	0.16***	0.19*	0.22***
	(0.023)	(0.090)	(0.066)
Student Characteristics	✓	✓	✓
Family Characteristics	✓	✓	✓
School Characteristics	✓	✓	✓
Regional Characteristics	✓	✓	✓
Private tutoring in G8	✓	✓	✓
Observations	4,378	3,761	4378
R-squared	0.585	0.579	0.261

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Dependent variable: G9VEM_Z (average score in grade 9); (2) Complete table for OLS and IV are provided in Table C.15 in Appendix.

I investigated these single-year effects more closely by separating the analyses into academic subjects. Each dichotomous variable for private tutoring represents whether a student takes private tutoring, and if so, in which subject and during what grade. The results of single-year analyses by academic subject are presented from Table 36. First, verbal private tutoring in each of the grades 7, 8, and 9 is not statistically significant in explaining students' verbal achievement during middle school years. Taking account of the IV and PSM approaches, results remain the same. In the case of English private tutoring in each grade level, however, effects are striking. Taking English private tutoring in grade 7 has an effect on improving English achievement in grade 7 by 0.25 standard deviations, according to the OLS estimate in column 1 of English tutoring in Table 36. When estimating with the IV method, the estimate is about three times larger than the OLS estimate, which means English private tutoring in grade 7 increases a student's English achievement by 0.67 standard deviations in the same year of starting English private tutoring. This effect of English private tutoring does not disappear in the next two years, and the effect sizes are also steady (0.46 in grade 8 and 0.49 in grade 9). However, these large sizes of the IV estimates bring concerns in estimation because the IV estimates are much larger than the OLS and PSM estimates. The next two rows indicate the effect of English tutoring in grade 8 on English achievement in grades 8 and 9. Starting English tutoring in grade 8 increases English achievement by 0.31 standard deviations in grade 8, but the effect does not stay in grade 9. However, the PSM estimates suggest that taking English tutoring in grade 8 increases English achievement for two years with a similar size of effects (0.18 in grade 8 and 0.19 in grade 9). Similarly, English tutoring in grade 9 does not have an impact on English achievement in the same grade, according to the IV estimates, while the PSM estimate suggests that it increases English scores by 0.22 standard deviations, which is larger than the OLS estimate (0.16). Lastly,

results for the effect of math private tutoring in each grade are presented in the bottom part of Table 36. According to the OLS estimates, math tutoring in grade 7 increases math achievement by 0.26 and 0.09 standard deviations in grades 7 and 8, respectively, and it does not have any effect on math achievement in grade 9. The similar pattern is shown when estimating the effects with the PSM method. However, using the IV estimation method, taking math tutoring in grade 7 boosts math scores by about half of a standard deviation (0.53) in grade 7 and about one-third of a standard deviation in grade 8 (0.36) and grade 9 (0.34). Therefore, the effects of math tutoring taken in grade 7 are steady and sizable but smaller than the effects of English private tutoring. Math private tutoring in grade 8 is also effective in raising math scores in grades 8 and 9. According to the IV estimates, a student with math private tutoring in grade 8 receives a score of about 0.4 standard deviations higher in both grades 8 and 9 than a student with no math tutoring in grade 8. The PSM estimates also suggest that math tutoring in grade 8 increases math scores by 0.31 and 0.19 standard deviations, which are smaller than the IV estimates but larger than the OLS estimates. Unlike English private tutoring, the effects of math tutoring continue for two years. Starting math tutoring in grade 9 does not help improve math achievement in the same grade similar to English tutoring based on the IV estimates, while the PSM estimate explains that taking math tutoring in grade 9 increases math achievement by 0.30. In summary, the analyses of single-year effects suggest that private tutoring affects overall academic achievement in a larger extent when a student takes private tutoring in grades 7 and 9. In addition, English and math private tutoring in grades 7 and 8 largely contribute to academic achievement. However, the magnitude of the effects is still questionable because the estimates from the IV and PSM methods are quite different.

Table 36. Summary of the estimates in single-year effects by academic subject and grade

	Grade 7			Grade 8			Grade 9		
	(1)	(2)	(2)	(3)	(4)	(4)	(5)	(6)	(6)
Treatment Variable	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
VERBAL TUTORING									
VERBAL PT in G7	-0.01	0.01	0.02	-0.05	-0.08	-0.02	-0.02	-0.12	-0.02
	(0.022)	(0.056)	(0.034)	(0.025)	(0.071)	(0.041)	(0.031)	(0.087)	(0.050)
VERBAL PT in G8				0.04*	-0.00	0.04	0.00	-0.11	0.06
				(0.021)	(0.053)	(0.039)	(0.028)	(0.075)	(0.056)
VERBAL PT in G9							-0.00	-0.04	-0.02
							(0.027)	(0.093)	(0.051)
ENGLISH TUTORING									
ENGLISH PT in G7	0.25***	0.67***	0.24***	0.12***	0.46***	0.11**	0.07*	0.49***	0.07*
	(0.024)	(0.077)	(0.038)	(0.029)	(0.090)	(0.045)	(0.033)	(0.105)	(0.035)
ENGLISH PT in G8				0.14***	0.31***	0.18***	0.09**	0.18	0.19**
				(0.024)	(0.073)	(0.047)	(0.030)	(0.102)	(0.063)
ENGLISH PT in G9							0.16***	-0.15	0.22**
							(0.028)	(0.272)	(0.067)
MATH TUTORING									
MATH PT in G7	0.26***	0.53***	0.25***	0.09**	0.36***	0.16**	0.04	0.34**	0.07
	(0.024)	(0.081)	(0.039)	(0.030)	(0.085)	(0.047)	(0.033)	(0.132)	(0.056)
MATH PT in G8				0.17***	0.45***	0.31***	0.11***	0.43***	0.19*
				(0.026)	(0.083)	(0.054)	(0.032)	(0.111)	(0.080)
MATH PT in G9							0.24***	-0.09	0.30***
							(0.031)	(0.287)	(0.072)

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) all numbers for the OLS and IV methods are the estimates of treatment effect after controlling for all covariates; (2) the PSM estimate is from difference-in-means method. (3) Complete tables for OLS and IV are provided in Table D's in Appendix.

Private Tutoring in Middle School: Long-term Effects

Instead of using achievement scores in middle school years, I used the CSAT results to observe the long-term effect of private tutoring during middle school years. Due to data limitation, instead of using a raw score or percentile rank of the CSAT, defile rank is used as a dependent variable. As noticed, using the decile rank is concerning because it does not have accurate information on the CSAT achievement, and very small differences in the decile can make a big difference in getting into the most competitive institutions. I also included variables that indicate participation in private tutoring during high school years to isolate the impact of middle school tutoring on the CSAT. However, information on tutoring participation prior to entering middle school is not included in the models due to data limitation.

In terms of overall private tutoring, there are no cumulative or single-year effects of taking private tutoring in middle school as presented in Table 37 except for the effect of tutoring in grade 7. The PSM estimate suggests that taking private tutoring in grade 7 increases average CSAT scores by 0.33 deciles. As expected, verbal private tutoring is also not statistically significant in explaining verbal achievement on the CSAT (Table 38). English private tutoring, however, shows positive and significant cumulative effects as shown in Table 39. The IV estimate suggests that an English score on the CSAT of a student with three years of English private tutoring is 1.23 deciles higher than an English score of a student with zero years of English tutoring. Moreover, taking English tutoring in grade 7 increases English scores on the CSAT by 0.65 deciles, whereas having English tutoring in later grades does not contribute to the improvement in English scores. The effects of English tutoring are surprising because taking three years of English tutoring increases the CSAT English scores by 1.23 deciles and this increment of score dramatically changes the pool of universities that students can apply to. Since the prestige of the university that a student attends is regarded as an important determinant of

future success in Korea (Lee, 2006), it seems to be worth investing in private tutoring in English during middle school years. However, the more surprising result is that math private tutoring taken in middle school does not help increase CSAT math scores (Table 40) as opposed to the results of short-term effects of math tutoring presented earlier. Since math is reported as the most demanded subject of private tutoring as shown in Table 9, this long-term effect of math private tutoring is astonishing.

Table 37. Long-term effects of private tutoring in middle school on the CSAT

Panel A. Cumulative effects

	1 year of PT			2 years of PT			3 years of PT		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.03	0.34	0.09	0.13	0.36	-0.10	0.04	0.48	-0.08
	(0.180)	(0.482)	(0.299)	(0.166)	(0.410)	(0.168)	(0.134)	(0.456)	(0.097)
Covariates	✓	✓		✓	✓		✓	✓	
PT in high school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	246	181	246	421	325	421	1,452	1,190	1,434
R-squared	0.275	0.294	0.078	0.181	0.180	0.158	0.318	0.310	0.419

Panel B. Single-year effects

	PT in grade 7			PT in grade 8			PT in grade 9		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.14	0.42	0.33*	0.09	-0.18	0.11	-0.07	0.31	0.07
	(0.087)	(0.274)	(0.159)	(0.086)	(0.293)	(0.255)	(0.081)	(0.385)	(0.197)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in grade 7				✓	✓	✓	✓	✓	✓
PT in grade 8	✓	✓	✓				✓	✓	✓
PT in grade 9	✓	✓	✓	✓	✓	✓			
PT in high school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,905	1,800	1,905	1,934	1,770	1,934	2,021	1,785	2,021
R-squared	0.296	0.287	0.227	0.405	0.403	0.310	0.39	0.378	0.303

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_avg (average CSAT score); (2) Complete tables for OLS and IV are provided in Table E.1 and E.2 in Appendix.

Table 38. Long-term effects of verbal tutoring in middle school on the CSAT verbal achievement

Panel A. Cumulative effects

	1 year of Verbal PT			2 years of Verbal PT			3 years of Verbal PT		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	-0.17	0.52*	-0.32	-0.21*	-0.28	-0.20	-0.26**	-0.47*	-0.29
	(0.106)	(0.256)	(0.181)	(0.103)	(0.222)	(0.178)	(0.098)	(0.192)	(0.169)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in high school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	791	635	791	925	722	925	1,114	909	1,114
R-squared	0.254	0.204	0.043	0.222	0.214	0.080	0.212	0.210	0.121

Panel B. Single-year effects

	Verbal PT in grade 7			Verbal PT in grade 8			Verbal PT in grade 9		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	-0.04	-0.08	-0.03	-0.04	-0.33	0.05	-0.07	0.07	-0.04
	(0.071)	(0.188)	(0.111)	(0.071)	(0.176)	(0.121)	(0.072)	(0.290)	(0.116)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 7				✓	✓	✓	✓	✓	✓
Verbal PT in grade 8	✓	✓	✓				✓	✓	✓
Verbal PT in grade 9	✓	✓	✓	✓	✓	✓			
Verbal PT in high school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2,032	1,921	2,032	2,064	1,889	2,064	2,044	1,812	2,044
R-squared	0.198	0.194	0.142	0.282	0.278	0.221	0.252	0.243	0.201

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_V (Verbal score on the CSAT); (2) Complete tables for OLS and IV are provided in Table E.3 and E.4 in Appendix.

Table 39. Long-term effects of English tutoring in middle school on the CSAT English achievement

Panel A. Cumulative effects

	1 year of English PT			2 years of English PT			3 years of English PT		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	-0.18	-0.02	-0.59*	-0.13	0.54	-0.53	0.09	1.23**	-0.26
	(0.180)	(0.521)	(0.286)	(0.163)	(0.408)	(0.299)	(0.132)	(0.444)	(0.362)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in high school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	343	260	343	595	462	595	1,678	1,375	1,678
R-squared	0.203	0.203	0.081	0.204	0.173	0.187	0.257	0.225	0.288

Panel B. Single-year effects

	English PT in grade 7			English PT in grade 8			English PT in grade 9		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.10	0.65**	0.2	0.13	0.39	0.15	-0.05	0.51	0.10
	(0.085)	(0.251)	(0.127)	(0.090)	(0.317)	(0.177)	(0.092)	(0.389)	(0.207)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 7				✓	✓	✓	✓	✓	✓
English PT in grade 8	✓	✓	✓				✓	✓	✓
English PT in grade 9	✓	✓	✓	✓	✓	✓			
English PT in high school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2,302	2,179	2,302	2,339	2,148	2,339	2,319	2,062	2,319
R-squared	0.247	0.229	0.174	0.342	0.342	0.307	0.337	0.326	0.291

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_E (English score on the CSAT); (2) Complete tables for OLS and IV are provided in Table E.5 and E.6 in Appendix.

Table 40. Long-term effects of math tutoring in middle school on the CSAT math achievement

Panel A. Cumulative effects

	1 year of Math PT			2 years of Math PT			3 years of Math PT		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	-0.04	-0.34	0.01	-0.17	0.13	-0.49	-0.15	0.56	-0.99*
	(0.192)	(0.475)	(0.317)	(0.172)	(0.442)	(0.289)	(0.143)	(0.461)	(0.349)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in high school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	344	266	334	594	466	594	1,668	1,369	1,668
R-squared	0.235	0.258	0.045	0.243	0.230	0.148	0.256	0.242	0.263

Panel B. Single-year effects

	Math PT in grade 7			Math PT in grade 8			Math PT in grade 9		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.11	-0.13	0.08	-0.07	0.01	-0.14	-0.14	0.44	-0.20
	(0.091)	(0.450)	(0.166)	(0.098)	(0.362)	(0.214)	(0.102)	(0.437)	(0.211)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 7				✓	✓	✓	✓	✓	✓
Math PT in grade 8	✓	✓	✓				✓	✓	✓
Math PT in grade 9	✓	✓	✓	✓	✓	✓			
Math PT in high school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	2,294	2,172	2,294	2,330	2,142	2,330	2,310	2,055	2,310
R-squared	0.238	0.236	0.185	0.298	0.297	0.291	0.296	0.284	0.290

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_M (Math score on the CSAT); (2) Complete tables for OLS and IV are provided in Table E.7 and E.8 in Appendix.

Private Tutoring in High School: Short-term Effects

Instead of using variables indicating private tutoring in middle school, this section utilizes dichotomous variables of private tutoring in high school in order to observe the cumulative and single-year effects of private tutoring in high school on the CSAT. Unlike the analysis of middle school, short-term effects of private tutoring in high school are observed using the results of the CSAT only because scores of the KEDI test during high school years are not available. Also, there are no outcome variables after high school graduation to measure a long-term effect.

Table 41 explains that there are cumulative effects of taking private tutoring in high school on overall achievement on the CSAT. Even though one year and two years of private tutoring in high school do not explain the CSAT achievement, three years of private tutoring is statistically significant in explaining the improvement of the CSAT score. The OLS estimate suggests that students with three years of private tutoring in high school show higher achievement on the CSAT by 0.59 deciles compared to non-tutored students. This estimate is statistically significant at the 0.1 percent level. Moreover, the IV estimate also explains a similar effect of three years of private tutoring in high school (0.51 deciles) with the 5 percent level significance. However, there are no consistent single-year effects of high school tutoring as shown in Panel B in Table 41. These estimates are calculated after controlling for students' family, school, and regional characteristics, which also include students' academic achievement prior to the treatment and private tutoring participation in middle school and high school (for single-year effects).

Table 41. Cumulative and single-year effects of private tutoring in high school on the CSAT achievement

Panel A. Cumulative effects

	1 year of PT in HS			2 years of PT in HS			3 years of PT in HS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.06	0.36	0.01	0.29**	0.51	0.26	0.59***	0.51*	0.30
	-0.104	-0.376	(0.177)	-0.101	-0.304	(0.239)	(0.105)	(0.251)	(0.324)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in middle school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	639	465	639	826	627	826	985	782	985
R-squared	0.327	0.319	0.074	0.407	0.402	0.235	0.453	0.442	0.393

Panel B. Single-year effects

	PT in grade 10			PT in grade 11			PT in grade 12		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.07	0.20	0.15	0.25***	0.36	0.26	0.26***	0.16	0.19
	(0.073)	(0.335)	(0.159)	(0.067)	(0.283)	(0.163)	(0.059)	(0.145)	(0.095)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in middle school	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in grade 10				✓	✓	✓	✓	✓	✓
PT in grade 11	✓	✓	✓				✓	✓	✓
PT in grade 12	✓	✓	✓	✓	✓	✓			
Observations	1,940	1,680	1,940	1,940	1,827	1,940	1,940	1,752	1,940
R-squared	0.421	0.407	0.247	0.421	0.413	0.291	0.421	0.422	0.204

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_avg (average CSAT score); (2) Complete tables for OLS and IV are provided in Table F.1 and F.2 in Appendix.

In terms of verbal tutoring in high school, there are no significant cumulative effects of high school tutoring on the CSAT (Table 42). Even though the results suggest that two years of verbal tutoring in high school increases the CSAT verbal achievement by 0.24 deciles based on the OLS estimate, the IV and PSM estimates do not show the same result. In terms of the single-year effects, the OLS and PSM estimates suggest that verbal tutoring in grade 12 leads to an increase in the CSAT verbal achievement by 0.21 and 0.40 deciles, respectively, whereas the IV estimate is not statistically significant. Verbal tutoring in grades 10 and 11 is not statistically significant in explaining the verbal achievement on the CSAT.

Table 42. Cumulative and single-year effects of verbal tutoring in high school on the CSAT verbal achievement

Panel A. Cumulative effects

	1 year of Verbal PT			2 years of Verbal PT			3 years of Verbal PT		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.01	0.54	0.03	0.24**	0.34	0.07	0.23	0.23	0.13
	(0.071)	(0.464)	(0.118)	(0.093)	(0.240)	(0.154)	(0.143)	(0.258)	(0.244)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in middle school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,596	1,227	1,596	1,208	938	1,208	988	760	988
R-squared	0.256	0.230	0.045	0.273	0.275	0.120	0.290	0.270	0.228

Panel B. Single-year effects

	Verbal PT in grade 10			Verbal PT in grade 11			Verbal PT in grade 12		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.00	0.11	0.11	0.13	0.05	0.26	0.21*	0.09	0.40**
	(0.064)	(0.291)	(0.112)	(0.075)	(0.279)	(0.138)	(0.094)	(0.260)	(0.166)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in middle school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 10				✓	✓	✓	✓	✓	✓
Verbal PT in grade 11	✓	✓	✓				✓	✓	✓
Verbal PT in grade 12	✓	✓	✓	✓	✓	✓			
Observations	2,070	1,790	2,070	2,070	1,952	2,070	2,070	1,870	2,070
R-squared	0.269	0.261	0.101	0.269	0.259	0.151	0.269	0.272	0.146

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_V (Verbal score on the CSAT); (2) Complete tables for OLS and IV are provided in Table F.3 and F.4 in Appendix.

In terms of English tutoring in high school in Table 43, the OLS estimates suggest that two and three years of English tutoring in high school contribute to the CSAT English achievement by 0.22 and 0.35 deciles, respectively. However, taking account of the IV and PSM approaches, the effects are smaller and become insignificant. When observing the single-year effects, taking English tutoring in grades 11 and 12 is statistically significant in increasing the CSAT English achievement by 0.18 and 0.19 deciles, respectively, based on the OLS estimates, whereas the PSM method suggests that only English tutoring in grade 12 is beneficial to students in increasing English scores on the CSAT by 0.34 deciles. However, none of the IV estimates is

statistically significant in all grade levels in high school. Even though the IV estimates are not statistically significant, it is still noteworthy to mention the size of several coefficients. Taking three years of English tutoring in high school increases CSAT English scores by 0.29 deciles compared to no English tutoring. In addition, the coefficients for taking English tutoring in grades 10 and 11 show increases in CSAT English scores by 0.26 and 0.33 deciles, respectively. Even though these estimates have large standard errors that make the coefficients statistically insignificant, sizes of the coefficients are large enough to mention.

Table 43. Cumulative and single-year effects of English tutoring in high school on the CSAT English achievement

Panel A. Cumulative effects

	1 year of English PT			2 years of English PT			3 years of English PT		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	-0.12	0.41	-0.24	0.22*	0.18	-0.06	0.36***	0.29	0.13
	(0.090)	(0.349)	(0.155)	(0.090)	(0.221)	(0.162)	(0.100)	(0.164)	(0.084)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in middle school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,157	878	1,157	1,228	956	1,228	963	757	963
R-squared	0.327	0.298	0.061	0.363	0.352	0.180	0.399	0.377	0.234

Panel B. Single-year effects

	English PT in grade 10			English PT in grade 11			English PT in grade 12		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.03	0.26	0.01	0.18**	0.33	0.10	0.19**	0.14	0.34***
	(0.067)	(0.267)	(0.123)	(0.065)	(0.212)	(0.115)	(0.068)	(0.144)	(0.112)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in middle school	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 10				✓	✓	✓	✓	✓	✓
English PT in grade 11	✓	✓	✓				✓	✓	✓
English PT in grade 12	✓	✓	✓	✓	✓	✓			
Observations	2,344	2,032	2,344	2,344	2,212	2,344	2,344	2,114	2,344
R-squared	0.348	0.336	0.159	0.348	0.335	0.191	0.348	0.349	0.142

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_E (English score on the CSAT); (2) Complete tables for OLS and IV are provided in Table F.5 and F.6 in Appendix.

Table 44. Cumulative and single-year effects of math tutoring in high school on the CSAT math achievement

Panel A. Cumulative effects

	1 year of Math PT			2 years of Math PT			3 years of Math PT		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.20	0.56	0.06	0.73***	1.01***	0.65**	1.18***	1.08***	0.85***
	(0.111)	(0.374)	(0.187)	(0.116)	(0.283)	(0.230)	(0.121)	(0.246)	(0.263)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in middle school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	910	680	910	1,083	832	1,083	1,081	854	1,081
R-squared	0.259	0.247	0.077	0.324	0.308	0.237	0.401	0.386	0.383

Panel B. Single-year effects

	Math PT in grade 10			Math PT in grade 11			Math PT in grade 12		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	OLS	IV	PSM	OLS	IV	PSM	OLS	IV	PSM
Coefficient of interest	0.14	0.14	0.01	0.55***	0.63**	0.44***	0.43***	0.42**	0.37***
	(0.082)	(0.322)	(0.193)	(0.076)	(0.241)	(0.132)	(0.072)	(0.157)	(0.118)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in middle school	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 10				✓	✓	✓	✓	✓	✓
Math PT in grade 11	✓	✓	✓				✓	✓	✓
Math PT in grade 12	✓	✓	✓	✓	✓	✓			
Observations	2,338	2,033	2,338	2,338	2,209	2,338	2,338	2,117	2,338
R-squared	0.345	0.334	0.222	0.345	0.341	0.272	0.345	0.343	0.204

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_M (Math score on the CSAT); (2) Complete tables for OLS and IV are provided in Table F.7 and F.8 in Appendix.

Unlike verbal and English private tutoring, math private tutoring in high school has positive and significant effects on the CSAT math achievement as shown in Table 44. In terms of the cumulative effects, taking two and three years of math tutoring in high school significantly increases the CSAT math achievement by 0.73 and 1.18 deciles, according to the OLS estimation. Moreover, these effects are fairly consistent with the estimates from the IV and PSM methods. The IV method implies that students with two and three years of math tutoring in high school have higher math achievement on the CSAT by 1.01 and 1.08 deciles, respectively. The PSM estimates show similar results with slightly smaller effect sizes (0.65 deciles for two years of

math tutoring and 0.85 deciles for three years). Therefore, it is evident that there are statistically significant cumulative effects of math tutoring in high school. In terms of the single-year effects, the results in Panel B suggest that math tutoring in grades 11 and 12 is statistically significant in explaining the improvement of CSAT math scores, and this result is consistent in all three empirical methods. Taking math tutoring in grade 11 contributes to raising math achievement by 0.55, 0.63, and 0.44 deciles based on the OLS, IV, and PSM methods, respectively. Moreover, math tutoring in grade 12 has similar effects on math achievement on the CSAT. Thus, while the effects of verbal and English tutoring in high school are not conclusive using the three methods, the effect of math tutoring in high school is incontrovertible. Based on these empirical results, more in-depth discussion should take place as follows.

4.7 Discussion

Participation in private tutoring regardless of subject during middle school shows positive effects on students' academic achievement in the last grade of middle school as opposed to the results obtained by Kang (2005) and Choi (2007). Taking three years of private tutoring in middle school increases an average score on the KEDI tests by 0.3-0.5 standard deviations when taking account of the PSM and IV approaches, respectively. Even though this positive effect was anticipated, the magnitude of the effect is surprisingly small if you take the annual costs of private tutoring into consideration. According to the descriptive statistics presented in Table 18, the average monthly cost of private tutoring is about 180,000 Won[15]. So, annually, on average, parents of middle school students who take private tutoring spend about 2,160,000 Won, which

[15] Take an average of monthly cost in private tutoring in grades 7, 8, and 9 [(13.33+16.90+25.22)/3 = 18.48] in the unit of 10,000 won.

is approximately equivalent to 2,160 USD. Thus, the effect does not seem substantial when considering the cost of tutoring.

The results also imply that the effect of private tutoring becomes larger as the number of years in private tutoring increases. For example, if a student takes three years of private tutoring during middle school, he or she benefits by 0.5 standard deviations while a student who has similar characteristics and takes one year of private tutoring benefits by 0.2 standard deviations, according to the IV estimates. This pattern is the same in the OLS and PSM methods. Therefore, it is evident that benefits become larger as students continue taking private tutoring.

The results also suggest that among the three years of middle school, on average, taking private tutoring in grade 7 is most effective in raising average achievement, according to the results of single-year effects. Taking tutoring in grade 7 increases overall achievement by 0.53 in grade 7, 0.33 in grade 8, and 0.22 in grade 9 based on the IV estimation. The PSM estimation shows 0.21 in grade 7, 0.19 in grade 8, and 0.12 in grade 9, which imply the effects of tutoring in grade 7. The sizes of these estimates are bigger than the ones for the effects of tutoring in grades 8 and 9. This result indicates that understanding the basics covered in the first grade in middle school is crucial to understanding advanced curriculum covered in upper grades. Another interpretation of this result would be that learning-in-advance in grade 7 seems important to succeed in schools. As mentioned in Section 3.3 in Chapter III, it is common in *hakwon* for students to learn materials that will be taught in formal schools in advance. This argument seems also convincing because if students listen to lectures in schools after having been exposed to the content already, it would take less time for them to fully understand compared to those who learn them for the first time in schools.

Separate analyses by academic subject during middle school also suggest several conclusions. The results of verbal tutoring are especially striking because verbal subject is one of the popular subjects for private tutoring. As the results suggest, verbal tutoring is not statistically significant in explaining verbal achievement in any grades. This also means that there is no statistical difference between a student with verbal tutoring and a student with formal schooling only. This ineffectiveness of verbal tutoring may be explained by the pedagogy of verbal tutoring. Verbal tutoring is mostly designed to practice analytical reading using various literatures chosen by tutors. However, instead of covering each literature as a whole, an excerpt of each piece of literature is used to cover as many literatures as possible. From the author's experience, therefore, verbal tutoring places more importance on quantity of materials rather than quality of instruction. This aspect of verbal tutoring may explain why it does not play a significant effect on verbal achievement.

As opposed to verbal tutoring, English and math tutoring show significant and positive effects on English and math achievement in middle school. Taking three years of English and math tutoring increases English and math achievement in grade 9 by 0.41 and 0.46 standard deviations, respectively, according to the OLS estimates. These OLS estimates are similar to the PSM results. However, the IV estimates suggest that it contributes to English and math achievement by 1.06 and 0.88 standard deviations, respectively. Similar to the results from overall private tutoring, having English tutoring in grade 7 is the most effective in increasing achievement in middle school based on the IV estimates; English tutoring in grade 7 raises English achievement by 0.67 in grade 7, 0.46 in grade 8, and 0.49 in grade 9. Even though the OLS and PSM estimates are smaller than the IV estimates, the effect sizes are larger than the ones for English tutoring in grades 8 and 9. In addition, according to the IV and PSM results, the

effects of English tutoring in grades 8 and 9 on English achievement in grade 9 are none or minimal. It means that English tutoring in grades 8 and 9 does not largely contribute to students' English achievement in grade 9, which is critical for success in high school. In the situation where about 61 percent of total middle school students report that they take English tutoring, according to the national statistics, this result is quite striking because it implies that many parents spend so much money without reaping large benefits from it. Fortunately, math tutoring is more promising than English tutoring. Math tutoring in both grades 7 and 8 is beneficial to students' math achievement in middle school. Unlike English tutoring, however, taking math tutoring in grade 8 is most effective in raising math achievement followed by math tutoring in grade 7. Math tutoring in grade 9 is not effective like English tutoring, according to the IV estimate, whereas the OLS and PSM methods suggest that math tutoring in grade 9 is also effective. These results also imply that understanding the contents in English and math covered in early grades in middle school is important for understanding advanced contents in the later grades in middle school. In addition, the instructional strategy of English and math tutoring, which is mostly drill and practice, seems to be effective in generating higher scores on the tests.

The less significant long-term effects of middle school tutoring on the university entrance examination also need to be discussed. There are no positive and significant effects of private tutoring in middle school on the CSAT except for English tutoring. Especially, overall participation in private tutoring does not show any effect on the CSAT, which is surprising. The ultimate goal of Korean parents who spend money on private tutoring in middle school is for their child to succeed in high-stakes tests such as the CSAT, which is closely related to their child's future success in Korea. Existing Korean literature also claims that private tutoring at the middle school level is not only for improving school grades, but for the long-term development

of academic competence for admission to prestigious universities (Kim, Kang, Park, Lee & Hwang, 2006). In addition, even though the contents of private tutoring in middle school are not aligned specifically with curriculum contents in high school, which the CSAT usually tests, curriculum in middle school provides the foundations of curriculum in high school. Therefore, it is unexpected to find a lack of measurable effectiveness of middle school private tutoring on the CSAT. It also implies that the CSAT does not place much attention on fundamental knowledge that is learned in middle school and it requires advanced knowledge to succeed on the CSAT instead.

However, English tutoring follows the authors' expectation; three years of English tutoring in middle school raises 1.23 deciles on the CSAT English scores. This is a huge effect that can influence admission to universities. Since the KEDI tests were not administered during high school years, it is impossible to observe the effect of middle school tutoring on academic achievement during high school years in these analyses. However, even though the OLS and PSM estimates do not show significant effects, it is still noteworthy that the effects of English tutoring in middle school last longer than the effects of verbal and math tutoring.

As opposed to middle school tutoring, the OLS results suggest that high school tutoring seems effective on CSAT achievement. This positive and significant effect of tutoring in high school on the CSAT may be explained by the characteristics of high school tutoring. Unlike middle school tutoring, tutoring during high school is more focused on preparing for the CSAT (Lee, Park & Lee, 2009). In addition, curriculum in high school is more tightly linked to what the CSAT measures than curriculum in middle school. However, the IV and PSM estimates do not show similar results, which bring concerns about the accuracy of the OLS estimates. When observing the effects by academic subject, only math tutoring in grades 11 and 12 shows

consistently significant effects on the CSAT math achievement. Taking two and three years of math tutoring raise math achievement on the CSAT by about 1 decile, and math tutoring in grades 11 and 12 increases math score on the CSAT by about 0.4-0.6 deciles, which are quite large. However, this large effectiveness of math tutoring also raises concerns about math education in formal schools. It can be posited that math education in formal schools does not successfully prepare students to achieve high scores on the CSAT. Another perspective on this is that a student having math education only in formal schools cannot excel a student with math tutoring. This argument is connected to the existing literature on private tutoring, which claim the ineffectiveness of formal education and unmet needs of students and parents from formal education (Kim & Lee, 2010; Chun et al., 2003; Kim, 2004). Lee and Hong (2001) argued that this is due to the rigidity of the formal school system in Korea caused by the government's heavy regulation and strict control. In addition, Lee, Park, and Lee (2009) claimed that parents believe that succeeding on the CSAT for entrance to a university is not possible without private tutoring. Therefore, as the effect of high school tutoring on the CSAT becomes larger, it might be considered as a possible evidence that formal education is ineffective. In the last chapter, based on these results and upcoming results obtained from the analyses below, I will provide further implications for policy makers in education.

This chapter investigated the effect of private tutoring on students' academic achievement in various ways. In the next chapter, I will explore how private tutoring affects the learning environment in formal schooling by using the degree of students' attention to lessons in schools. This analysis will provide implications of a larger influence of private tutoring not only on students, but also on formal schooling.

CHAPTER V. THE IMPACT ON FORMAL SCHOOLING

The second part of the analysis focuses on the impact of private tutoring on formal schooling. In many studies, the quality of formal schooling is often regarded as one of the important determinants or causes of taking private tutoring (Kim & Lee, 2010; Buchmann, 1999; Silova & Bray, 2006). Especially, Silova and Bray (2006) argued that the ineffectiveness of the public school education provision is found as one of the main determinants of private tutoring. However, other studies perceive private tutoring as influencing the quality of formal schooling. For example, tutoring can cause a great lack of interest and attention to lessons in formal schools on the part of students because they have already covered the topics with tutors (Hussein, 1987; Nanayakkara & Ranaweera, 1994; Sawada & Kobayashi, 1986). This is a serious issue for teachers and schools because as more students lose interest in school lessons due to private tutoring, it dilutes the learning environment of the classroom, which directly affects the quality of schooling and students' academic performance. Even though there are a few qualitative studies that deal with this issue, researchers have not paid much attention to this in a quantitative way. Therefore, it is not statistically proven whether private tutoring negatively or positively affects the quality of formal schooling. To fill this gap in research, this chapter focuses on the influence of private tutoring on the quality of formal schooling. This study is designed to answer the following research question.

> *Does private tutoring influence students' behavior in formal schools that affect the learning environment in schools? In particular, how is participation in private tutoring associated with students' attention to lessons in schools?*

As a proxy for measuring the learning environment in schools, the degree of students' attention to lessons is chosen as a dependent variable. As expected, the estimation of the effects of private tutoring on the learning environment in formal schooling is also subject to an endogeneity problem. The possible source of endogeneity would be reverse causality. The reverse causality means that private tutoring could affect the quality of the learning environment in formal schooling, and this quality could reversely affect the participation of private tutoring. In other words, if students are not satisfied with formal schooling due to the unproductive learning environment, they would tend to find supplementary education such as private tutoring, to satisfy their desire to learn. This reverse causality would create a problem in measuring the causal relationship between private tutoring and the quality of formal schooling. I tested this reverse causality by using school fixed effects to compare estimates with or without school fixed effects. The estimates presented in the section of empirical results are very similar to the estimates with school fixed effects (results are not reported in the text). This implies that school characteristics do not play significant roles in estimation, which also implies that reverse causality is not a serious issue in this study. Having this threat of endogeneity bias, two quasi-experimental methods are introduced: Propensity Score Matching and Difference-in-Differences.

5.1 Estimation Models

The main purpose of this section is to observe whether there is any effect of private tutoring on students' attention to lessons in formal schools. I began the analysis by conducting the Ordered Logit estimation.

(5.1) $$ATTN_{ij} = \alpha_0 + \alpha_1 * PT_{ij} + \alpha_k * X_{ij,k} + \varepsilon_{ij}$$

where $ATTN_{ij}$ is the degree of student *i*' attention to lessons in grade *j*, which is a categorical variable, PT is a private tutoring variable, and $X_{ij,k}$ is a vector of covariates that indicate student *i*'s family, school, and regional characteristics in grade *j*. There is a more detailed description about how the dependent variable and covariates were constructed in the next section of description of variables. In this equation, α_1 is a coefficient of interest that indicates the effect of taking private tutoring on students' attention to lessons after controlling for the students' background characteristics. However, α_1 tends to be biased in the linear estimation because the dependent variable can affect the independent variable, which is the participation in private tutoring (reverse causality). In addition, as explained in Chapter I, students who take private tutoring tend to have different unobserved characteristics from those who do not. These unobserved variables could also affect the dependent variable (attention to lessons in formal schools). This complication will make the estimate of the tutoring effect biased. In this context, one of the popular approaches includes Propensity Score Matching (Rosenbaum & Rubin, 1983).

5.1.1 Propensity Score Matching

Propensity Score Matching (PSM) is one of the quasi-experimental methods, which is used with observational data in order to detect a causal mechanism. In PSM, rather than controlling for all the covariates in $X_{i,k}$, students in a treatment group (i.e., students who participate in private tutoring) are matched with students in a control group (i.e., students who do not participate in private tutoring) using the propensity score, e(X), which is a numerical summary of $X_{i,k}$. We can estimate e(X) by using logistic or probit regression where the dependent variable is the treatment (a dichotomous variable that indicates participation in private tutoring) and the predictors are all confounding covariates. In the process of matching, a simple

one-to-one nearest neighbor matching with replacement is used among various types of matching (Dehejia & Wahba, 2002). In this method, each treatment unit can be matched to the nearest comparison unit, even if a comparison unit is matched more than once. Researchers claim that this method helps in reducing the bias because it minimizes the propensity score distance between the treatment unit and the matched comparison unit. Using this method of matching, I constructed a counterfactual to measure the outcome (i.e., the degree of students' attention to lessons in formal schools) that students would have obtained, had they not participated in private tutoring.

(5.2) $e(X) = Pr(PT_i=1|X_{i,k})$

This propensity score, e(X), is a predicted probability for each person that receives the treatment. Using these two groups that are similar in various ways except for the treatment (the participation in private tutoring), the mean of the dependent variable (i.e., the degree of attention to lessons in formal schools) for a treatment group is compared to the one for a control group to observe the treatment effect. This effect is called the average treatment effect on the treated (ATT). The mathematical representation of difference-in-means in PSM is as follows.

(5.3) $\tau = E[Y(1)|Z=1,e(X)] - E[Y(0)|Z=0,e(X)] = \overline{Y}_{Z=1,e(X)} - \overline{Y}_{Z=0,e(X)}$

where τ is the treatment effect. In addition to this method of difference-in-means, I also conducted the regression-adjusted matched estimation, which is running a regression of outcome on the treatment indicator and confounding covariates using weights to construct the sample to

represent matched group. The regression-adjusted matched estimation also provides a sensitivity check for estimates obtained from the difference-in-means.

Two estimation methods derive τ, which is the average treatment effect on the treated. Specifically, τ measures the effects of private tutoring on the degree of attention to school lessons of students who participated in private tutoring. By constructing the counterfactual group by matching, I compared the mean of the degree of attention to lessons of the treated group with the one of the control group. This effect provides an overall picture on the average effect of private tutoring on students' attention to lessons in the absence of explaining the effect within each ability group. The effect of private tutoring for high-achieving students may be different from the one for low-achieving students. To uncover the differential effects of private tutoring by ability group, I observed the effect by each subgroup of students. I constructed three subgroups of students using students' academic standing.

It should be noted that correctly calculating standard errors in PSM is a problem for several reasons. After matching, the observations are no longer independent of each other even with regular matching. In other words, if there are correlations between matched pairs, standard errors are subject to be biased. In addition, matching with replacement creates the additional complication of including some units multiple times. In order to correct for standard errors, standard errors are calculated by bootstrapping with 1,000 replications.

However, PSM also bears methodological drawbacks that should be stated explicitly. Several researchers have criticized that this method still has potential problems that are caused by unobserved variables because only observed characteristics of the sample are used in the process of matching (Michalopoulos, Bloom & Hill, 2004). In addition, the method is sensitive to choices of confounding covariates to calculate propensity score, e(X). Even though this

method carries these methodological disadvantages, it can help reduce large biases compared to Ordered Logit.

5.1.2 Difference-in-Differences Estimation

Another method to observe the effect of private tutoring on students' attention to lessons in formal schools is the difference-in-differences (DID) estimation using a natural experiment. The natural experiment is that the Seoul metropolitan government enacted the regulation in 2008 that prohibits late instruction in *hakwon* located in Seoul after 10 pm (Kim & Chang, 2010). The Seoul metropolitan government enacted this regulation to aim at reducing excessive participation in private tutoring and to secure students' time for sleeping and resting. According to the KNSO's national statistics, the participation rate had decreased by about 2 percent from 2007 to 2008 as shown in Table 3. Therefore, the DID estimation is used to investigate how the reduction in private tutoring caused by the regulation affects students' attention to lessons. The underlying assumption here is that regulating late instruction at *hakwon* actually reduces the participation rate in private tutoring. The national statistics showed the actual decrease in the participation rate from 2007 to 2008. In addition, Kim and Chang (2010) also found that this governmental law that regulates the operating hours of *hakwon* contributed to a decrease in tutoring hours. However, there may be violations of the law by tutors or *hakwon* that do not follow the regulation, which is unlikely to be reported in the national statistics. Although this national experiment has potential problems of illegal practices, it is reasonable to say that the absolute amount of time that students spend and the participation rate on private tutoring has decreased after the regulation. However, even though reducing a few hours a week may not have much of an effect on the degree of attention to lessons, it is meaningful to investigate the effect

of this regulation because it has had quite a large influence on the tutoring market and reducing students' participation in tutoring.

Using this regulation as an "exogenous" shock that acts like a treatment, the DID estimation compares the dependent variable of students who live in the treated city (i.e., Seoul) with one of the students who live in another metropolitan city similar to Seoul before and after the regulation was enforced. However, in the KELS data, the sample size for students who live in another metropolitan city similar to Seoul, such as Gyeonggi or Busan, is very small. Instead of using a small sample as a control group, I used the representative sample of students who live in six metropolitan cities[16] in Korea. In the KELS, the "pre-regulation" period is denoted as the first, second, and third year of the survey covering the period 2005, 2006, and 2007, and the "post-regulation" period is denoted as fourth, fifth, and sixth year of the survey covering the period 2008, 2009, and 2010. In this analysis, the difference in outcomes between Seoul and other metropolitan cities in 2007 (year 0) is compared with the one in 2008 (year 1), 2009 (year 2) and 2010 (year 3) using the equation below.

$$(5.4) \quad ATTN_{it} = \alpha_{0t} + a_1 * SEOUL_{it} + a_k * X_{kit} + u_{it}, \quad t = 0, 1, 2, 3$$

$ATTN_{it}$ is the dependent variable that indicates the degree of student *i*'s attention to lessons in formal schools, and $SEOUL_{it}$ is a binary indicator whether student *i* lives in Seoul at time *t*. X_{kit} is a vector of students' characteristics in family, school, and region, and u_{it} is the idiosyncratic error. The coefficient a_1 is the treatment effect. Since the KELS data is individual-level longitudinal data, I observed the same students over time unlike the cross-sectional data

[16] There are 6 other metropolitan cities in Korea: Busan, Daegu, Incheon, Gwangju, Daejeon, and Ulsan metropolitan cities.

that has several cohorts of students. Using equation 5.4, I subtracted the results in year 0 from the ones in year 1, year 2, or year 3 in order to obtain a_1 as follows.

(5.5) $\Delta ATTN_i = \Delta a_0 + a_1 * \Delta SEOUL_i + a_k * \Delta X_{ki} + \Delta u_i$

In addition to the average effect, heterogeneous effects are also observed using three subgroups of students, constructed by academic achievement. These heterogeneous effects provide a detailed picture of the effect of this regulation by ability group.

5.2 Variables

Dependent variables. As a dependent variable, a variable indicating the degree of students' attention to lessons in formal schools (ATTN) is selected as a proxy for measuring the quality of formal schooling. This variable is reported by a student's homeroom teacher in each grade. The actual question is *"How much does this student pay attention to lessons in school?"* This variable consists of five categories (1=having attention to a lesson less than 10 minutes; 2=11-20 minutes; 3=21-30 minutes; 4=31-40 minutes; 5=more than 40 minutes). Therefore, this is a teacher perception of the attention span of a student. I transformed the dependent variables into z-scored measures to interpret estimates in a standardized unit. However, this teacher-reported measure of students' attention to lessons tends to be subjective because it is only a teacher's perception of about 40 students in a classroom without clear criteria to measure their level of attention. Therefore, this measure has limitation on its accuracy in measuring the actual attention span of a student.

Treatment variables. Same as the first analysis, treatment variables are a set of dichotomous variables taking the value 1 if a student participates in any form of private tutoring,

0 otherwise. This variable is measured in each grade by parents (G7PT, G8PT, G9PT, G10PT, G11PT, and G12PT).

Control variables. To control for observed differences between treatment and control groups, I included various explanatory variables in a vector X. The first set of controls include student and family characteristics: 1) gender of a student taking the value 1 if a student is female, 0 male (GENDER); 2) household monthly income in the unit of 10,000 Korean Won, which is approximately 10 USD (HINCOME); 3) father's education level, which consists of seven categories (DADEDU; 1=less than elementary school, 2=middle school graduate, 3=high school graduate; 4=two-year college graduate; 5=Bachelor's degree; 6= Master's degree; 7=Ph.D degree); 4) parental academic aspiration for their children (PARASPIRE), which indicates parents' expectation on their children's final educational level, that is a categorical variable with seven categories as DADEDU; 5) students' academic motivation (ACAMOTIV), which indicates students' plan for final educational level in the future, that also have the same seven categories as DADEDU and ACAMOTIV. 6) Students' verbal, English, and math scores in the KEDI tests during middle school years are also used to control for students' previous academic ability (VER_S, ENG_S, and MAT_S). As school characteristics, similar to the first analysis, there are three variables: 1) type of school that a student attends taking the value 1 if a school is private, 0 public (SCH_TYPE); 2) high school track taking the value 1 if a high school follows general track, 0 if a high school follows a technical track (SCH_TRACK); 3) student-teacher ratio as a proxy for education quality (ST_RATIO) by subtracting the total number of students by the total number of teaching faculty in a school. The last set of controls contain regional characteristics; 1) urban residence taking the value 1 if a student lives in urban area, 0 otherwise (URBAN); 2) district with a school choice scheme taking the value 1 if a student lives in a

district where he or she could choose a school; 0 if a student is randomly assigned to a school affected by the School Equalization policy (SCH_CHOICE); 3) residence in Seoul taking the value 1 if a student lives in Seoul, 0 otherwise (SEOUL). Except GENDER and DADEDU, all of the variables are measured in each grade as shown in Table 45.

5.3 Estimation and Results

5.3.1 Descriptive Statistics

Tables 45 and 46 present descriptive statistics of the control variables and the dependent variables, respectively. Male students are more likely to take private tutoring than female students; 54 percent of students in the group of students who participate in private tutoring (treated group) are male, while 48 percent of students in the group without private tutoring (control group) are male students. Households of students with private tutoring, on average, have much higher monthly income than households of students with no private tutoring. The difference at most is about 1,880,000 Won, which is approximately equivalent to 1,880 USD for students in grade 11. Fathers of students taking private tutoring have slightly higher educational levels than fathers of students without private tutoring. As the existing literature claimed, parents who support their children with private tutoring tend to have a higher academic aspiration for their children and, as expected, a similar pattern is observed in terms of students' academic motivation. In terms of academic achievement in verbal, English, and math, students who take private tutoring, on average, show higher achievement than those who do not take tutoring. Students with private tutoring score higher by about 8 raw scores in verbal, and 17 raw scores in English and math compared to students without private tutoring.

In terms of school characteristics, students assisted by private tutoring are more likely to attend a school that follows a general track, attend private schools, and come from a school that has a higher student-teacher ratio. Specifically, more than 80 percent of students who take private tutoring attend schools that follow a general track, while about half of students who do not take tutoring do so. There are no statistically significant differences in school type during middle school in grades 7, 8, and 9, but the difference is significant during the high school years. On average, schools with students who take tutoring have about two students more per teacher compared to schools with students who do not take tutoring.

Regarding regional characteristics, students who receive private tutoring are more likely to live in urban areas than students who do not receive tutoring. About half of students in the treated group report that they live in an urban area, whereas only about two-fifths of students in the control group report as such. Students in the treated group are less likely to live in a district with a school choice scheme than students in the control group; only 35 percent of students who receive private tutoring have the freedom to choose their high school, but about half of students who do not receive tutoring have it. This implies that if students do not have a choice in schools, they are more likely to take tutoring as a choice. Lastly, students who take tutoring are more likely to live in Seoul than those who do not.

Table 46 presents summary statistics of the dependent variables used in the analysis. Except for grade 7, students with private tutoring show a higher degree of attention to lessons in formal schools than those without tutoring. Among seventh graders, the difference between students in the treatment and control groups is not statistically significant. The overall findings suggest that tutoring may reduce attention to classroom instruction, but we need to survey this result through the full statistical equations.

As already explained in Table 18 in the first analysis, during middle school years, more than 70 percent of students reported that they received private tutoring. However, the participation rate decreases after students enter high school; 68 percent in grade 10, 59 percent in grade 11, and 35 percent in grade 12 reported that they currently received private tutoring. This pattern is similar to the national statistics shown in Table 3.

Table 45. Descriptive statistics of control variables

Variables	Description	Private Tutoring		Difference	t-value[3]
		yes[1]	no[2]		
Student and Family Characteristics					
Gender	1=female; 0=male	0.46	0.52	-0.06	-3.78
Household's Income (unit=10,000 KRW, approximately 10 USD)					
G7HINCOME	Household's monthly income in grade 7	385.50	265.80	119.70	16.33
G8HINCOME	Household's monthly income in grade 8	383.16	246.01	137.15	17.91
G9HINCOME	Household's monthly income in grade 9	493.61	310.69	182.92	7.87
G10HINCOME	Household's monthly income in grade 10	485.23	304.95	180.28	10.09
G11HINCOME	Household's monthly income in grade 11	489.57	301.55	188.02	10.67
G12HINCOME	Household's monthly income in grade 12	464.36	312.82	151.54	11.91
Father's Education					
dadedu	Father's education level (categorical 1/7)	3.86	3.24	0.62	16.70
Parent's Academic Aspiration for their children (categorical)					
g7paraspire	Parents' plan for child's future education level in G7	4.66	4.26	0.40	13.51
g8paraspire	Parents' plan for child's future education level in G8	4.62	4.11	0.51	17.74
g9paraspire	Parents' plan for child's future education level in G9	4.54	4.00	0.54	17.85
g10paraspire	Parents' plan for child's future education level in G10	3.52	3.04	0.48	19.13
g11paraspire	Parents' plan for child's future education level in G11	3.45	3.01	0.44	18.63
g12paraspire	Parents' plan for child's future education level in G12	3.54	3.08	0.46	18.20
Student's Academic Motivation (categorical)					
g7acamotiv	plans for education level in the future in grade 7	4.21	3.93	0.28	9.45
g8acamotiv	plans for education level in the future in grade 8	4.16	3.82	0.34	12.28
g9acamotiv	plans for education level in the future in grade 9	4.24	3.82	0.42	14.42
g10acamotiv	plans for education level in the future in grade 10	3.21	2.79	0.42	17.51
g11acamotiv	plans for education level in the future in grade 11	3.25	2.80	0.45	19.79
g12acamotiv	plans for education level in the future in grade 12	3.35	2.90	0.45	17.64
Verbal Achievement					
G7VER_S	KEDI test: Verbal score in grade 7	67.96	60.47	7.49	13.52
G8VER_S	KEDI test: Verbal score in grade 8	61.79	52.88	8.91	15.56
G9VER_S	KEDI test: Verbal score in grade 9	59.07	49.58	9.49	13.89
English Achievement					
G7ENG_S	KEDI test: English score in grade 7	60.62	45.42	15.20	22.70
G8ENG_S	KEDI test: English score in grade 8	59.84	42.71	17.13	23.71
G9ENG_S	KEDI test: English score in grade 9	58.19	39.46	18.73	22.32
Math Achievement					
G7MAT_S	KEDI test: Math score in grade 7	62.65	46.80	15.85	22.51
G8MAT_S	KEDI test: Math score in grade 8	54.90	38.21	16.69	23.02
G9MAT_S	KEDI test: Math score in grade 9	55.78	36.50	19.28	24.12

Variables	Description	Private Tutoring yes[1]	Private Tutoring no[2]	Difference	t-value[3]
School Characteristics					
High School Track (1=general; 0=technical)					
g10track	school track in grade 10	0.85	0.49	0.36	32.38
g11track	school track in grade 11	0.87	0.57	0.30	27.66
g12track	school track in grade 12	0.92	0.67	0.25	20.76
School Type (1=private; 0=public)					
g7sch_type	school type in grade 7	0.20	0.18	0.02	1.56
g8sch_type	school type in grade 8	0.20	0.20	0.00	0.15
g9sch_type	school type in grade 9	0.20	0.20	0.00	0.38
g10sch_type	school type in grade 10	0.49	0.44	0.05	3.36
g11sch_type	school type in grade 11	0.50	0.45	0.05	3.82
g12sch_type	school type in grade 12	0.51	0.46	0.06	3.90
Student-Teacher Ratio					
g7STratio	# of students/# of teachers in grade 7	20.74	19.16	1.58	11.44
g8STratio	# of students/# of teachers in grade 8	20.75	18.82	1.93	14.22
g9STratio	# of students/# of teachers in grade 9	20.50	18.57	1.93	13.90
g10STratio	# of students/# of teachers in grade 10	16.40	14.75	1.65	21.43
g11STratio	# of students/# of teachers in grade 11	16.40	14.75	1.65	21.43
g12STratio	# of students/# of teachers in grade 12	16.87	15.23	1.64	20.50
Regional Characteristics					
Urbanicity (1=urban; 0=suburban or rural)					
g7urban	Urban residency in grade 7	0.49	0.36	0.13	8.53
g8urban	Urban residency in grade 8	0.49	0.36	0.13	8.82
g9urban	Urban residency in grade 9	0.48	0.37	0.11	7.10
g10urban	Urban residency in grade 10	0.49	0.37	0.12	9.35
g11urban	Urban residency in grade 11	0.51	0.39	0.12	8.85
g12urban	Urban residency in grade 12	0.58	0.41	0.16	11.47
School Choice (1=choice; 0=no choice)					
g7choice	Residence with a school choice scheme in grade 7	0.35	0.49	-0.14	-9.49
g8choice	Residence with a school choice scheme in grade 8	0.35	0.50	-0.14	-9.72
g9choice	Residence with a school choice scheme in grade 9	0.37	0.49	-0.13	-8.03
g10choice	Residence with a school choice scheme in grade 10	0.35	0.49	-0.14	-11.00
g11choice	Residence with a school choice scheme in grade 11	0.33	0.46	-0.12	-9.36
g12choice	Residence with a school choice scheme in grade 12	0.28	0.46	-0.18	-13.08
Residence in Seoul (1=Seoul; 0=non-Seoul)					
g7seoul	Residence in Seoul in grade 7	0.19	0.12	0.07	6.85
g8seoul	Residence in Seoul in grade 8	0.19	0.12	0.07	6.10
g9seoul	Residence in Seoul in grade 9	0.19	0.13	0.06	4.83
g10seoul	Residence in Seoul in grade 10	0.19	0.13	0.06	6.53
g11seoul	Residence in Seoul in grade 11	0.21	0.12	0.09	8.40
g12seoul	Residence in Seoul in grade 12	0.26	0.12	0.14	13.19

[1] N=4,884 (7th); 4,904 (8th); 3,651 (9th); 4,256 (10th); 3,370 (11th); 1,897 (12th)
[2] N=1,341 (7th); 1,381 (8th); 1,333 (9th); 1,952 (10th); 2,294 (11th); 3,487 (12th)
[3] t-value for [diff= mean(1) - mean(0)]

Table 46. Descriptive statistics of dependent variables

Variables		Average	Standard Deviation	Private Tutoring		Difference	t-value[3]
				yes[1]	no[2]		
Dependent Variables (categorical: 1-5)							
G7ATTN	Degree of attention to lessons in grade 7	4.15	1.02	4.15	4.16	-0.01	-0.36
G8ATTN	Degree of attention to lessons in grade 8	4.09	1.06	4.22	3.74	0.47	14.47
G9ATTN	Degree of attention to lessons in grade 9	3.97	1.12	4.09	3.54	0.55	15.15
G10ATTN	Degree of attention to lessons in grade 10	3.97	1.01	4.09	3.73	0.36	13.18
G11ATTN	Degree of attention to lessons in grade 11	3.48	1.01	3.58	3.31	0.26	9.42
G12ATTN	Degree of attention to lessons in grade 12	3.54	0.98	3.70	3.46	0.24	8.59

[1] N=4,884 (7th); 4,904 (8th); 3,651 (9th); 4,256 (10th); 3,370 (11th); 1,897 (12th)
[2] N=1,341 (7th); 1,381 (8th); 1,333 (9th); 1,952 (10th); 2,294 (11th); 3,487 (12th)
[3] t-value for [diff= mean(1) - mean(0)]

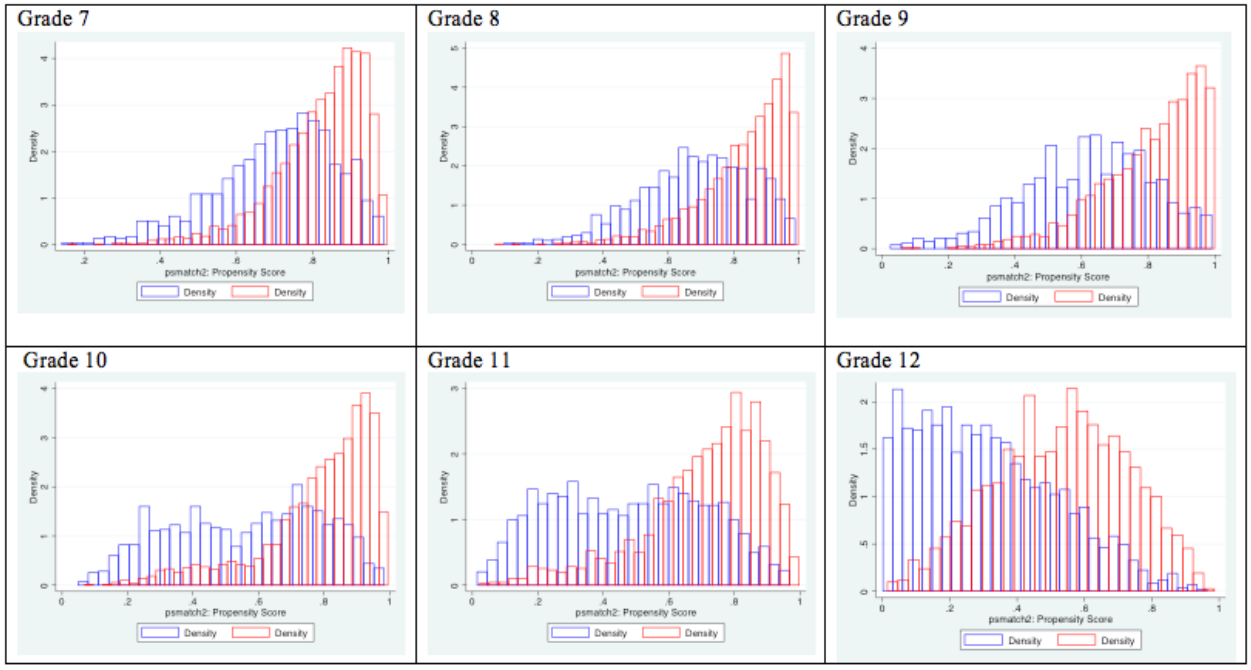
5.3.2 Diagnostics for Propensity Score Matching

After matching, there are two concerns to check for in validating subsequent analyses. The first diagnostic is to check whether there is a sufficient overlap between the treatment and control groups. It's also called a common support between the two groups. If these two groups do not overlap or overlap insufficiently, I may surmise that the people are in the different specifications of covariates or I may not be able to proceed with further analyses, at worst. By plotting the histograms for the propensity scores of both groups, I can compare and check the overlap between the two groups. Figure 4 presents the histograms for each grade. The red histograms show the distribution of propensity scores for the treatment group, and blue histograms indicate the control group. According to the histograms in Figure 4, there seems to be a sufficient overlap between the red and blue histograms in each grade level. However, six sets of histograms commonly indicate that there are insufficient overlaps in the right end (students who have high propensity scores). After many trials to seek a common overlap for those with high propensity scores, I was unsuccessful in obtaining sufficient commonality between the treated and untreated groups.

The second diagnostic is to examine the balance between the treatment and control groups using the *psbal* command in STATA. This command allows checking for balances in means and standard deviations using both the unmatched and matched sample between the treatment and control groups. In order to reach a better balance, I transformed several variables; I added square terms for score variables and several interaction terms, and used the logarithm of household income. I also removed variables that seemed less important with regard to the outcome variable. The covariates listed in Table G in Appendix are the final model specifications that reached the best balance. Compared to the balance using unmatched datasets,

balances in means and standard deviations are improved after matching. The balance diagnostics are available from Table G.1 to G.6 in Appendix. Based on these two diagnostics, subsequent analyses using these matched samples are justified.

Figure 4. Common support between the treatment and control groups



5.3.3 Empirical Results

Average Effects

Table 47 is a truncated version of empirical results. Column 1 presents the empirical results obtained from the Ordered Logit estimation. First, private tutoring in grade 7 shows a negative association with students' attention to lessons in formal schools in grade 7. A student who receives private tutoring in grade 7 paid less attention to lessons in school by 0.08 standard deviations than a student who did not receive any private tutoring. However, this association is not statistically significant. Interesting patterns are shown in the complete table of results

available in Table H.1 in Appendix. As presented in column 2, students who live in urban areas, on average, were reported to pay less attention to lessons in schools compared with students who live in suburban or rural areas. As expected, motivated students paid more attention to lessons than less motivated peers. Also, students who lived in a district with a school choice scheme paid less attention to schools than those who have the freedom to choose their schools.

Table 47. Summary of estimates of the average effect of private tutoring on students' attention to lessons in formal schools

	(1)	(2)	(3)	N for PSM1
Dependent variable (z-score)	Ordered Logit	PSM1[a]	PSM2[b]	
ATTENTION in Grade 7	-0.08	0.01	0.01	4,916
	(0.080)	(0.057)	(0.056)	
ATTENTION in Grade 8	0.27**	0.17**	0.14**	4,984
	(0.083)	(0.059)	(0.053)	
ATTENTION in Grade 9	0.17*	0.05	0.06	3,552
	(0.086)	(0.071)	(0.056)	
ATTENTION in Grade 10	0.16*	0.07	0.09	3,618
	(0.078)	(0.071)	(0.051)	
ATTENTION in Grade 11	0.15*	0.07	0.10	3,672
	(0.070)	(0.059)	(0.054)	
ATTENTION in Grade 12	0.12	0.10	0.09	3,208
	(0.073)	(0.061)	(0.051)	

*** p<0.001, ** p<0.01, * p<0.05
Notes: (1) Complete table for Ordered Logit is provided in Table H's in Appendix; (2) [a] Difference-in-means; (3) [b] Regression-adjusted matched estimate

Unlike the estimate in grade 7, students with private tutoring in grade 8 showed a higher degree of attention to lessons by 0.27 standard deviations than students without private tutoring, and this estimate is statistically significant at the 1 percent level. In terms of the associations between covariates and the dependent variable in Table H.2 in Appendix, high-achieving students in verbal, English, and math pay more attention to lessons than low-achieving students, as expected. Female students pay more attention than male students, and students with parents who have higher academic aspiration for their children show higher attention to lessons than

students with parents who have less aspiration. Lastly, students in schools that have a higher student-teacher ratio pay less attention to lessons than those who attend schools with a lower student-teacher ratio. However, the association between school choice and students' attention is opposite to the results in Table H.1. In grade 8, students in an area with a school choice scheme demonstrate higher attention to lessons than their peers in an area with no school choice scheme.

It is also noticeable that the average effect of private tutoring on students' attention decreases as students move to upper grades as shown in column 1 of Table 47. In grades 9, 10, and 11, students who take private tutoring also show higher attention to lessons by 0.17, 0.16, and 0.15 compared to students without private tutoring. The magnitudes of these effects are smaller than the effect in grade 8, and these estimates are statistically significant at the 5 percent level. Furthermore, there is no statistical difference in the degree of attention to lessons between the treatment and control groups in grade 12. In summary for the estimates of Ordered Logit, private tutoring positively affects students' attention to school lessons, which is likely to affect the learning environment in formal schooling.

It must be noted that these are the estimates from Ordered Logit that are unadjusted for the endogeneity of private tutoring. Therefore, I applied PSM. As mentioned in the section of estimation models, PSM is designed to estimate the average treatment effect on the treated (ATT) within the common support region shown in Figure 4. In addition, the standard errors are calculated by bootstrapping with 1,000 replications for several reasons already mentioned. Column 2 in Table 47 presents the empirical results using difference-in-means in the PSM method. The results suggest that only taking private tutoring in grade 8 has positive effects on students' attention to school lessons. Students with private tutoring in grade 8 show a higher degree of attention by 0.17 standard deviations than students with no private tutoring. Compared

to the estimate in column 1, the effect size becomes smaller, but it is still statistically significant at the 1 percent level. However, the rest of estimates in column 2 are not statistically significant; there is no statistically significant effect of taking private tutoring on students' attention to lessons in grades 7, 9, 10, 11, and 12. In order to check whether estimates in difference-in-means are robust, I also applied the regression-adjusted matched estimation presented in column 3. Although the effect size of private tutoring effect in grade 8 is 0.14 standard deviations, which is slightly smaller than the one in column 2, the results in column 3 are consistent with the ones in column 2. In terms of the magnitude of the effect, 0.19 implies about a five percent change in the degree of attention to school lessons, which is a small change. However, if many students in a classroom improve their attention by five percent, that would change the overall learning environment in a visible way. Therefore, it should be considered as a sizable effect. At this point, it is questionable whether these results remain similar when I estimate the effect of private tutoring by ability group. Using three subgroups of ability group, differential effects are investigated.

Heterogeneous Effects

Using the same methodologies, the effect of private tutoring on students' attention to lessons in formal schools is observed for three ability groups as presented in Table 48. These three ability groups were constructed by making three subgroups using the KEDI scores measured in grade 7, which is a year prior to the regulation. Observing the effect for each group provides information on whether there are differential effects by ability group. In grade 7, there are no heterogeneous effects of private tutoring on students' attention to lessons, which is consistent with the average effect. In grade 8, the positive and significant effects are

concentrated in the lowest ability group. The OLS estimate for the low ability group indicates that taking private tutoring increases students' attention to lessons by 0.27 standard deviations after controlling for students' background characteristics. The estimates with the PSM methods are slightly smaller but consistent with the OLS estimate as shown in column 2 and 3 of Table 48, that taking private tutoring raises students' degree of attention to lessons by 0.22 and 0.20 standard deviations, respectively.

Table 48. Heterogeneous effects of private tutoring on students' attention to lessons in formal schools

	Group 1 (low ability)			Group 2 (medium ability)			Group 3 (high ability)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Outcomes	Ordered Logit	PSM1[a]	PSM2[b]	Ordered Logit	PSM1[a]	PSM2[b]	Ordered Logit	PSM1[a]	PSM2[b]
ATTENTION IN G7	-0.10	0.17	0.16	-0.10	-0.01	-0.03	-0.02	0.00	0.00
	(0.117)	(0.096)	(0.085)	(0.140)	(0.109)	(0.104)	(0.184)	(0.101)	(0.115)
ATTENTION IN G8	0.27*	0.22*	0.20*	0.22	0.06	0.07	0.32	0.07	0.09
	(0.121)	(0.101)	(0.099)	(0.139)	(0.091)	(0.073)	(0.208)	(0.094)	(0.092)
ATTENTION IN G9	0.19	0.36**	0.30**	0.23	0.10	0.11	-0.13	-0.09	-0.08
	(0.126)	(0.139)	(0.113)	(0.142)	(0.109)	(0.099)	(0.227)	(0.069)	(0.081)
ATTENTION IN G10	0.16	-0.01	0.02	0.15	0.28**	0.29**	0.18	0.10	0.12
	(0.123)	(0.139)	(0.093)	(0.124)	(0.104)	(0.083)	(0.178)	(0.170)	(0.113)
ATTENTION IN G11	0.04	0.30*	0.28**	0.01	-0.01	0.00	0.44***	0.11	0.15*
	(0.125)	(0.120)	(0.108)	(0.118)	(0.114)	(0.083)	(0.126)	(0.112)	(0.074)
ATTENTION IN G12	0.26	0.05	0.02	0.26*	0.12	0.12	-0.03	-0.02	0.00
	(0.162)	(0.164)	(0.131)	(0.127)	(0.105)	(0.081)	(0.111)	(0.088)	(0.066)

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Complete table for Ordered Logit is provided in Table H's in Appendix. (2) [a] Difference-in-means; (3) [b] Regression-adjusted matched estimate

However, there are no statistically significant differences between the treatment and control groups for the middle and highest ability groups in grade 8. A similar pattern is shown in grade 9. Positive and significant effects of private tutoring at the 1 percent level are detected

only in the lowest ability group. Although the OLS estimate is not statistically significant, estimates from the PSM method show that private tutoring increases attention of low-achieving students by 0.36 standard deviations based on the results from difference-in-means. The regression-adjusted matched estimate is 0.30, which is smaller but still statistically significant at the 1 percent level. The effects for the middle and upper groups are not statistically significant, similar to the results in grade 8. When I averaged out the estimates for all groups, the average effect should be insignificant as shown in Table 47. In grade 10, private tutoring is effective in raising attention of students in the middle group only. An increase of about 0.3 in the degree of attention is found for students who received private tutoring. In grade 11, the effect is detected in the lowest ability group, according to the PSM estimates. Even though the regression-adjusted matched estimate for the highest ability group (0.15) is statistically significant at the 5 percent level, this result is not robust because the estimate from difference-in-means in column 8 is not significant. Similar to the average effect in grade 12, there are no heterogeneous effects detected in grade 12. In summary, the significant effects are investigated in either the lowest or middle groups, but mostly in the lowest group. Therefore, mostly low-achieving students are positively affected by private tutoring on their attention to lessons, which would improve the learning environment in classrooms.

Effect of Regulation on Private Tutoring

As another way to estimate the effect of private tutoring on students' attention to lessons in formal schools, I used a natural experiment, which is the regulatory enactment on late private tutoring in Seoul. This analysis observes the effects of the regulation on students' attention using the DID method employing the same dependent and control variables shown in the previous analyses with PSM. As column 2 of Table 49 shows, in the first year after the regulation was

enacted, the difference in attention to lessons between students in Seoul and students in other metropolitan cities increased by 0.11 standard deviations, but this difference is not statistically significant. When this average estimate is disaggregated by three ability groups, the results suggest that the difference favoring students in Seoul increased by 0.46 for the highest ability group after one year of the regulation, and it is statistically significant at the 5 percent level. This can be interpreted that attention to lessons among students in the highest ability group in Seoul has increased after the regulation. Since this regulation is supposed to reduce students' time spent on private tutoring and reduce the participation in private tutoring nationally, this result also implies that the reduction in time spent on private tutoring increases the degree of attention of high-achieving students in classroom. This may also be a result of students getting more rest and sleep, which increases their energy in schools. There are no statistically significant results in the second and third year of the regulation.

As explained, only high-achieving students seem to be affected by this regulation. This phenomenon does not seem spurious because high achievers show higher participation in private tutoring than low achievers in Korea as the descriptive statistics show. Therefore, the group of high-achieving students is more subject to be affected by this regulation than the rest. As a result, on average, there is no statistically significant change in students' attention to lessons between Seoul and other metropolitan cities, but the decrease in demand for private tutoring due to the regulation positively affects high-achieving students in terms of their attention to lessons in classrooms.

Table 49. Difference-in-differences estimation: effect of the regulation on private tutoring on students' attention to lessons in formal schools

(Year 1)

	Average Effect		Heterogeneous Effect		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Empty	Full	Low	Middle	High
SEOUL	-0.02	0.11	0.06	-0.08	0.46*
	(0.075)	(0.110)	(0.205)	(0.184)	(0.192)
Covariates		Yes	Yes	Yes	Yes
Observations	2,500	1,342	342	468	532

Note: Dependent variable: chg_attention_yr1 (=G10ATTN-G9ATTN)

(Year 2)

	Average Effect		Heterogeneous Effect		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Empty	Full	Low	Middle	High
SEOUL	-0.03	0.11	0.05	0.01	0.28
	-0.079	-0.112	-0.218	-0.192	-0.186
Covariates		Yes	Yes	Yes	Yes
Observations	2283	1241	316	415	510

Note: Dependent variable: chg_attention_yr2 (=G11ATTN-G9ATTN)

(Year 3)

	Average Effect		Heterogeneous Effect		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Empty	Full	Low	Middle	High
SEOUL	0.01	-0.02	-0.21	-0.04	0.21
	(0.082)	(0.116)	(0.233)	(0.194)	(0.195)
Covariates		Yes	Yes	Yes	Yes
Observations	2,145	1,152	275	399	478

*** p<0.001, ** p<0.01, * p<0.05
Note: Dependent variable: chg_attention_yr3 (=G12ATTN-G9ATTN)

5.4 Discussion

The purpose of this part of the analysis is to explore the effect of private tutoring on formal schooling. To observe whether private tutoring indirectly affects formal schooling, I used students' attention to lessons in formal schools reported by teachers as a proxy for the quality of learning environment in formal schooling. Two methods were used to observe this causal relationship. First, by using PSM in order to take account of endogeneity bias that the Ordered

Logit estimation is prone to, I constructed a counterfactual and investigated the average treatment effect on the treated. Also, the heterogeneous effects by ability group were examined. In summary, private tutoring is statistically significant in explaining the quality of the learning environment in formal schooling explained by students' attention to lessons. Students who received private tutoring showed a higher degree of attention to lessons in formal schools compared to students who do not. But this positive and significant effect is detected in grade 8 only. This result implies that if there are many students in one classroom who are exposed to tutoring, those students will pay more attention to lessons, influencing the overall learning environment in a positive way. However, this finding runs counter to the conclusions of the existing literature. It is argued that tutoring can take away students' interest and attention to lessons in formal schools because they have already covered the topics with tutors (Hussein, 1987; Nanayakkara & Ranaweera, 1994; Sawada & Kobayashi, 1986). Furthermore, this positive effect could be much larger than estimated when the results in heterogeneous effects are taken into account as below.

As shown in Table 47, significant effect among the PSM estimates is detected in grade 8. However, when I narrowed down the analyses into three ability groups, positive effects were detected at other grade levels too. In grades 9, 10, and 11, positive effects of private tutoring on students' attention to lessons were shown in either the bottom or middle group. These positive effects were not identified when observing the average effect. The focal point of these results is that most of the positive effects are identified for the low ability group. In many cases, low-achieving students do not pay attention to lessons or disturb other students' studying, which undermines the academic learning environment. Therefore, it is often the case that the learning environment becomes more supportive as there are fewer low-achieving students in a classroom.

Since the empirical results in this chapter suggest that low-achieving students who have a high probability of diluting the learning environment in a classroom improve their behavior in a classroom when tutored, it is highly likely that the quality of the overall academic learning environment in formal schooling will be upgraded. Even though the size of effects may seem trivial, I believe that the actual effects would be much larger than shown in the estimation. Because if this small and positive change in students' attention to school lessons is aggregated by many students in a classroom, that would largely increase the quality of the learning environment in a classroom. Furthermore, the improved learning environment may have an effect in reducing the achievement gap between the low and high ability groups. Analysis in terms of the influence on achievement gap is going to be conducted in the next part of this study.

Lastly, using the regulation on late private tutoring, I explored the effect of the reduction in private tutoring on students' attention to lessons in formal schools. On average, the regulation did not influence the learning environment in classrooms. However, high-achieving students seem to be affected by the regulation. The results imply that as the time spent on private tutoring decreases due to the regulation, high-achieving students who live in Seoul pay more attention to lessons than before the regulation. Again, this may be due to more resting for students, which makes students more productive and motivated in schools. Therefore, the difference in the degree of attention between students in Seoul (under the regulation) and students in other metropolitan cities (not affected by the regulation) become larger after the regulation, whereas students in the low and middle groups are not affected by it. Based on these results, it can be concluded that this regulation is somewhat effective in increasing high-achieving students' attention to lessons in formal schools, but is not successful in improving the overall quality of the

learning environment in formal schooling because the behaviors of low- and average-achieving students are not affected.

Observing the heterogeneous effects of private tutoring on students' attention to lessons has generated questions on whether private tutoring actually creates heterogeneous effects on students' academic achievement that was not addressed in the first part of the study. In the next chapter, I will conduct further study to observe how private tutoring affects educational inequality in the Korean society.

CHAPTER VI. THE IMPACT ON EDUCATIONAL INEQUALITY

In the first and second parts of the empirical analyses, I investigated the effects of private tutoring on students' academic achievement and formal schooling. In this further analysis, I investigated the social consequences of private tutoring. As the existing literature has suggested, private tutoring has potential social consequences such as increased pressure on students (Tsukada, 1991; Wijetunge, 1994), alteration of social relationships among students (De Silva, 1994; Paiva et al., 1997; Russell, 1997), and the expansion of social inequalities (Bray, 1999; Dang, 2008; Jelani & Tan, 2012). Among these several social consequences, social inequality in education is the most controversial topic in Korea as well as other countries. Bray (1999) argued that private tutoring may create a mechanism that increases social inequality. Since most forms of private tutoring in Korea are more easily accessible to students from high-income families, it can create greater inequality in accessing supplementary education such as private tutoring that widens the achievement gap among income or ability groups. However, the existing literature that points out this possibility deriving from private tutoring is mostly speculative and anecdotal without quantitative evidence. Therefore, it has not been established by quantitative evidence whether and by how much private tutoring exacerbates or improves social inequality in education. Using the following research questions, I tried to uncover the relationship between private tutoring and educational inequality in Korea.

> *Does private tutoring exacerbate educational inequality? Are there heterogeneous effects of private tutoring on student academic achievement? For whom are private tutoring effects significant and how large might they be?*

To answer this research question, two forces that create an inequality of achievement due to tutoring need to be considered. One force is a differential amount of private tutoring by each quantile group. The other force is the inequality in the effectiveness of tutoring by quantile that this chapter mostly focuses on. It is the product of these two forces for each quantile that determine whether tutoring causes inequality in academic achievement. To observe the first force, I observed the percentage of students who participate in tutoring and the median amount of tutoring in each quantile group using the weekly hours spent on private tutoring. As shown in Table 50, in the case of private tutoring in middle school, students in the upper quantiles show a higher participation rate in private tutoring compared to students in the lower quantiles, as expected. However, the differences in percentages between quantiles are not dramatic. In terms of median weekly hours spent on private tutoring, however, there is about a six-hour difference between the bottom and top quantiles. Based on these statistics, it seems that inequality in the amount of private tutoring by quantile influences the inequality of achievement to some extent.

Table 50. Inequality in the amount of private tutoring in middle school by quantile group

	q10	q25	q50	q75	q90
Percentage of participants in PT (%)	48.3	55.5	50.1	61.3	65.1
Median weekly hours for PT (hours)	3	4.6	6	7.3	9

Using hours of private tutoring as a treatment variable, it seems possible to estimate how much this first force affects inequality in achievement. However, this study is only limited to observe the second force (effectiveness of private tutoring by quantile) due to data limitation. The variable of weekly tutoring hours in high school has a large number of missing observations,

which makes difficult to estimate the effects, while data on tutoring hours in middle school is available.

In order to observe how much the second force affects inequality in academic achievement, I applied Quantile Regression (QR) with the instrumental variable, which is also called a Two-Stage Least Absolute Deviation estimator (2SLAD), originally developed by Amemiya (1982). Since a simple QR uses linear regression at each quantile, which does not control for endogeneity of private tutoring, I used a QR framework by employing the 2SLAD method. In addition, I applied Propensity Score Subclassification, which enables to observe the difference between the matched groups in each subclass or strata. These three methods will help investigate the heterogeneous effects of private tutoring on students' academic achievement.

6.1 Estimation Models

Both the OLS and IV methods that were introduced in Chapter IV aimed to estimate the average causal effect of private tutoring on students' academic achievement. That is to say, most of the studies estimate the effects of a change in private tutoring on the achievement of the average individual in the sample being analyzed. The alternative QR approach goes further. It concerns itself not only with the efficiency of private tutoring on the average individual, but allows the researcher to estimate the marginal effect of private tutoring for individuals at different points in the achievement distribution. This makes it possible to assess the equity implications resulting from having private tutoring. Rather than estimating the effects of independent variables at the mean, the quantile estimator is designed to predict the effects of independent variables at different points (quantiles) in the conditional distribution of the dependent variables (i.e., student's achievement score). For this reason, the estimator has

become very attractive to researchers interested in determining the differential effects of regressors at varying points in the distribution of a dependent variable (Levin, 2001).

Given the threat of endogeneity of private tutoring generated by the selectivity of students with private tutoring and unobserved characteristics of these students, this dissertation takes into account this problem in a QR framework by employing 2SLAD. The 2SLAD procedure is essentially the quantile estimation analog of 2SLS. Instead of using the actual independent variables that indicate private tutoring participation, the predicted values for private tutoring participation derived from the following first-stage equations are used.

Cumulative Effect (first stage):

(6.1) $TOTALPT_{ih(a)} = \gamma_0 + \gamma_1 * Z_{ih(a)} + \gamma_2 * X_{ih} + \theta_{ih}$

Single-year Effect (first stage):

(6.2) $PT_{ij(a)} = \delta_0 + \delta_1 * Z_{ij(a)} + \delta_2 * X_{ij} + \vartheta_{ij}$

Same as equation 4.3 and 4.4 in the first set of the analyses, $TOTALPT_{ih(a)}$ and $PT_{ij(a)}$ are private tutoring variables, which indicate years of private tutoring and participation in private tutoring, respectively. In equation 6.1, $Z_{ih(a)}$ is an instrumental variable, which is a proportion of student *i*'s costs of private tutoring on subject *a* or overall in a monthly household income during education level *h*. This instrument is the same as the one used in the first part of the empirical analysis. Several tests for checking the validity of the instrument have previously been explained in Section 4.5 in Chapter IV. Similarly, $Z_{ij(a)}$ in equation 6.2 is a proportion of student *i*'s costs of private tutoring on subject *a* or overall in grade *j*. θ_{ih} and ϑ_{ij} are random error terms associated with the reduced form equations. From these equations 6.1 and 6.2, the predicted

values of two variables of private tutoring are calculated, and they are inserted in the second stage as follows.

Cumulative Effect (second stage):

(5.14) $Y_{ih(a),q} = \lambda_{0,q} + \lambda_{1,q} * \widehat{TOTALPT}_{ih(a)} + \lambda_{2,q} * X_{ih,q} + \rho_{ih,q}$

Single-year Effect (second stage):

(5.15) $Y_{ij(a),q} = \mu_{0,q} + \mu_{1,q} * \widehat{PT}_{ij(a)} + \mu_{2,q} * X_{ij,q} + \varrho_{ij,q}$

where ^ represents predicted values, and $\lambda_{1,q}$ and $\mu_{1,q}$ are the main coefficients of interest that imply the cumulative effect and single-year effect of private tutoring using QR at a given quantile of interest, q, to see whether there are different effects of private tutoring on student academic achievement, Y, by each quantile. Here, q represents the 10th, 25th, 50th, 75th or 90th percentiles in the distribution of academic achievement.

The last method used to explore the heterogeneous effects is the propensity score subclassification (Rosenbaum & Rubin, 1984). This is another way of using propensity scores to make causal inferences. Instead of using the propensity scores to match students, I used propensity scores to divide the sample into subclasses. Within each subclass, the covariates are balanced between the treated and control groups. First, I calculated propensity scores, e(X), in equation 4.7, for all students using confounding covariates, and identified the five quantiles of the distribution of propensity scores. These quantiles are used as cut-points that determine the five subclasses. Within each subclass, treatment effect estimates are calculated by observing difference-in-means between the treated and control groups. Using 2SLAD and propensity score subclassification, this chapter will explore the heterogeneous effects of private tutoring.

6.2 Variables

Variables used in this analysis are identical to the ones listed in Section 4.3 for the first analysis regarding the effects of private tutoring on students' academic achievement. As a reminder, two types of dependent variables are used: students' scores of the test administered by the KEDI in grades 7, 8, and 9 and decile rank on the CSAT in grade 12. Also, there are two types of dichotomous independent variables, which indicate total years of private tutoring and private tutoring participation. The variables that indicate years of participation in private tutoring aim to estimate the cumulative effects of private tutoring. The dichotomous variables that indicate private tutoring participation are used to estimate the effects of private tutoring for each grade. Control variables in a vector X are also the same as the ones listed in Table 16. The descriptive statistics for these variables are also provided in Table 16, 17, and 18, which have been described in Section 4.4.

6.3 Empirical Results

6.3.1 Private Tutoring in Middle School: Short-term Heterogeneous Effects

Cumulative Effects. Table 51, 52, and 53 present the average and heterogeneous effects of one, two, and three years of private tutoring, respectively, on students' academic achievement in grade 9 based on three estimation models.

Table 51. Heterogeneous effects of 1 year of private tutoring in middle school on overall academic achievement in grade 9

	OLS					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
1 year of PT in middle school	-0.03	-0.06	-0.04	-0.10*	-0.04	0.15
	(0.046)	(0.056)	(0.042)	(0.053)	(0.070)	(0.116)
Covariates	✓	✓	✓	✓	✓	✓
Observations	778	778	778	778	778	778
R-squared	0.261					
	2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
1 year of PT in middle school	0.16	-0.00	0.08	0.16***	0.26***	0.27***
	(0.131)	(0.028)	(0.064)	(0.050)	(0.043)	(0.038)
Covariates	✓	✓	✓	✓	✓	✓
Observations	521	4,286	4,286	4,286	4,286	4,286
R-squared	0.294					
	PSM					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
1 year of PT in middle school	0.06	-0.06	0.06	-0.14	0.09	-0.13
	(0.079)	(0.139)	(0.129)	(0.160)	(0.154)	(0.176)
Covariates	✓	✓	✓	✓	✓	✓
Observations	778	155	156	154	156	155
Pseudo R^2	0.029	0.034	0.042	0.042	0.021	0.034

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: G9VEM_Z (average score in grade 9); (2) Complete tables for OLS and 2SLAD are provided in Table I.1 in Appendix.

Table 52. Heterogeneous effects of 2 years of private tutoring in middle school on overall academic achievement in grade 9

	OLS					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
2 years of PT in middle school	0.19***	0.10*	0.14*	0.18**	0.30***	0.41***
	(0.048)	(0.044)	(0.059)	(0.069)	(0.060)	(0.063)
Covariates	✓	✓	✓	✓	✓	✓
Observations	1,084	1,084	1,084	1,084	1,084	1,084
R-squared	0.240					
	2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
2 years of PT in middle school	0.25	-0.00	0.15	0.31***	0.49***	0.50***
	(0.132)	(0.054)	(0.108)	(0.086)	(0.096)	(0.081)
Covariates	✓	✓	✓	✓	✓	✓
Observations	763	4,286	4,286	4,286	4,286	4,286
R-squared	0.257					
	PSM					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
2 years of PT in middle school	0.12	0.14	0.20	0.10	0.33*	0.01
	(0.070)	(0.120)	(0.127)	(0.137)	(0.162)	(0.217)
Covariates	✓	✓	✓	✓	✓	✓
Observations	1,084	214	217	216	218	216
Pseudo R^2	0.082	0.028	0.008	0.042	0.042	0.054

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: G9VEM_Z (average score in grade 9); (2) Complete tables for OLS and 2SLAD are provided in Table I.2 in Appendix.

Table 53. Heterogeneous effects of 3 years of private tutoring in middle school on overall academic achievement in grade 9

	OLS					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of PT in middle school	0.38***	0.21***	0.31***	0.37***	0.53***	0.57***
	(0.045)	(0.061)	(0.060)	(0.045)	(0.050)	(0.075)
Covariates	✓	✓	✓	✓	✓	✓
Observations	2,854	2,854	2,854	2,854	2,854	2,854
R-squared	0.294					
	2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of PT in middle school	0.54***	-0.01	0.30	0.61**	0.98***	1.00***
	(0.133)	(0.097)	(0.246)	(0.201)	(0.199)	(0.151)
Covariates	✓	✓	✓	✓	✓	✓
Observations	2,252	4,286	4,286	4,286	4,286	4,286
R-squared	0.267					
	PSM					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of PT in middle school	0.29**	0.43***	0.42***	0.55***	0.12	-0.03
	(0.109)	(0.088)	(0.111)	(0.162)	(0.267)	(0.606)
Covariates	✓	✓	✓	✓	✓	✓
Observations	2,854	572	571	571	571	447
Pseudo R^2	0.260	0.101	0.031	0.025	0.081	0.222

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: G9VEM_Z (average score in grade 9); (2) Complete tables for OLS and 2SLAD are provided in Table I.3 in Appendix.

The OLS estimates suggest that there are cumulative effects of private tutoring in middle school on students' academic achievement in grade 9. While one year of private tutoring does not show significant heterogeneous effects, two and three years of private tutoring suggest that there are larger effects for students in the upper quantiles. For example, students in the 75th and 90th quantiles increase their achievement by more than 0.30 and 0.50 standard deviations after taking two and three years of private tutoring, respectively, while students in the 10th and 25th quantiles benefit by about 0.10 and 0.30 standard deviations with two and three years of private tutoring, respectively. In other words, students in the higher percentiles benefit more from

private tutoring than students in the lower percentiles. In the 2SLAD estimation, students in the 10th and 25th percentiles do experience significant effects of private tutoring on their academic achievement, while estimates for students in the 50th, 75th, and 90th percentiles remain statistically significant. However, the effect sizes are much larger than the ones from the OLS estimation. Taking one year of private tutoring for students in the 90th percentile positively affects their achievement by 0.27 standard deviations, and this estimate is the largest among other quantiles. In addition, taking two and three years of private tutoring increases the overall academic achievement by 0.50 and 1 standard deviations for students in the 90th percentiles. Since high-achieving students benefit more from private tutoring than low-achieving students, as the results suggest, private tutoring seems to widen the achievement gap between high and low achievers, according to the 2SLAD estimates. However, the results from propensity score subclassification suggest that two years of private tutoring is most beneficial for students in the 75th quantiles, while three years of private tutoring increases academic achievement for students in the lower quantiles only. Therefore, the consistent results in all three methods are that two years of private tutoring increases academic achievement for students in the higher quantile, which implies the greater achievement gap. One concern in the PSM estimation is that the sample size for matched students in each quantile is small in several estimations. Sample sizes are sometimes less than 200, which limits tests of significance. The small sample size may be one of the reasons why several estimates are not statistically significant.

Instead of observing the heterogeneous effects of overall private tutoring, I narrowed down the analysis by academic subject. In terms of years of verbal tutoring, there are no statistically significant heterogeneous effects on students' verbal achievement in grade 9[17]. However, the results of English and math tutoring are different from the ones of verbal tutoring.

[17] Results of the heterogeneous effects of years of verbal tutoring are available in Table I.4, I.5 and I.6 in Appendix.

As shown in Table 54, taking one year of English tutoring is statistically significant in explaining English achievement in grade 9 for students in the higher quantiles. Especially, both the 2SLAD and PSM estimates show that taking one year of English tutoring increases English scores by 0.46 and 0.35 standard deviations, respectively, for students in the 75th percentile. Even though students in other quantiles except for the lowest one benefit from having one year of English tutoring based on the 2SLAD estimates, these results are not consistent in the PSM method. Table 55 presents the effects of two years of English tutoring. All methods show that there are greater effects of two years of English tutoring for students in the upper quantiles. Even though the effect sizes are not similar, it is consistent that English tutoring broadens the achievement gap between students in low and high quantiles. Three years of English tutoring didn't show consistent results of heterogeneity[18].

[18] Results of the heterogeneous effects of three years of English tutoring are available in Table I.9 in Appendix.

Table 54. Heterogeneous effects of 1 year of English tutoring in middle school on English achievement in grade 9

	OLS					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
1 year of English PT in MS	0.05	0.08	0.01	0.07	0.06	0.04
	(0.050)	(0.053)	(0.054)	(0.073)	(0.073)	(0.122)
Covariates	✓	✓	✓	✓	✓	✓
Observations	993	993	993	993	993	993
R-squared	0.231					
	2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
1 year of English PT in MS	0.24	0.01	0.24*	0.35***	0.46***	0.33***
	(0.156)	(0.075)	(0.097)	(0.072)	(0.079)	(0.050)
Covariates	✓	✓	✓	✓	✓	✓
Observations	687	4,196	4,196	4,196	4,196	4,196
R-squared	0.274					
	PSM					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
1 year of English PT in MS	0.04	0.15	0.06	-0.34	0.35*	-0.20
	(0.074)	(0.108)	(0.133)	(0.173)	(0.180)	(0.195)
Covariates	✓	✓	✓	✓	✓	✓
Observations	993	198	197	196	200	199
Pseudo R^2	0.031	0.051	0.039	0.057	0.036	0.031

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: G9ENG_Z (English score in grade 9); (2) Complete tables for OLS and 2SLAD are provided in Table I.7 in Appendix.

Table 55. Heterogeneous effects of 2 years of English tutoring in middle school on English achievement in grade 9

	OLS					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
2 years of English PT in MS	0.23***	0.13***	0.19***	0.21***	0.30***	0.27**
	(0.049)	(0.028)	(0.049)	(0.050)	(0.082)	(0.081)
Covariates	✓	✓	✓	✓	✓	✓
Observations	1,377	1,377	1,377	1,377	1,377	1,377
R-squared	0.274					
	2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
2 years of English PT in MS	0.11	0.13	2.18*	3.16***	4.14***	2.96***
	(0.293)	(0.717)	(0.934)	(0.582)	(0.700)	(0.450)
Covariates	✓	✓	✓	✓	✓	✓
Observations	993	4,196	4,196	4,196	4,196	4,196
R-squared	0.270					
	PSM					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
2 years of English PT in MS	0.33***	0.16	0.14	0.19	0.27*	0.66*
	(0.079)	(0.109)	(0.144)	(0.134)	(0.169)	(0.297)
Covariates	✓	✓	✓	✓	✓	✓
Observations	1,377	278	264	275	279	275
Pseudo R^2	0.112	0.044	0.021	0.023	0.037	0.062

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: G9ENG_Z (English score in grade 9); (2) Complete tables for OLS and 2SLAD are provided in Table I.8 in Appendix.

The estimates on the effects of math tutoring, on average, show that the estimates from the three methods indicate that there are more positive effects of math tutoring for students in the upper quantiles. Table 56 explains that three years of math tutoring raised math achievement by 0.74 and 0.61 standard deviations for students in the 75th and 90th percentiles, while it increased math achievement by 0.14 and 0.29 standard deviations based on the OLS estimates. A similar pattern is shown in the 2SLAD estimates; three years of math tutoring increased math scores by more than three-fourth of a standard deviation for students in the upper quantiles, but there were no statistically significant effects for students in the lower quantiles. The PSM estimates also

indicate the greater effects for students in the 75th percentile compared to the effects for students in the 10th and 25th percentiles. Thus, three years of math tutoring generates a bigger achievement gap between the lower and upper quantiles, but one and two years of math tutoring do not show consistent results in heterogeneity[19].

Table 56. Heterogeneous effects of 3 years of math tutoring in middle school on math achievement in grade 9

	OLS					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of Math PT in MS	0.46***	0.14**	0.29***	0.48***	0.74***	0.61***
	(0.048)	(0.052)	(0.061)	(0.058)	(0.088)	(0.111)
Covariates	✓	✓	✓	✓	✓	✓
Observations	3,198	3,198	3,198	3,198	3,198	3,198
R-squared	0.254					
	2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of Math PT in MS	0.88***	0.02	0.31	0.90**	1.13***	0.76***
	(0.136)	(0.218)	(0.280)	(0.280)	(0.226)	(0.204)
Covariates	✓	✓	✓	✓	✓	✓
Observations	2,531	4,260	4,260	4,260	4,260	4,260
R-squared	0.215					
	PSM					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of Math PT in MS	0.31**	0.42***	0.43**	0.49**	0.61*	-0.12
	(0.088)	(0.089)	(0.120)	(0.146)	(0.305)	(0.433)
Covariates	✓	✓	✓	✓	✓	✓
Observations	3,198	642	635	640	641	640
Pseudo R^2	0.223	0.092	0.031	0.015	0.042	0.066

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: G9MAT_Z (math score in grade 9); (2) Complete tables for OLS and 2SLAD are provided in Table I.12 in Appendix.

[19] Results of the heterogeneous effects of one and two years of math tutoring are available in Table I.10 and I.11 in Appendix.

Single-year Effects. Using a dichotomous variable of private tutoring participation in each grade, I explored the effect of tutoring in each grade to identify the most effective time of private tutoring on academic achievement in middle school. In terms of the short-term effects of private tutoring in grade 7 as presented in Table 57, the OLS estimates indicate that private tutoring in grade 7 helps increase overall achievement in grade 7 for students in all quantiles, but the effects are larger for students in the upper quantiles than students in the lower quantiles. As an example, the positive effect of private tutoring in grade 7 for students in the 90th quantile (0.27) is larger than the one for students in the 10th percentile (0.10). These positive effects remain in the next year only for students in the 50th, 75th, and 90th percentiles, but with smaller effect sizes. Tutoring in grade 7 does not affect achievement in grade 9 as shown in year 2. Taking account of the 2SLAD approach, the effect sizes of the estimates are much greater than the ones of the OLS estimates. Except for the bottom quantile, there are more than three-quarters of a standard deviation increases in overall achievement in grade 7. Tutoring in grade 7 for students in the 90th percentile increases the average score by 0.93 standard deviations, whereas the same tutoring for students in the 10th percentile affects scores only by 0.32 standard deviations. Therefore, the effect for students in the highest quantile is three times bigger than the one for students in the bottom quantile. These positive and significant effects remain in the next two years for students in the higher quantiles only, while the effect disappears for the students in the lower quantiles. It also means that the achievement gap becomes greater as students move to upper grades. According to the PSM results, even though the differences in the estimates among quantiles are smaller compared to the IV estimates, the effects are bigger for high achievers than the ones for low achievers and this heterogeneity continues until year 2.

The effect of private tutoring in grade 8 is also heterogeneous in different quantiles. The OLS estimates in Table 58 show that the effects for high-achieving students are larger than the ones for low-achieving students, and those effects are somewhat consistent in grade 9. However, the 2SLAD estimates indicate that tutoring in grade 8 positively affects overall achievement for middle quantiles (25th, 50th, and 75th quantiles). Furthermore, the effect for students in the 25th quantile is larger than the one for the 50th and 75th percentiles, which is counter to the results in grade 7. The PSM estimates are consistent with the 2SLAD estimates; students in the 25th percentile benefit from taking private tutoring in grade 8 by 0.21 standard deviations, while students in the upper quantiles do not receive significant effects. Moreover, both the 2SLAD and PSM estimates suggest that the heterogeneity disappears in the next year. In terms of private tutoring in grade 9, there are no statistically significant heterogeneous effects based on all three methods. The OLS estimates show that there are similar effects for students in each quantile, and the 2SLAD and PSM methods do not show statistically significant results. Based on these results, it is concluded that, on average, tutoring in grade 7 is more beneficial for high-achieving students than low-achieving students, while tutoring in grade 8 seems more beneficial for students in the lower quantiles.

Table 57. Heterogeneous effects of private tutoring in grade 7 on overall academic achievement for 3 years

	OLS																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
PT in G7	0.22***	0.10**	0.18***	0.25***	0.27***	0.27***	0.09**	0.02	0.02	0.08*	0.15***	0.14***	0.05	0.02	0.01	0.06	0.09	0.11
	(0.022)	(0.035)	(0.035)	(0.028)	(0.026)	(0.032)	(0.026)	(0.035)	(0.027)	(0.034)	(0.035)	(0.038)	(0.033)	(0.033)	(0.045)	(0.049)	(0.059)	(0.069)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in G8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in G9													✓	✓	✓	✓	✓	✓
Observations	5,895	5,895	5,895	5,895	5,895	5,895	5,380	5,380	5,380	5,380	5,380	5,380	3,990	3,990	3,990	3,990	3,990	3,990
R-squared	0.444						0.364						0.315					
	2SLAD																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
PT in G7	0.53***	0.32*	0.77***	0.75***	0.82***	0.93***	0.33***	0.1	0.3	0.61***	0.73***	0.82***	0.22*	0.19	0.1	0.23	0.51**	0.52**
	(0.066)	(0.150)	(0.171)	(0.140)	(0.109)	(0.129)	(0.076)	(0.132)	(0.158)	(0.183)	(0.114)	(0.138)	(0.094)	(0.148)	(0.058)	(0.149)	(0.179)	(0.189)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in G8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in G9													✓	✓	✓	✓	✓	✓
Observations	5,473	5,882	5,882	5,882	5,882	5,882	5,022	5,377	5,377	5,377	5,377	5,377	3,716	3,990	3,990	3,990	3,990	3,990
R-squared	0.419						0.351						0.307					
	PSM																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
PT in G7	0.21***	0.22***	0.13*	0.34***	0.24**	0.13	0.15**	0.07	0.15*	0.37***	0.36**	0.15	0.17***	0.14*	0.22**	0.31***	0.26*	-0.12
	(0.040)	(0.053)	(0.064)	(0.067)	(0.084)	(0.111)	(0.038)	(0.054)	(0.063)	(0.076)	(0.094)	(0.117)	(0.043)	(0.057)	(0.067)	(0.075)	(0.098)	(0.121)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in G8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in G9													✓	✓	✓	✓	✓	✓
Observations	5,895	1,180	1,178	1,176	1,180	1,181	5,582	1,122	1,128	1,125	1,112	1,095	5,692	1,143	1,143	1,154	1,137	1,115
Pseudo R^2	0.105	0.037	0.021	0.019	0.018	0.028	0.105	0.033	0.025	0.023	0.017	0.031	0.103	0.034	0.022	0.018	0.015	0.029

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G7VEM_Z (average score in grade 7) for Year 0; G8VEM_Z (average score in grade 8) for Year 1; G9VEM_Z (average score in grade 9) for Year 2; (2) Complete tables for OLS and 2SLAD are provided in Table J.1 and Table J.2 in Appendix.

Table 58. Heterogeneous effects of private tutoring in grade 8 on overall achievement for 2 years

	OLS											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
PT in grade 8	0.12***	0.07***	0.11***	0.10***	0.11***	0.17***	0.09**	0.03	0.07*	0.10***	0.07*	0.16***
	(0.020)	(0.018)	(0.024)	(0.022)	(0.024)	(0.025)	(0.028)	(0.036)	(0.030)	(0.023)	(0.029)	(0.031)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	5,501	5,501	5,501	5,501	5,501	5,501	4,077	4,077	4,077	4,077	4,077	4,077
R-squared	0.633						0.54					
	2SLAD											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
PT in grade 8	0.27***	0.26	0.32**	0.29***	0.24*	0.14	0.13	0.05	0.07	0.11	0.18	0.21
	(0.066)	(0.143)	(0.099)	(0.069)	(0.101)	(0.079)	(0.097)	(0.176)	(0.146)	(0.134)	(0.143)	(0.207)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	4,953	5,000	5,000	5,000	5,000	5,000	3,657	3,696	3,696	3,696	3,696	3,696
R-squared	0.623						0.53					
	PSM											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
PT in grade 8	0.18**	0.08	0.21**	0.17*	0.10	0.05	0.21*	0.06	0.00	0.26*	0.10	-0.06
	(0.057)	(0.059)	(0.062)	(0.073)	(0.097)	(0.241)	(0.082)	(0.071)	(0.084)	(0.114)	(0.206)	(0.542)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	5,501	1,100	1,103	1,087	1,107	1,093	4,077	814	814	816	818	815
Pseudo R^2	0.231	0.039	0.024	0.014	0.008	0..053	0.318	0.097	0.036	0.022	0.019	0.106

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G8VEM_Z (average score in grade 8) for year 0; G9VEM_Z (average score in grade 9) for year 1; (2) Complete tables for OLS and 2SLAD are provided in Table J.3 and Table J.4 in Appendix.

Table 59. Heterogeneous effects of private tutoring in grade 9 on academic achievement in grade 9

	OLS					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
PT in grade 9	0.16***	0.15***	0.12***	0.15***	0.17***	0.12*
	(0.025)	(0.023)	(0.031)	(0.025)	(0.026)	(0.047)
Covariates	✓	✓	✓	✓	✓	✓
PT in grade 7	✓	✓	✓	✓	✓	✓
PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	4,044	4,044	4,044	4,044	4,044	4,044
R-squared	0.575					
	2SLAD					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
PT in grade 9	0.19	-0.05	-0.08	-0.03	0.15	0.37
	(0.103)	(0.067)	(0.067)	(0.174)	(0.192)	(0.222)
Covariates	✓	✓	✓	✓	✓	✓
PT in grade 7	✓	✓	✓	✓	✓	✓
PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	3,490	4,504	4,504	4,504	4,504	4,504
R-squared	0.568					
	PSM					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
PT in grade 9	0.14*	0.10	0.14	0.33**	0.03	0.21
	(0.068)	(0.074)	(0.078)	(0.098)	(0.047)	(0.322)
Covariates	✓	✓	✓	✓	✓	✓
PT in grade 7	✓	✓	✓	✓	✓	✓
PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	4,044	809	807	807	810	808
Pseudo R^2	0.724	0.079	0.030	0.031	0.026	0.113

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G9VEM_Z (average score in grade 9); (2) Complete tables for OLS and 2SLAD are provided in Table J.5 and Table J.6 in Appendix.

When these single-year effects are observed by academic subject, there are different patterns of heterogeneous effects from the ones described above. There are no significant heterogeneous effects detected in verbal tutoring as shown in Table 60, 61, and 62. As opposed to verbal tutoring, English and math tutoring show heterogeneity in its effects on English and math achievement. Table 63 presents the effect of English tutoring in grade 7 on achievement in all three years of middle school. The OLS estimates indicate greater effects for students in the upper quantiles in terms of English achievement in grade 7. Even though the sizes of effects

decrease in the next year, students in the 75th and 90th percentiles benefit the most by having English tutoring compared to students in the lower quantiles. The effect of English tutoring in grade 7 remains significant only for students in the 75th percentile in year 2, while the effects for the rest of students disappear. However, the 2SLAD estimates show a different story. As shown in Table 63, the 2SLAD estimates indicate that English tutoring affects all students in the achievement distribution to a larger extent than the OLS estimates. Moreover, the effects remain significant in the next two years for students in all quantiles even though the effect sizes for high-achieving students are greater than the ones for low-achieving students. Specifically, English tutoring in grade 7 contributes to increased English scores of students in the 90th percentile by 1.03 in grade 7, 0.78 in grade 8, and 0.50 in grade 9. For the lower quantiles, students in the 25th percentile also benefited from English tutoring in grade 7 on English achievement by 0.74 in grade 7, 0.74 in grade 8, and 0.71 in grade 9. These estimates imply that benefits of English tutoring taken in grade 7 are distributed reasonably and equally regardless of students' academic standing. Therefore, taking English tutoring in grade 7 does not exacerbate the achievement gap in English to a larger extent. The absence of heterogeneity is also shown when estimating the effects with the propensity score subclassification, but the overall size of effects is much smaller than the ones from the 2SLAD estimates. English tutoring in grades 8 and 9 shows greater effects for students in the upper quantiles, according to the OLS and PSM methods, while the 2SLAD estimates do not show a similar pattern as shown in Table 64 and 65.

Compared to English, math tutoring shows more heterogeneity in its effects on math achievement. In Table 66, the IV estimation suggests that math tutoring in grade 7 affects math scores in the same grade by 0.75, 0.80, and 0.76 standard deviations for students in the 25th, 50th, and 75th percentiles, respectively. So, its effects are evenly distributed among students in the

middle quantiles. However, while students in the 90th percentile benefit from math tutoring by 0.52, students in the 10th percentile do not receive any benefit of having the same math tutoring. The differences in effects between quantiles become greater in the next year. Math tutoring in grade 7 has a larger effect on math scores achieved in grade 8 than math achievement in grade 7. Taking math tutoring in grade 7 has positive effects on math scores in grade 8 by 0.84, 0.97, and 1.12 standard deviations for students in the 50th, 75th, and 90th percentiles, respectively. And these effects are much larger than the effects observed in grade 7. This ascending pattern of effect sizes is in contrast to the pattern shown in the analyses for total tutoring and English tutoring. However, in year 2, most of the effects of math tutoring in grade 7 disappear except for the effect in the 75th percentile. With smaller effect sizes, this pattern is also revealed in the OLS and PSM estimates; there are greater effects for students in the upper quantiles and these effects last in the next year.

Interestingly, math tutoring in grade 8 seems to reduce the achievement gap in math achievement, according to the 2SLAD and PSM methods. According to Table 67, while math tutoring is not statistically significant in explaining math achievement for students in the 90th percentile, it helps increase math scores for students in the lower quantiles. In addition, there is a slightly larger effect for students in the 25th percentile (0.47) than students in the 75th quantiles (0.40) in year 1 as well. The PSM estimates also suggest that math tutoring in grade 8 increases math achievement by 0.14 for students in the 10th percentile, while it does not have significant effects for students in the 75th and 90th percentiles. This pattern is also shown in the next year. Thus, taking math tutoring in grade 8 seems to reduce the achievement gap in math achievement. However, the effects of math tutoring in grade 9 do not show a consistently significant pattern in terms of heterogeneity.

Table 60. Heterogeneous effects of verbal tutoring in grade 7 on verbal achievement for 3 years

	OLS																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 7	-0.01	-0.06	-0.03	-0.02	0.01	0.00	-0.05	-0.02	-0.04	-0.06	-0.07*	-0.05	-0.02	-0.01	-0.03	0.03	0.00	-0.06*
	(0.022)	(0.045)	(0.032)	(0.021)	(0.020)	(0.024)	(0.025)	(0.039)	(0.044)	(0.034)	(0.032)	(0.039)	(0.031)	(0.050)	(0.063)	(0.034)	(0.036)	(0.029)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 9													✓	✓	✓	✓	✓	✓
Observations	5,855	5,855	5,855	5,855	5,855	5,855	5,357	5,357	5,357	5,357	5,357	5,357	4,073	4,073	4,073	4,073	4,073	4,073
R-squared	0.316						0.257						0.198					
	2SLAD																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 7	0.01	0.04	-0.01	-0.03	0.04	0.01	-0.08	-0.03	-0.06	-0.13*	-0.05	0.04	-0.12	-0.02	-0.09	-0.09	0.02	-0.11
	(0.056)	(0.101)	(0.077)	(0.088)	(0.092)	(0.090)	(0.071)	(0.128)	(0.072)	(0.063)	(0.106)	(0.120)	(0.087)	(0.174)	(0.154)	(0.113)	(0.091)	(0.080)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 9													✓	✓	✓	✓	✓	✓
Observations	5,435	5,825	5,825	5,825	5,825	5,825	5,004	5,346	5,346	5,346	5,346	5,346	3,790	4,058	4,058	4,058	4,058	4,058
R-squared	0.307						0.25						0.192					
	PSM																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 7	0.02	0.02	0.02	-0.01	0.04	-0.00	-0.01	-0.14	0.01	-0.07	0.01	0.08	-0.02	-0.19	-0.19	0.06	-0.03	0.14
	(0.034)	(0.082)	(0.073)	(0.079)	(0.080)	(0.069)	(0.041)	(0.100)	(0.084)	(0.083)	(0.091)	(0.080)	(0.050)	(0.118)	(0.096)	(0.094)	(0.095)	(0.113)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 9													✓	✓	✓	✓	✓	✓
Observations	5,855	1,168	1,169	1,170	1,175	1,173	5,357	1,073	1,064	1,076	1,076	1,068	4,073	815	811	814	819	814
Pseudo R^2	0.025	0.051	0.016	0.014	0.009	0.012	0.121	0.037	0.003	0.054	0.012	0.015	0.155	0.029	0.012	0.016	0.011	0.013

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G7VER_Z (verbal score in grade 7) for Year 0; G8VER_Z (verbal score in grade 8) for Year 1; G9VER_Z (verbal score in grade 9) for Year 2; (2) Complete tables for OLS and 2SLAD are provided in Table K.1 and Table K.2 in Appendix.

Table 61. Heterogeneous effects of verbal tutoring in grade 8 on verbal achievement for 2 years

	OLS											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 8	0.04*	0.00	0.02	0.02	0.04	0.04	0.02	-0.02	-0.05	0.01	0.07*	0.02
	(0.021)	(0.055)	(0.041)	(0.027)	(0.027)	(0.033)	(0.028)	(0.088)	(0.049)	(0.035)	(0.029)	(0.044)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	5,478	5,478	5,478	5,478	5,478	5,478	4,164	4,164	4,164	4,164	4,164	4,164
R-squared	0.469						0.392					
	2SLAD											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 8	0.00	-0.15	0.05	-0.03	0.00	-0.03	-0.05	-0.05	0.04	0.14	0.13	-0.02
	(0.053)	(0.130)	(0.073)	(0.057)	(0.058)	(0.094)	(0.077)	(0.140)	(0.104)	(0.076)	(0.085)	(0.081)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	4,935	4,991	4,991	4,991	4,991	4,991	3,728	3,738	3,738	3,738	3,738	3,738
R-squared	0.462						0.381					
	PSM											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 8	0.04	-0.01	-0.09	0.11	0.10	0.13	0.03	0.14	0.16	0.04	0.27*	-0.15
	(0.041)	(0.096)	(0.079)	(0.079)	(0.079)	(0.091)	(0.054)	(0.132)	(0.104)	(0.091)	(0.109)	(0.107)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Verbal PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	5,478	1,094	1,091	1,099	1,098	1,096	4,164	833	832	838	831	830
Pseudo R^2	0.126	0.022	0.006	0.046	0.002	0.016	0.219	0.031	0.037	0.013	0.036	0.017

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G8VER_Z (verbal score in grade 8) for year 0; G9VER_Z (verbal score in grade 9) for year 1; (2) Complete tables for OLS and 2SLAD are provided in Table K.3 and Table K.4 in Appendix.

Table 62. Heterogeneous effects of verbal tutoring in grade 9 on verbal achievement in grade 9

	OLS					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 9	0.00	0.02	-0.01	-0.01	-0.04	-0.02
	(0.027)	(0.037)	(0.039)	(0.035)	(0.034)	(0.039)
Covariates	✓	✓	✓	✓	✓	✓
Verbal PT in grade 7	✓	✓	✓	✓	✓	✓
Verbal PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	4,133	4,133	4,133	4,133	4,133	4,133
R-squared	0.425					
	2SLAD					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 9	-0.04	0.05	-0.15	0.00	0.09	-0.07
	(0.093)	(0.150)	(0.080)	(0.140)	(0.129)	(0.096)
Covariates	✓	✓	✓	✓	✓	✓
Verbal PT in grade 7	✓	✓	✓	✓	✓	✓
Verbal PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	3,556	4,404	4,404	4,404	4,404	4,404
R-squared	0.414					
	PSM					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 9	-0.02	-0.14	0.00	0.15	-0.08	-0.08
	(0.052)	(0.111)	(0.098)	(0.097)	(0.114)	(0.116)
Covariates	✓	✓	✓	✓	✓	✓
Verbal PT in grade 7	✓	✓	✓	✓	✓	✓
Verbal PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	4,133	834	815	825	825	833
Pseudo R^2	0.164	0.012	0.014	0.024	0.017	0.011

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G9VER_Z (verbal score in grade 9); (2) Complete tables for OLS and 2SLAD are provided in Table K.5 and Table K.6 in Appendix.

Table 63. Heterogeneous effects of English tutoring in grade 7 on English achievement for 3 years

	OLS																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
English PT in grade 7	0.25***	0.13***	0.21***	0.27***	0.33***	0.33***	0.12***	0.02	0.08**	0.12**	0.21***	0.21***	0.07*	0.01	0.06	0.06	0.18***	0.11
	(0.024)	(0.037)	(0.023)	(0.036)	(0.030)	(0.037)	(0.029)	(0.030)	(0.028)	(0.041)	(0.044)	(0.038)	(0.033)	(0.039)	(0.039)	(0.055)	(0.042)	(0.063)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 9													✓	✓	✓	✓	✓	✓
Observations	5,910	5,910	5,910	5,910	5,910	5,910	5,380	5,380	5,380	5,380	5,380	5,380	4,546	4,546	4,546	4,546	4,546	4,546
R-squared	0.403						0.338						0.314					
	2SLAD																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
English PT in grade 7	0.72***	0.32*	0.74***	1.07***	1.20***	1.03***	0.61***	0.23	0.74**	1.02***	0.86***	0.78***	0.64***	0.42*	0.71***	0.68***	0.75***	0.50***
	(0.071)	(0.145)	(0.173)	(0.126)	(0.140)	(0.115)	(0.086)	(0.239)	(0.259)	(0.154)	(0.133)	(0.183)	(0.098)	(0.191)	(0.149)	(0.108)	(0.122)	(0.066)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 9													✓	✓	✓	✓	✓	✓
Observations	5,487	5,880	5,880	5,880	5,880	5,880	5,023	5,364	5,364	5,364	5,364	5,364	4,248	4,532	4,532	4,532	4,532	4,532
R-squared	0.362						0.301						0.269					
	PSM																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
English PT in grade 7	0.24***	0.29***	0.23**	0.24**	0.24*	0.32**	0.11*	0.09	0.14	0.17*	0.14	0.22	0.05	-0.02	0.02	0.16	0.23	0.12
	(0.035)	(0.057)	(0.062)	(0.075)	(0.091)	(0.099)	(0.050)	(0.073)	(0.077)	(0.087)	(0.108)	(0.122)	(0.056)	(0.085)	(0.093)	(0.099)	(0.131)	(0.124)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 9													✓	✓	✓	✓	✓	✓
Observations	5,910	1,183	1,181	1,179	1,183	1,184	5,380	1,071	1,080	1,077	1,081	1,071	4,546	906	909	911	918	901
Pseudo R^2	0.084	0.039	0.010	0.009	0.005	0.014	0.191	0.039	0.035	0.009	0.019	0.017	0.219	0.049	0.023	0.014	0.016	0.024

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G7ENG_Z (English score in grade 7) for Year 0; G8ENG_Z (English score in grade 8) for Year 1; G9ENG_Z (English score in grade 9) for Year 2; (2) Complete tables for OLS and 2SLAD are provided in Table L.1 and Table L.2 in Appendix.

Table 64. Heterogeneous effects of English tutoring in grade 8 on English achievement for 2 years

	OLS											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
English PT in grade 8	0.14***	0.08	0.13***	0.16***	0.14***	0.16***	0.09**	0.04	0.10**	0.06	0.10***	0.08*
	(0.024)	(0.057)	(0.025)	(0.027)	(0.031)	(0.045)	(0.030)	(0.033)	(0.032)	(0.033)	(0.027)	(0.033)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	5,502	5,502	5,502	5,502	5,502	5,502	4,643	4,643	4,643	4,643	4,643	4,643
R-squared	0.561						0.504					
	2SLAD											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
English PT in grade 8	0.31***	0.19	0.45***	0.40***	0.26*	0.30***	0.18	-0.11	0.27	0.29**	0.12	0.12
	(0.073)	(0.108)	(0.105)	(0.090)	(0.104)	(0.068)	(0.102)	(0.206)	(0.139)	(0.101)	(0.092)	(0.157)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	4,955	5,003	5,003	5,003	5,003	5,003	4,188	4,230	4,230	4,230	4,230	4,230
R-squared	0.555						0.499					
	PSM											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
English PT in grade 8	0.18**	0.09	0.08	0.14	0.22*	0.06	0.20*	0.09	0.07	0.07	0.22	0.17
	(0.049)	(0.068)	(0.080)	(0.097)	(0.104)	(0.161)	(0.077)	(0.080)	(0.093)	(0.129)	(0.174)	(0.230)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
English PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	5,502	1,099	1,104	1,097	1,107	1,095	4,643	930	931	926	931	920
Pseudo R^2	0.221	0.045	0.028	0.004	0.012	0.035	0.313	0.098	0.025	0.027	0.019	0.056

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G8VER_Z (verbal score in grade 8) for year 0; G9VER_Z (verbal score in grade 9) for year 1; (2) Complete tables for OLS and 2SLAD are provided in Table L.3 and Table L.4 in Appendix.

Table 65. Heterogeneous effects of English tutoring in grade 9 on English achievement in grade 9

	OLS					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
English PT in grade 9	0.16***	0.12**	0.14***	0.16***	0.23***	0.17**
	(0.028)	(0.037)	(0.028)	(0.034)	(0.029)	(0.056)
Covariates	✓	✓	✓	✓	✓	✓
English PT in grade 7	✓	✓	✓	✓	✓	✓
English PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	4,609	4,609	4,609	4,609	4,609	4,609
R-squared	0.536					
	2SLAD					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
English PT in grade 9	-0.15	-0.14	-0.34	0.33	2.02	0.37
	(0.272)	(1.478)	(1.406)	(2.044)	(1.919)	(1.349)
Covariates	✓	✓	✓	✓	✓	✓
English PT in grade 7	✓	✓	✓	✓	✓	✓
English PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	4,002	4,423	4,423	4,423	4,423	4,423
R-squared	0.524					
	PSM					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
English PT in grade 9	0.22**	0.22**	0.19*	0.17	-0.08	0.62**
	(0.068)	(0.076)	(0.088)	(0.104)	(0.129)	(0.194)
Covariates	✓	✓	✓	✓	✓	✓
English PT in grade 7	✓	✓	✓	✓	✓	✓
English PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	4,609	919	922	926	920	914
Pseudo R^2	0.265	0.044	0.024	0.008	0.015	0.030

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G9ENG_Z (English score in grade 9); (2) Complete tables for OLS and 2SLAD are provided in Table L.5 and Table L.6 in Appendix.

Table 66. Heterogeneous effects of math tutoring in grade 7 on math achievement for 3 years

	OLS																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Math PT in grade 7	0.26***	0.17***	0.23***	0.26***	0.31***	0.22***	0.09**	0.04	0.04	0.10**	0.15***	0.12*	0.04	-0.01	-0.01	0.03	0.12**	0.05
	(0.024)	(0.045)	(0.034)	(0.027)	(0.028)	(0.042)	(0.030)	(0.036)	(0.037)	(0.033)	(0.042)	(0.049)	(0.033)	(0.039)	(0.042)	(0.051)	(0.042)	(0.061)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 9													✓	✓	✓	✓	✓	✓
Observations	5,859	5,859	5,859	5,859	5,859	5,859	5,391	5,391	5,391	5,391	5,391	5,391	4,641	4,641	4,641	4,641	4,641	4,641
R-squared	0.348						0.286						0.259					
	2SLAD																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Math PT in grade 7	0.53***	0.46	0.75***	0.80***	0.76***	0.52***	0.36***	0.16	0.27	0.84***	0.97**	1.12***	0.34**	0.38	0.26	0.46	0.61**	0.61
	(0.081)	(0.312)	(0.176)	(0.131)	(0.162)	(0.106)	(0.085)	(0.220)	(0.224)	(0.237)	(0.304)	(0.230)	(0.132)	(0.260)	(0.260)	(0.295)	(0.213)	(0.347)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 9													✓	✓	✓	✓	✓	✓
Observations	5,445	5,830	5,830	5,830	5,830	5,830	5,035	5,372	5,372	5,372	5,372	5,372	4,336	4,622	4,622	4,622	4,622	4,622
R-squared	0.33						0.275						0.244					
	PSM																	
	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Math PT in grade 7	0.25***	0.19*	0.13	0.15	0.25*	0.19	0.16**	0.15*	0.08	0.12	0.15	0.24*	0.07	0.07	0.00	-0.11	0.11	0.23
	(0.042)	(0.081)	(0.091)	(0.093)	(0.104)	(0.097)	(0.048)	(0.067)	(0.081)	(0.092)	(0.112)	(0.122)	(0.056)	(0.084)	(0.087)	(0.108)	(0.128)	(0.145)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 8							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 9													✓	✓	✓	✓	✓	✓
Observations	5,859	809	901	932	945	986	5,391	1,072	1,083	1,080	1,084	1,072	4,641	929	928	926	926	932
Pseudo R^2	0.075	0.040	0.014	0.017	0.007	0.012	0.187	0.039	0.045	0.016	0.019	0.019	0.210	0.064	0.022	0.011	0.020	0.038

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G7MAT_Z (math score in grade 7) for Year 0; G8MAT_Z (math score in grade 8) for Year 1; G9MAT_Z (math score in grade 9) for Year 2; (2) Complete tables for OLS and 2SLAD are provided in Table M.1 and Table M.2 in Appendix.

Table 67. Heterogeneous effects of math tutoring in grade 8 on math achievement for 2 years

	OLS											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Math PT in grade 8	0.17***	0.16***	0.13***	0.17***	0.20***	0.19***	0.11***	0.04	0.11**	0.10**	0.13***	0.15*
	(0.026)	(0.044)	(0.036)	(0.039)	(0.048)	(0.057)	(0.032)	(0.043)	(0.036)	(0.040)	(0.037)	(0.070)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	5,513	5,513	5,513	5,513	5,513	5,513	4,739	4,739	4,739	4,739	4,739	4,739
R-squared	0.471						0.419					
	2SLAD											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Math PT in grade 8	0.45***	0.39**	0.52***	0.48***	0.40***	0.15	0.43***	0.28	0.47***	0.48***	0.40**	0.37
	(0.083)	(0.120)	(0.141)	(0.090)	(0.106)	(0.157)	(0.111)	(0.189)	(0.132)	(0.131)	(0.151)	(0.189)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	4,964	5,011	5,011	5,011	5,011	5,011	4,275	4,316	4,316	4,316	4,316	4,316
R-squared	0.455						0.405					
	PSM											
	Year 0 (Grade 8)						Year 1 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
Math PT in grade 8	0.31***	0.14*	0.06	0.29**	0.19	0.21	0.19*	0.13	0.19*	0.08	0.16	0.14
	(0.057)	(0.064)	(0.082)	(0.092)	(0.117)	(0.192)	(0.076)	(0.083)	(0.087)	(0.114)	(0.148)	(0.274)
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Math PT in grade 9							✓	✓	✓	✓	✓	✓
Observations	5,513	1,096	1,111	1,100	1,108	1,097	4,739	946	950	947	946	950
Pseudo R^2	0.223	0.046	0.014	0.021	0.008	0.047	0.305	0.111	0.021	0.025	0.010	0.059

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G8MAT_Z (math score in grade 8) for year 0; G9MAT_Z (math score in grade 9) for year 1; (2) Complete tables for OLS and 2SLAD are provided in Table M.3 and Table M.4 in Appendix.

Table 68. Heterogeneous effects of math tutoring in grade 9 on math achievement in grade 9

	OLS					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
Math PT in grade 9	0.24***	0.16***	0.22***	0.23***	0.32***	0.30***
	(0.031)	(0.035)	(0.033)	(0.047)	(0.059)	(0.055)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in grade 7	✓	✓	✓	✓	✓	✓
Math PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	4,697	4,697	4,697	4,697	4,697	4,697
R-squared	0.443					
	2SLAD					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
Math PT in grade 9	-0.09	-0.17	-0.34	1.83	1.23	0.40
	(0.287)	(1.302)	(1.575)	(1.228)	(1.336)	(1.293)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in grade 7	✓	✓	✓	✓	✓	✓
Math PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	4,073	4,491	4,491	4,491	4,491	4,491
R-squared	0.427					
	PSM					
	Year 0 (Grade 9)					
VARIABLES	Avg	q10	q25	q50	q75	q90
Math PT in grade 9	0.30***	0.31***	0.17	0.37**	0.06	0.00
	(0.067)	(0.074)	(0.094)	(0.097)	(0.154)	(0.257)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in grade 7	✓	✓	✓	✓	✓	✓
Math PT in grade 8	✓	✓	✓	✓	✓	✓
Observations	4,697	940	943	931	936	934
Pseudo R^2	0.268	0.057	0.021	0.016	0.018	0.042

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: G9MAT_Z (math score in grade 9); (2) Complete tables for OLS and 2SLAD are provided in Table M.5 and Table M.6 in Appendix.

6.3.2 Private Tutoring in Middle School: Long-term Heterogeneous Effects

Using the CSAT scores, I also observed the heterogeneous effects of private tutoring in middle school on the university entrance exam. Heterogeneous effects of years of private tutoring are not observed, according to all three estimations[20]. Similarly, cumulative measures of verbal, English, and math tutoring do not show any differential effects depending on the academic standing[21].

Single-year analyses also tend to provide evidence on the absence of heterogeneity except for private tutoring in grade 7, English tutoring in grades 7 and 8, and math tutoring in grade 7. As explained, no heterogeneous effects are found in the analysis using cumulative measures of private tutoring. Unlike the cumulative effects, private tutoring in grade 7 shows that it benefits students in the 75th percentile by 1.01 deciles, with no significant effects for students in other quantiles, according to PSM (Table 69). However, the OLS and 2SLAD estimates do not support this result. Private tutoring in grades 8 and 9 does not show any heterogeneous effects[22].

Verbal tutoring in grades 7 and 8 also does not heterogeneously affect verbal achievement on the CSAT[23], but verbal tutoring in grade 9 positively affects CSAT verbal scores for students in the top quantile as presented in Table 70. According to the PSM estimates, students in the top quantile benefit from verbal tutoring in grade 9 by 0.63 deciles, while other students do not benefit from it. Also, distinguishing heterogeneity is observed in English tutoring taken in grades 7 and 8. English tutoring in grade 7 improves English CSAT scores by

[20] Results of the heterogeneous effects of one, two and three years of private tutoring are available in Table N.1 – N.3 in Appendix.
[21] Results of the heterogeneous effects of one, two and three years of verbal, English and math tutoring are available in Table N.4 – N.12 in Appendix.
[22] Results of the heterogeneous effects of private tutoring in grade 8 and 9 are available in Table O.2, and O.3 in Appendix.
[23] Results of the heterogeneous effects of verbal tutoring in grade 7 and 8 are available in Table O.4, and O.5 in Appendix.

0.70, 0.91, and 0.98 deciles for students in the 50th, 75th, and 90th percentiles, respectively, as shown in Table 71. The PSM estimates also indicate that students in the 75th percentile benefit from taking English tutoring in grade 7 by 0.56 deciles, while students in the 10th percentile receive a negative impact on their English CSAT scores by a similar amount. Adversely, English tutoring in grade 8 has positive and significant effects for students in the bottom quantile only. Taking English tutoring in grade 8 increases English CSAT scores by 0.67 deciles for students in the 10th percentile, while other students do not benefit from it, according to the PSM estimates in Table 72. The OLS and 2SLAD estimates do not suggest any heterogeneous effects of English tutoring in grade 8. However, English tutoring in grade 9 does not affect English achievement on the CSAT[24]. In terms of math tutoring, math tutoring in grade 7 has a positive and significant effect on CSAT math scores for students in the lower quantiles (Table 73). The OLS estimates indicate that math tutoring in grade 7 increases math scores by 0.36 deciles for students in the 10th percentile, and the PSM estimates show an increase in math scores by 0.71 deciles for students in the 25th percentile. However, the 2SLAD estimates are not consistent with this result. Math tutoring in grade 8 and 9 does not show heterogeneous effects, which is consistent with the previous results[25].

[24] Results of the effects of English tutoring in grade 9 are available in Table O.9 in Appendix.
[25] Results of the effects of math tutoring by grade 8 and 9 are available in Table O.11, and O.12 in Appendix.

Table 69. Long-term heterogeneous effects of private tutoring in grade 7 on overall achievement on the CSAT

	OLS					
VARIABLES	Avg	q10	q25	q50	q75	q90
PT in grade 7	0.14	0.28	0.17	0.13	0.09	-0.00
	(0.087)	(0.158)	(0.119)	(0.125)	(0.147)	(0.153)
Covariates	✓	✓	✓	✓	✓	✓
PT in grade 8	✓	✓	✓	✓	✓	✓
PT in grade 9	✓	✓	✓	✓	✓	✓
PT in high school	✓	✓	✓	✓	✓	✓
Observations	1,905	1,905	1,905	1,905	1,905	1,905
R-squared	0.296					
	2SLAD					
VARIABLES	Avg	q10	q25	q50	q75	q90
PT in grade 7	0.42	0.04	0.19	0.57	0.39	0.20
	(0.274)	(0.608)	(0.142)	(0.331)	(0.368)	(0.360)
Covariates	✓	✓	✓	✓	✓	✓
PT in grade 8	✓	✓	✓	✓	✓	✓
PT in grade 9	✓	✓	✓	✓	✓	✓
PT in high school	✓	✓	✓	✓	✓	✓
Observations	1,800	1,888	1,888	1,888	1,888	1,888
R-squared	0.287					
	PSM					
VARIABLES	Avg	q10	q25	q50	q75	q90
PT in grade 7	0.33	-0.04	0.01	0.15	1.01*	0.74
	(0.209)	(0.267)	(0.215)	(0.347)	(0.397)	(0.701)
Covariates	✓	✓	✓	✓	✓	✓
PT in grade 8	✓	✓	✓	✓	✓	✓
PT in grade 9	✓	✓	✓	✓	✓	✓
PT in high school	✓	✓	✓	✓	✓	✓
Observations	1,905	270	328	405	449	349
Pseudo R^2	0.227	0.107	0.029	0.059	0.056	0.300

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: CSAT_avg (average CSAT score); (2) Complete tables for OLS and 2SLAD are provided in Table O.1 in Appendix.

Table 70. Long-term heterogeneous effects of verbal tutoring in grade 9 on the CSAT verbal achievement

	OLS					
VARIABLES	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 9	-0.07	0.09	0.01	-0.10	-0.05	-0.32*
	(0.072)	(0.085)	(0.080)	(0.111)	(0.097)	(0.139)
Covariates	✓	✓	✓	✓	✓	✓
Verbal PT in grade 7	✓	✓	✓	✓	✓	✓
Verbal PT in grade 8	✓	✓	✓	✓	✓	✓
Verbal PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,044	2,044	2,044	2,044	2,044	2,044
R-squared	0.252					
	2SLAD					
VARIABLES	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 9	0.07	-0.19	0.05	-0.12	0.01	0.74
	(0.290)	(0.608)	(0.499)	(0.274)	(0.573)	(0.830)
Covariates	✓	✓	✓	✓	✓	✓
Verbal PT in grade 7	✓	✓	✓	✓	✓	✓
Verbal PT in grade 8	✓	✓	✓	✓	✓	✓
Verbal PT in high school	✓	✓	✓	✓	✓	✓
Observations	1,812	2,273	2,273	2,273	2,273	2,273
R-squared	0.243					
	PSM					
VARIABLES	Avg	q10	q25	q50	q75	q90
Verbal PT in grade 9	-0.04	0.16	-0.13	0.03	-0.11	0.63*
	(0.129)	(0.327)	(0.239)	(0.234)	(0.253)	(0.246)
Covariates	✓	✓	✓	✓	✓	✓
Verbal PT in grade 7	✓	✓	✓	✓	✓	✓
Verbal PT in grade 8	✓	✓	✓	✓	✓	✓
Verbal PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,044	350	394	431	426	443
Pseudo R^2	0.201	0.077	0.034	0.041	0.031	0.045

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: CSAT_V (CSAT verbal score); (2) Complete tables for OLS and 2SLAD are provided in Table O.6 in Appendix.

Table 71. Long-term heterogeneous effects of English tutoring in grade 7 on the CSAT English achievement

	OLS					
VARIABLES	Avg	q10	q25	q50	q75	q90
English PT in grade 7	0.10	0.19	0.01	0.11	0.16	-0.07
	(0.085)	(0.167)	(0.108)	(0.107)	(0.120)	(0.166)
Covariates	✓	✓	✓	✓	✓	✓
English PT in grade 8	✓	✓	✓	✓	✓	✓
English PT in grade 9	✓	✓	✓	✓	✓	✓
English PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,302	2,302	2,302	2,302	2,302	2,302
R-squared	0.247					
	2SLAD					
VARIABLES	Avg	q10	q25	q50	q75	q90
English PT in grade 7	0.65**	0.32	0.05	0.70***	0.91**	0.98*
	(0.251)	(0.336)	(0.453)	(0.199)	(0.302)	(0.407)
Covariates	✓	✓	✓	✓	✓	✓
English PT in grade 8	✓	✓	✓	✓	✓	✓
English PT in grade 9	✓	✓	✓	✓	✓	✓
English PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,179	2,281	2,281	2,281	2,281	2,281
R-squared	0.229					
	PSM					
VARIABLES	Avg	q10	q25	q50	q75	q90
English PT in grade 7	0.20	-0.58*	0.30	-0.03	0.56*	-0.33
	(0.145)	(0.274)	(0.253)	(0.282)	(0.276)	(0.277)
Covariates	✓	✓	✓	✓	✓	✓
English PT in grade 8	✓	✓	✓	✓	✓	✓
English PT in grade 9	✓	✓	✓	✓	✓	✓
English PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,302	338	410	491	519	536
Pseudo R^2	0.174	0.071	0.035	0.022	0.034	0.048

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: CSAT_E (CSAT English score); (2) Complete tables for OLS and 2SLAD are provided in Table O.7 in Appendix.

Table 72. Heterogeneous effects of English tutoring in grade 8 on the CSAT English achievement

	OLS					
VARIABLES	Avg	q10	q25	q50	q75	q90
English PT in grade 8	0.13	0.10	0.17	0.16	0.09	0.03
	(0.090)	(0.164)	(0.129)	(0.102)	(0.125)	(0.170)
Covariates	✓	✓	✓	✓	✓	✓
English PT in grade 7	✓	✓	✓	✓	✓	✓
English PT in grade 9	✓	✓	✓	✓	✓	✓
English PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,339	2,339	2,339	2,339	2,339	2,339
R-squared	0.342					
	2SLAD					
VARIABLES	Avg	q10	q25	q50	q75	q90
English PT in grade 8	0.39	0.33	0.39	1.04*	0.20	0.60
	(0.317)	(0.507)	(0.437)	(0.430)	(0.389)	(0.467)
Covariates	✓	✓	✓	✓	✓	✓
English PT in grade 7	✓	✓	✓	✓	✓	✓
English PT in grade 9	✓	✓	✓	✓	✓	✓
English PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,148	2,161	2,161	2,161	2,161	2,161
R-squared	0.342					
	PSM					
VARIABLES	Avg	q10	q25	q50	q75	q90
English PT in grade 8	0.15	0.67*	-0.02	-0.38	0.37	0.97
	(0.194)	(0.323)	(0.239)	(0.403)	(0.384)	(0.708)
Covariates	✓	✓	✓	✓	✓	✓
English PT in grade 7	✓	✓	✓	✓	✓	✓
English PT in grade 9	✓	✓	✓	✓	✓	✓
English PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,339	302	469	477	527	562
Pseudo R^2	0.307	0.171	0.046	0.024	0.022	0.055

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: CSAT_E (CSAT English score); (2) Complete tables for OLS and 2SLAD are provided in Table O.8 in Appendix.

Table 73. Heterogeneous effects of math tutoring in grade 7 on the CSAT math achievement

	OLS					
VARIABLES	Avg	q10	q25	q50	q75	q90
Math PT in grade 7	0.11	0.36*	0.12	0.06	-0.02	0.14
	(0.091)	(0.174)	(0.153)	(0.094)	(0.151)	(0.197)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in grade 8	✓	✓	✓	✓	✓	✓
Math PT in grade 9	✓	✓	✓	✓	✓	✓
Math PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,294	2,294	2,294	2,294	2,294	2,294
R-squared	0.238					
	2SLAD					
VARIABLES	Avg	q10	q25	q50	q75	q90
Math PT in grade 7	-0.13	0.03	-0.26	-0.54	-0.06	2.62**
	(0.450)	(0.787)	(0.578)	(0.489)	(0.728)	(0.987)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in grade 8	✓	✓	✓	✓	✓	✓
Math PT in grade 9	✓	✓	✓	✓	✓	✓
Math PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,172	2,265	2,265	2,265	2,265	2,265
R-squared	0.236					
	PSM					
VARIABLES	Avg	q10	q25	q50	q75	q90
Math PT in grade 7	0.08	-0.01	0.71*	0.28	0.55	0.16
	(0.175)	(0.305)	(0.278)	(0.269)	(0.399)	(0.452)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in grade 8	✓	✓	✓	✓	✓	✓
Math PT in grade 9	✓	✓	✓	✓	✓	✓
Math PT in high school	✓	✓	✓	✓	✓	✓
Observations	2,294	350	425	463	509	542
Pseudo R^2	0.186	0.098	0.050	0.016	0.046	0.053

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: CSAT_M (CSAT Math score); (2) Complete tables for OLS and 2SLAD are provided in Table O.10 in Appendix.

6.3.3 Private Tutoring in High School: Short-term Heterogeneous Effects

Private tutoring in high school seems to improve educational inequality on the CSAT. For example, while one year of private tutoring in high school is not significant in explaining heterogeneity[26], two years of private tutoring in high school improves overall CSAT results by 0.45, 0.52, and 0.37 deciles for students in the 10th, 25th, and 50th percentiles, respectively, according to the OLS estimation (Table 74). The 2SLAD estimation also suggests that it has positive and significant effects only for students in the 25th and 50th percentiles by 0.71 and 0.57 deciles, respectively, without having significant effects for students in the upper quantiles. However, the PSM estimates are not consistent with this result. Moreover, three years of private tutoring in high school shows a greater impact on the CSAT for students in the lower quantiles, which is consistent with all three estimation methods (Table 75). The OLS estimates show that three years of private tutoring in high school increases overall achievement on the CSAT for students in all quantiles, but the effects for students in the lower quantiles are greater than the ones for students in the upper quantiles. It improves CSAT scores for students in the 10th and 25th percentiles by 0.56 and 0.72 deciles, respectively, while it benefits students in the 75th and 90th percentiles by 0.48 and 0.45 deciles each. Similarly, the 2SLAD estimates explain that students in the 10th and 25th percentiles benefit from three years of tutoring in high school by 0.54 and 0.75 deciles, respectively, while students in the 75th percentile increase their CSAT scores by 0.46 deciles after taking three years of private tutoring in high school. Moreover, the PSM estimates also show that only students in the 25th percentile receive higher CSAT scores by 0.75 deciles after three years of tutoring, without having significant effects for students in other quantiles. Therefore, it is evident that three years of private tutoring improves overall CSAT

[26] Results of the effects of private tutoring in high school are available in Table P.1 in Appendix.

achievement only for students in the lower quantiles, which contributed to reducing the achievement gap. This pattern is opposite to the effects of private tutoring in middle school, which often contributes to exacerbating the achievement gap as explained in the previous section.

Table 74. Heterogeneous effects of 2 years of private tutoring in high school on the CSAT

	OLS					
VARIABLES	Average	q10	q25	q50	q75	q90
2 years of PT in high school	0.29**	0.45**	0.52***	0.37**	0.09	0.14
	(0.101)	(0.149)	(0.122)	(0.117)	(0.152)	(0.194)
Covariates	✓	✓	✓	✓	✓	✓
PT in middle school	✓	✓	✓	✓	✓	✓
Observations	826	826	826	826	826	826
R-squared	0.407					
	2SLAD					
VARIABLES	Average	q10	q25	q50	q75	q90
2 years of PT in high school	0.51	0.51	0.71***	0.57***	0.44	0.32
	(0.304)	(0.285)	(0.162)	(0.127)	(0.241)	(0.326)
Covariates	✓	✓	✓	✓	✓	✓
PT in middle school	✓	✓	✓	✓	✓	✓
Observations	627	1,571	1,571	1,571	1,571	1,571
R-squared	0.402					
	PSM					
VARIABLES	Average	q10	q25	q50	q75	q90
2 years of PT in high school	0.26	0.15	0.43	0.44	0.78	-0.46
	(0.232)	(0.729)	(0.306)	(0.343)	(0.459)	(0.584)
Covariates	✓	✓	✓	✓	✓	✓
PT in middle school	✓	✓	✓	✓	✓	✓
Observations	826	83	125	187	207	223
Pseudo R^2	0.235	0.224	0.164	0.049	0.062	0.142

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_avg (average CSAT score); (2) Complete tables for OLS and 2SLAD are provided in Table P.2 in Appendix.

Table 75. Heterogeneous effects of 3 years of private tutoring in high school on the CSAT

	OLS					
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of PT in high school	0.59***	0.56*	0.72***	0.64***	0.48***	0.45**
	(0.105)	(0.245)	(0.166)	(0.173)	(0.140)	(0.175)
Covariates	✓	✓	✓	✓	✓	✓
PT in middle school	✓	✓	✓	✓	✓	✓
Observations	985	985	985	985	985	985
R-squared	0.453					
	2SLAD					
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of PT in high school	0.51*	0.54*	0.75***	0.61***	0.46*	0.34
	(0.251)	(0.268)	(0.184)	(0.160)	(0.214)	(0.329)
Covariates	✓	✓	✓	✓	✓	✓
PT in middle school	✓	✓	✓	✓	✓	✓
Observations	782	1,571	1,571	1,571	1,571	1,571
R-squared	0.442					
	PSM					
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of PT in high school	0.30	0.33	0.75*	0.21	0.41	1.09
	(0.322)	(0.938)	(0.273)	(0.346)	(0.367)	(1.461)
Covariates	✓	✓	✓	✓	✓	✓
PT in middle school	✓	✓	✓	✓	✓	✓
Observations	985	93	166	241	233	120
Pseudo R^2	0.393	0.476	0.158	0.062	0.045	0.395

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_avg (average CSAT score); (2) Complete tables for OLS and 2SLAD are provided in Table P.3 in Appendix.

When analyzing the cumulative effects by academic subject, distinguished patterns are shown only in math tutoring. There are no consistent and significant cumulative effects of verbal and English tutoring based on the three estimation models[27]. However, three years of math tutoring in high school shows heterogeneous effects. As shown in Table 76, the results suggest that students in the 10th and 25th percentiles see greater effects of three years of math tutoring in high school than students in the 75th and 90th percentiles. CSAT math scores go up by 1.32 and 1.35 deciles for students in the 10th and 25th percentiles, respectively, while scores increase by 0.98 and 0.93 deciles for those in the 75th and 90th percentiles, respectively. Similar patterns are observed when estimating these effects with the 2SLAD method. In the PSM estimation, students only in the 25th and 50th percentiles benefit from it by 1.18 and 1.11 deciles, respectively, while students in other quantiles do not experience significant changes on their CSAT math scores. Thus, even though one and two years of math tutoring do not show consistent results in heterogeneity[28], three years of math tutoring contributes to improve the math achievement for students in the lower quantiles, which is beneficial in reducing educational inequality on the CSAT math achievement.

[27] Results of the heterogeneous effects of years of verbal and English tutoring in high school are available in Table P.4 – P.9 in Appendix.
[28] Results for the heterogeneous effects of one and two years of math tutoring in high school are available in Table P.10 and P.11 in Appendix.

Table 76. Heterogeneous effects of 3 years of math tutoring on the CSAT math achievement

	OLS					
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of Math PT in high school	1.18***	1.32***	1.35***	1.21***	0.98***	0.93***
	(0.121)	(0.233)	(0.185)	(0.176)	(0.233)	(0.245)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in middle school	✓	✓	✓	✓	✓	✓
Observations	1,081	1,081	1,081	1,081	1,081	1,081
R-squared	0.401					
	2SLAD					
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of Math PT in high school	1.08***	0.91*	1.32***	1.26***	1.10***	0.85**
	(0.246)	(0.363)	(0.228)	(0.269)	(0.333)	(0.327)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in middle school	✓	✓	✓	✓	✓	✓
Observations	854	1,899	1,899	1,899	1,899	1,899
R-squared	0.386					
	PSM					
VARIABLES	Average	q10	q25	q50	q75	q90
3 years of Math PT in high school	0.85*	1.00	1.18*	1.11**	0.52	0.60
	(0.318)	(0.877)	(0.415)	(0.316)	(0.530)	(0.617)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in middle school	✓	✓	✓	✓	✓	✓
Observations	1,081	102	175	260	263	224
Pseudo R^2	0.383	0.604	0.110	0.046	0.047	0.093

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variable: CSAT_M (CSAT Math score); (2) Complete tables for OLS and 2SLAD are provided in Table P.12 in Appendix.

The results of single-year effects are consistent with the previous results of the cumulative effects. The results suggest that there are no significant single-year heterogeneous effects of overall, verbal, and English tutoring[29]. However, the significant heterogeneous effects in all the estimations are observed in math tutoring, especially tutoring in grade 12 (Table 77). Math tutoring in grade 12 increases CSAT math scores for students in all quantiles, according to the OLS estimates. However, it is most beneficial for students in the 10th percentile by 0.57 deciles, which is about twice as large as the effect for students in the 90th percentile (0.27 deciles). The 2SLAD estimates also suggest that math tutoring in grade 12 increases math scores by 0.73 deciles for students in the 25th percentiles, while students in the 75th percentile benefit from it by 0.61 deciles. The differences in the effects between the lower and upper quantiles are larger when estimating with the PSM method. Students in the 25th percentile have higher math scores by 1.04 deciles after private tutoring in grade 12, while it increases scores by 0.40 and 0.59 deciles for students in the 75th and 90th percentiles, respectively. Even though there are no significant heterogeneous effects of math tutoring in grades 10 and 11[30], math tutoring in grade 12 shows significant differential effects on the CSAT math achievement by quantile. Furthermore, it helps reduce the math achievement gap on the CSAT.

[29] Results for the single-year heterogeneous effects of overall, verbal and English tutoring are available in Table Q.1 – Q.9 in Appendix.

[30] Results for the single-year effects of math tutoring in grades 10 and 11 are available in Table Q10 and Q.11 in Appendix.

Table 77. Heterogeneous effects of math tutoring in grade 12 on the CSAT math achievement

	OLS					
VARIABLES	Average	q10	q25	q50	q75	q90
Math PT in grade 12	0.43***	0.57***	0.49***	0.39***	0.37***	0.27*
	(0.072)	(0.160)	(0.087)	(0.085)	(0.102)	(0.120)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in middle school	✓	✓	✓	✓	✓	✓
Math PT in grade 10	✓	✓	✓	✓	✓	✓
Math PT in grade 11	✓	✓	✓	✓	✓	✓
Observations	2,338	2,338	2,338	2,338	2,338	2,338
R-squared	0.345					
	2SLAD					
VARIABLES	Average	q10	q25	q50	q75	q90
Math PT in grade 12	0.42**	0.40	0.73*	0.48	0.61*	0.45
	(0.157)	(0.362)	(0.285)	(0.252)	(0.287)	(0.366)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in middle school	✓	✓	✓	✓	✓	✓
Math PT in grade 10	✓	✓	✓	✓	✓	✓
Math PT in grade 11	✓	✓	✓	✓	✓	✓
Observations	2,117	2,117	2,117	2,117	2,117	2,117
R-squared	0.343					
	PSM					
VARIABLES	Average	q10	q25	q50	q75	q90
Math PT in grade 12	0.37**	0.62	1.04*	0.71**	0.40*	0.59**
	(0.113)	(0.806)	(0.363)	(0.243)	(0.179)	(0.184)
Covariates	✓	✓	✓	✓	✓	✓
Math PT in middle school	✓	✓	✓	✓	✓	✓
Math PT in grade 10	✓	✓	✓	✓	✓	✓
Math PT in grade 11	✓	✓	✓	✓	✓	✓
Observations	2,338	264	431	474	547	580
Pseudo R^2	0.204	0.042	0.022	0.062	0.017	0.025

*** p<0.001, ** p<0.01, * p<0.05

Notes: (1) Dependent variables: CSAT_M (CSAT Math score); (2) Complete tables for OLS and 2SLAD are provided in Table Q.12 in Appendix.

6.4 Discussion

In summary, private tutoring differentially affects students' achievement depending on students' academic ability. In terms of total private tutoring taken during middle school years, on average, its effects on the average achievement in grade 9 for high achievers are larger than the effects for low achievers. Similar patterns appear in the differential effects of English and math tutoring in middle school without having significant heterogeneous effects of verbal

tutoring in middle school. Therefore, it is evident that private tutoring taken during middle school years broadens the achievement gap in middle school between high- and low-achieving students, which exacerbates educational inequality. These findings correspond with the existing literature, which claims that private tutoring adversely affects educational inequality (Bray, 1999; Yang, 2007; Tansel & Bircan, 2005). Moreover, this study also finds interesting results in terms of different effects by grade level, which previous literatures have not analyzed. The results suggest that tutoring at an earlier grade level shows more dramatic heterogeneity than tutoring at a later grade level. In other words, the heterogeneous effects of tutoring in grade 7 are greater than the heterogeneous effects of tutoring in grade 8. Also, this heterogeneity shown in grade 7 is sustained for more years, while the heterogeneity in grade 8 does not last more than one year. Therefore, private tutoring at an early grade level in middle school has a more negative impact on educational inequality than tutoring at later grade levels. This pattern also applies to English and math tutoring.

Instead of using academic achievement in middle school as dependent variables, I used the CSAT results to observe the long-term effects of private tutoring in middle school on performance in the university entrance examination. Similar to the average effects discussed in Chapter IV, significant heterogeneous effects were detected only for English tutoring, and high-achieving students benefit more from it compared to low-achieving students. As before, the heterogeneity is severe in English tutoring taken in grade 7; it broadens the achievement gap in CSAT English by about 1 decile between students in the lower and upper quantiles (Table 73).

However, private tutoring in high school years affects academic achievement in an opposite direction. Overall findings indicate that private tutoring in high school contributes to reduce the achievement gap between low- and high-achieving students as opposed to private

tutoring in middle school. Taking three years of private tutoring increases overall CSAT scores by 0.75 deciles for students in the 25th percentile, which is larger than the effects for those in the upper quantiles (Table 75). Especially, math tutoring in high school shows that the effect for low achievers is larger than the one for high achievers (Table 76 and 77). Overall results explain that private tutoring in high school does not help improve the achievement of high achievers, whereas it is more beneficial to low achievers, which contradicts the arguments in the existing literature (Bray, 1999; Yang, 2007; Tansel & Bircan, 2005).

This positive aspect of private tutoring in high school in terms of educational inequality can be interpreted in two ways. First, it can be explained by diminishing marginal returns to education. It means that private tutoring predominantly influences academic achievement for low-achieving students who have a large room to grow, but the same private tutoring has a relatively small influence for high achievers who have less room for growth. However, this argument does not apply to private tutoring in middle school, which has a larger effect on high-achieving students. Secondly, the characteristics of private tutoring in high school may explain the positive influence of high school tutoring on educational inequality. As mentioned before, tutoring in high school is more focused on preparing for the CSAT (Lee, Park & Lee, 2009), which is different from tutoring in middle school that mimics formal education. Thus, private tutoring in high school is more like "drill and practice" designed for the CSAT that would be more necessary for low achievers than high achievers. With respect to this type of private tutoring, the effect would be maximized if students take tutoring when the examination is approaching. The results also follow this scenario because private tutoring in later grades (grades 11 and 12) in high school is more effective than tutoring at an early grade level (grade 10).

This study of heterogeneity in private tutoring draws interesting social implications. Even though private tutoring in middle school contributes to exacerbate educational inequality between ability groups, which can also be considered as income groups, private tutoring in high school plays an opposite role to improve educational inequality by benefiting low achievers to a larger extent. Therefore, it is hard to generalize the effect of private tutoring on educational inequality, and more attention should be placed on the characteristics of private tutoring, which play a different role in inequality in education.

CHAPTER VII: CONCLUSION

Over the last two decades, private tutoring has emerged as an important area in education as its demand has been growing around the world. The private tutoring sector is often considered the third emerging education sector in addition to public and private school sectors (Dang & Rogers, 2008). Especially, private tutoring in Asia is most predominant and expanding at an alarming rate (Bray & Lykins, 2012). However, empirical studies that explored the causal impact of private tutoring are lacking. Moreover, the existing evidence of its effectiveness is still mixed. Using the Korean Educational Longitudinal Survey (KELS), this dissertation aimed at investigating the causal impact of private tutoring in Korea on three outcomes: students' academic achievement, the quality of the learning environment in formal schooling, and educational inequality. In order to uncover the causal relationship between private tutoring and these three outcomes, several quasi-experimental methods were employed as described in the following section with a summary of findings.

7.1 Summary of Findings

For the first research question, I explored how private tutoring affects students' academic achievement in both the short- and long-term by using Ordinary Least Squares, Instrumental Variable, and Propensity Score Matching methods. The results suggest that private tutoring in middle school, on average, has positive short-term effects on students' academic achievement in middle school, but the long-term effects of middle school tutoring on the CSAT are minimal. By subject area, English and math tutoring in middle school are effective in improving academic achievement in English and math during middle school years, whereas verbal tutoring does not

have a positive influence on verbal performance in middle school. However, in the long-term, only English tutoring in middle school is helpful to achieve better CSAT English performance. It is also important to note that taking private tutoring in grade 7 is the most influential in increasing academic achievement in middle school years.

The effects of private tutoring in high school on overall CSAT performance are mixed. However, by subject, math tutoring in high school has a significant impact on the CSAT. When observing the impact by grade level, math tutoring in grades 11 and 12 increases CSAT math scores by about 0.4 to 0.6 deciles, which are quite large. Overall, private tutoring in middle school and high school brings positive impact on students' academic performance in secondary school. However, the cost-effectiveness is still questionable.

The second research question focuses on observing the impact of private tutoring on students' formal schooling using the degree of students' attention to lessons in formal schools as a proxy for the quality of formal schooling by employing Ordered Logit, Propensity Score Matching, and Difference-in-Differences methods. On average, private tutoring shows a positive influence on student's attention to lessons only in grade 8, but the magnitude of the influence is not substantial. However, when analyzing it by ability groups, positive effects are detected mostly in the low ability group, which means that low achievers pay more attention to lessons in formal schools if they take tutoring. It also improves the overall learning environment in classrooms, which, in turn, increases the quality of schooling. However, private tutoring seems to have a different effect on high achievers. The regulation on the operating hours of private tutoring institutes demonstrated that high achievers pay more attention to lessons in formal schools when tutoring hours are cut back. However, this regulation does not influence low

achievers. The overall results suggest that private tutoring does affect the learning environment in formal schooling in a positive direction.

The last research question aims at finding the causal relationship between private tutoring and educational inequality by using Quantile Regression, Two-Stage Least Absolute Deviation estimator, and Propensity Score Subclassification. The overall results indicate that private tutoring has heterogeneous effects on academic achievement. In the case of private tutoring in middle school, its effects on high achievers are, on average, bigger than that on low achievers. This pattern also appears in terms of the effects of English and math tutoring in middle school. Thus, private tutoring taken in middle school broadens the achievement gap between high and low achievers, which exacerbates educational inequality. In addition, tutoring at an earlier grade level shows more dramatic heterogeneity than tutoring at a later grade level, which means that tutoring taken in grade 7 has the largest influence in widening the achievement gap in middle school. However, except for English tutoring, most of private tutoring in middle school does not show significant heterogeneity in terms of its effects on the CSAT performance.

In contrast to the effects of private tutoring in middle school, private tutoring in high school contributes to reduce educational inequality. On average, low achievers benefit more on the CSAT from taking private tutoring in high school compared to high achievers. For example, three years of private tutoring is beneficial only for students at the 25th percentile. Moreover, three years of math tutoring and math tutoring in grade 12 contribute the most to lessen the achievement gap on the CSAT. Therefore, private tutoring in high school brings a positive influence to the society by reducing educational inequality, whereas private tutoring in middle school worsens educational inequality.

7.2 Policy Responses

7.2.1 History of policies on private tutoring in Korea

In the past decades, the Korean government has put a lot of effort into curbing the demand for private tutoring by proposing various policies. Most of the approaches from the 1960s to 1980s focused on reforming assessment and selection systems, which is one of the domains that Bray and Lykins (2012) have addressed. When the demand for private tutoring emerged as a social problem in the 1960s, the Korean government, as its very first approach, abolished entrance examinations to middle school in 1969, which was the major driver that fanned the demand for private tutoring. Since then, students have been assigned to neighborhood middle schools by lottery. However, the desire for private tutoring did not subside, and parents of middle school students showed a tremendous demand for private tutoring for high school admission (Kim & Chang, 2010). To cool off this consistent demand, the Korean government enacted the High School Equalization Policy in 1974, which abolished the high school entrance examination and deprived students of the freedom to choose their high schools. However, this policy was also unsuccessful to alleviate this demand. As the most radical approach, in 1980, the military government announced the Educational Reform Bill, which placed a total ban on all the supplementary, for-profit, tutoring activities. Even though all the tutoring activities were prohibited, there were still illegal tutoring lessons for students and parents with a desire to enter prestigious universities. After acknowledging that even a total ban does not solve the problem, the military government started relaxing the ban in stages from 1981 (Ministry of Education, 1989).

Even after year 2000, when the Constitutional Court declared that the prohibition of private tutoring was an infringement of human rights and unconstitutional (Kim & Chang, 2010),

various direct regulations and plans have been introduced. The Korean government started quality control of private tutoring institutions in terms of facility, qualifications of tutors, and fees of private tutoring institutions, etc. In addition, the government introduced a national model of private tutoring (Han, 2004). As substitutes for private tutoring, the government introduced the Educational Broadcasting System (EBS). EBS broadcasts tutoring lessons instructed by school teachers or famous tutors from the private tutoring sector, free of charge. In addition, the government supported formal schools to strengthen their after-school programs by diversifying the curriculum based on students' academic levels and by hiring famous tutors. Recently, the entrance examination to enter special purpose high schools (SPHSs), which was introduced in the late 1970s as a response to criticism of the High School Equalization Policy, has been abolished to cut back on the demand for private tutoring. As described, the Korean government attempted various approaches in several domains regarding the systems of assessment and selection, curriculum, technology, and so forth (Bray & Lykins, 2012). Even though the demand has been slowly decreasing, according to the national statistics, all of these efforts did not dramatically change household consumption of private tutoring for children. Having with these historical approaches in mind, I propose several suggestions to policy makers in Korea.

7.2.2 Suggestions to Policy Makers in Education

First, the Korean government should support formal schools to create a consumer-responsive curriculum. As explained in Chapter III, one of the major reasons students participate in private tutoring is because formal education fails to meet the educational needs of students and parents (Chun et al., 2003; Kim, 2004). Due to this reason, various programs have been introduced to formal schools, but they do not satisfy students and parents for the following

reasons. First, a large part of the curriculum is targeted at average ability students without diversifying the educational levels. However, the curriculum targeting average students does not satisfy others who have different levels of ability. Especially, for high-achieving students with a high probability of taking private tutoring, the curriculum in formal schooling is not challenging and does not satisfy their educational needs. In addition, low-achieving students face difficulties in following the curriculum because it is hard to receive additional support in formal schools. Fortunately, after-school programs that have been strengthened since the mid-2000s provide substantial support for these low-achieving disadvantaged students, but high achievers still have to satisfy their educational desire through private tutoring. Therefore, the government should support schools to create a quality curriculum that meets the needs of students of different levels. This can be made possible if the government provides more financial support and gives more flexibility to schools in designing their curriculum. The lack of flexibility under the current heavy regulation and strict control on the formal education system hampers schools from designing a consumer-responsive curriculum.

Secondly, the government should pay more attention to better allocate resources in order to improve the quality of formal education. Quality education entails many aspects of education such as curriculum, teacher proficiency, facilities, and additional services, etc. However, the government's resource allocation hasn't seemed balanced in recent years, so all these aspects of education have not been equally emphasized. In addition, resources have been sporadically allocated and altered depending on one or two influential government authorities without establishing a long-term goal. For example, recently, most of the resources in education have been allocated to the national free meal program for all students in elementary and middle schools, regardless of students' economic status, as proposed in 2011. Due to this program,

resources that were allocated to the curriculum and facilities had to be reallocated to this free meal program even though there are plenty of schools in dire need of the money for their curriculum and facilities. It became a huge problem for many schools in rural areas that still have old buildings with wooden floors and leaking ceilings without heating systems (Choi, 2012). Furthermore, budgets for curriculum development and after-school programs have also shrunk (Kim, 2013). This spontaneous budget planning is somewhat attributed to the tight linkage between education and politics in Korea. Since educational policies are often used by politicians to attract votes, a number of policies and initiatives have been proposed and executed without proper consideration of their consequences on students and schools. Therefore, it is crucial to allocate educational resources in balance with a long-term plan to improve the overall quality of formal schooling in order to satisfy students and parents.

As another way to improve the quality of formal schooling to decrease the demand for private tutoring, the government should create realistic plans for teacher empowerment. "The quality of a school system rests on the quality of its teachers (McKinsey & Company, 2007)." As many articles have already introduced, school teachers in Korea are recruited from the top 5 percent of each cohort of college graduates. Even though teacher quality in Korea is ranked top among OECD countries (McKinsey & Company, 2007), not enough attention has been paid to teacher empowerment after recruitment. For example, there is a lack of incentives for individual teachers to improve their performance. In other words, there is no premium system for teachers who make consistent efforts to improve their pedagogy and adopt new materials and technology to maximize educational outputs. Those teachers can be recognized through evaluations from stakeholders in education, but there are mostly bureaucratic evaluations in Korea. Due to this environment in the teacher market, school teachers become less inclined to change and less

likely to stay attuned to market dynamics in education compared to instructors in the private tutoring sector who are under fierce competition and high-stakes evaluations. This would create a large discrepancy between formal schooling and the educational needs of students and parents. I am not arguing that competition and evaluation are a panacea since there are many side effects of competition among teachers and high-stakes teacher evaluations as previous research has argued (Glazerman & Seifullah, 2010). Acknowledging undesirable effects of existing teacher policies, the government should place more attention on creating a motivating environment to empower school teachers.

The grading system in secondary schools should be revised in order to reduce the influence of private tutoring on students' overall academic performance. The current grading system is mostly exam-oriented; grade point average (GPA) is usually based on the performance of two examinations in each semester. Students only have limited opportunities to get evaluated, and there are no other alternatives to make up for their performance if they do not perform well on the examinations. This uniform and exam-oriented grading system encourages fierce competition among students and may drive up the demand for private tutoring in order to excel in the examinations. As the empirical results suggest in Chapter IV, private tutoring in middle school positively affects students' academic achievement during middle school years. Thus, the current grading system indirectly encourages students to receive additional tutoring since the influence of private tutoring on their GPA can be substantial. To solve this issue, schools must introduce various criteria or tools to evaluate students. For example, schools may reduce the weight of exam results on the GPA and introduce other methods for evaluation such as written assignments, quizzes, and class participation, etc. By mixing objective and subjective methods of evaluation, teachers should evaluate students by considering various aspects instead of solely

using test scores. The Korean government has started showing concerns regarding the grading system since 2011, and the grading system has changed from relative evaluation to absolute evaluation by giving schools more flexibility to evaluate students. However, it is important to establish specific grading rubrics for absolute evaluation in order to prevent teachers and schools from misusing the evaluation system. Therefore, the demand for private tutoring would decrease if the weight of tests on the GPA is reduced by introducing other methods in the grading system.

Last but not least, parents should be actively engaged in formal education. Schools should urge parents to participate in various school activities and offer them many opportunities for communication. Through these opportunities and activities, parents would be fully aware of what is happening to students in schools. Schools should also be aware of the needs of students and parents by communicating with each other in order to increase the quality of formal schooling and create a consumer-responsive curriculum. Instead of having students and parents fulfill their educational needs in the private tutoring sector, schools should play a major role in satisfying parents and students by incorporating their educational needs in the formal curriculum. This is possible when there is a steady communication channel between parents and schools.

As a result, it is crucial to improve the quality of formal education by emphasizing a consumer-responsive curriculum, balanced resource allocation, teacher empowerment, improved grading system, and parent engagement. If students and parents are satisfied with formal schooling, parents will naturally reduce their demand for private tutoring for their children. All the future policies related to private tutoring should consider these elements of education.

7.3 Limitations of the Study and Directions for Future Research

Several limitations result from the availability and structure of variables. First of all, the achievement scores during high school years are not available in the KELS data, so it was

impossible to observe the effect of private tutoring on academic achievement during high school years. The only available achievement data in high school is the CSAT results, which enabled me to explore the effect of private tutoring on the university entrance examination. However, the CSAT data is measured by decile rank, which is not as precise as percentile rank. This crude measure of the CSAT makes it difficult to accurately calculate the estimates of private tutoring effects on the CSAT. Secondly, this study is not able to explore the effect of private tutoring on college attendance, which is a better measure to investigate both academic performance and educational inequality caused by private tutoring. Variables that indicate whether students attend colleges and what type of colleges they attend are available in the 7th wave of the KELS data, which are not publicly available yet. In future research, it will be crucial to use more accurately measured variables in order to reduce biases that result from measurement error. In addition, more diverse measures in terms of students' academic achievement will be necessary to explore various educational outcomes of students.

Besides the limitations related to availability and precision of variables, the biggest limitation of this study is that it fails to render implications on the cost-effectiveness of private tutoring, which stakeholders in education would find the most curious and useful. This study was able to explore the effectiveness of private tutoring as presented in Chapter IV. However, it is still under the veil whether taking private tutoring is cost-effective after taking costs of private tutoring into account. As a mini study of cost-effectiveness of private tutoring, I compared the cost-effective ratios of four types of private tutoring as follows.

Table 78. Cost-effectiveness ratios of four types of private tutoring

	Annual Costs (monthly cost x 12)	Effects on average score in grade 9 (PSM estimates)	C/E ratio
Three years of private tutoring	665.28	0.31	2146.06
Private tutoring in grade 7	159.96	0.12	1333.00
Private tutoring in grade 8	202.68	0.21	965.14
Private tutoring in grade 9	302.64	0.22	1375.64

Since information on the monthly cost of each type of private tutoring is available in the KELS data, I multiplied it by 12 to calculate the annual costs of each type of private tutoring by assuming that students take tutoring year-round. In terms of the effects, I used the estimates for the effect of each type on academic achievement in grade 9. According to the cost-effectiveness ratios in Table 78, private tutoring in grade 8 is the most cost-effective to raise academic achievement in grade 9, followed by private tutoring in grade 7 and 9. Three years of private tutoring is the least cost-effective, which means that it requires the largest amount of cost to see the same effect. Future research should include a further study on the cost-effectiveness of private tutoring, which will draw more practical inferences on utilizing private tutoring for students in secondary schools.

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APPENDIX

Table A. Monthly salary schedule for K-12 teachers in 2011

Salary Class	Salary	Salary Class	Salary
1	1,243,700	21	2,370,400
2	1,281,500	22	2,457,900
3	1,319,700	23	2,544,800
4	1,357,800	24	2,631,800
5	1,396,200	25	2,718,700
6	1,434,500	26	2,805,900
7	1,472,200	27	2,896,800
8	1,510,100	28	2,987,800
9	1,548,600	29	3,082,600
10	1,590,300	30	3,178,000
11	1,631,400	31	3,272,900
12	1,673,300	32	3,367,700
13	1,749,600	33	3,464,000
14	1,826,100	34	3,560,000
15	1,902,500	35	3,656,300
16	1,979,000	36	3,751,900
17	2,054,800	37	3,835,400
18	2,134,000	38	3,918,900
19	2,213,000	39	4,002,500
20	2,291,700	40	4,085,600

Unit: 1 Korean Won

Source: 2011 Teacher Salary schedule (K-12 school teachers), The Korean Teachers and Education Workers' Union. http://www.eduhope.net/ (in Korean)

Note: 1,000 Korean won equal approximately 1 USD

Table B.1. Treatment variables used in the section 5.1

Variable Name	Type of variable	Description
Measures for cumulative tutoring		
PT1yr_ms	dichotomous	1 year of any private tutoring in middle school
PT2yr_ms	dichotomous	2 years of any private tutoring in middle school
PT3yr_ms	dichotomous	3 years of any private tutoring in middle school
PT1yr_hs	dichotomous	1 year of any private tutoring in high school
PT2yr_hs	dichotomous	2 years of any private tutoring in high school
PT3yr_hs	dichotomous	3 years of any private tutoring in high school
VERPT1yr_ms	dichotomous	1 year of Verbal private tutoring in middle school
VERPT2yr_ms	dichotomous	2 years of Verbal private tutoring in middle school
VERPT3yr_ms	dichotomous	3 years of Verbal private tutoring in middle school
VERPT1yr_hs	dichotomous	1 year of Verbal private tutoring in high school
VERPT2yr_hs	dichotomous	2 years of Verbal private tutoring in high school
VERPT3yr_hs	dichotomous	3 years of Verbal private tutoring in high school
ENGPT1yr_ms	dichotomous	1 year of English private tutoring in middle school
ENGPT2yr_ms	dichotomous	2 years of English private tutoring in middle school
ENGPT3yr_ms	dichotomous	3 years of English private tutoring in middle school
ENGPT1yr_hs	dichotomous	1 year of English private tutoring in high school
ENGPT2yr_hs	dichotomous	2 years of English private tutoring in high school
ENGPT3yr_hs	dichotomous	3 years of English private tutoring in high school
MATHPT1yr_ms	dichotomous	1 year of Math private tutoring in middle school
MATHPT2yr_ms	dichotomous	2 years of Math private tutoring in middle school
MATHPT3yr_ms	dichotomous	3 years of Math private tutoring in middle school
MATHPT1yr_hs	dichotomous	1 year of Math private tutoring in high school
MATHPT2yr_hs	dichotomous	2 years of Math private tutoring in high school
MATHPT3yr_hs	dichotomous	3 years of Math private tutoring in high school
Measure for Single-year tutoring		
PT_G7	dichotomous	Participation in any private tutoring in Grade 7
PT_G8	dichotomous	Participation in any private tutoring in Grade 8
PT_G9	dichotomous	Participation in any private tutoring in Grade 9
PT_G10	dichotomous	Participation in any private tutoring in Grade 10
PT_G11	dichotomous	Participation in any private tutoring in Grade 11
PT_G12	dichotomous	Participation in any private tutoring in Grade 12
VERBALPT_G7	dichotomous	Participation in Verbal private tutoring in grade 7
VERBALPT_G8	dichotomous	Participation in Verbal private tutoring in grade 8
VERBALPT_G9	dichotomous	Participation in Verbal private tutoring in grade 9
VERBALPT_G10	dichotomous	Participation in Verbal private tutoring in grade 10
VERBALPT_G11	dichotomous	Participation in Verbal private tutoring in grade 11
VERBALPT_G12	dichotomous	Participation in Verbal private tutoring in grade 12
ENGPT_G7	dichotomous	Participation in English private tutoring in grade 7
ENGPT_G8	dichotomous	Participation in English private tutoring in grade 8
ENGPT_G9	dichotomous	Participation in English private tutoring in grade 9
ENGPT_G10	dichotomous	Participation in English private tutoring in grade 10
ENGPT_G11	dichotomous	Participation in English private tutoring in grade 11

ENGPT_G12	dichotomous	Participation in English private tutoring in grade 12
MATHPT_G7	dichotomous	Participation in Math private tutoring in grade 7
MATHPT_G8	dichotomous	Participation in Math private tutoring in grade 8
MATHPT_G9	dichotomous	Participation in Math private tutoring in grade 9
MATHPT_G10	dichotomous	Participation in Math private tutoring in grade 10
MATHPT_G11	dichotomous	Participation in Math private tutoring in grade 11
MATHPT_G12	dichotomous	Participation in Math private tutoring in grade 12

Table B.2. Dependent variables used in the section 5.1

Variable Name	Description	Test	Unit
G7VEM_Z	Average score of Verbal, English and Math in grade 7	KEDI	z-score
G8VEM_Z	Average score of Verbal, English and Math in grade 8	KEDI	z-score
G9VEM_Z	Average score of Verbal, English and Math in grade 9	KEDI	z-score
G7VER_Z	Verbal score in grade 7	KEDI	z-score
G8VER_Z	Verbal score in grade 8	KEDI	z-score
G9VER_Z	Verbal score in grade 9	KEDI	z-score
G7ENG_Z	English score in grade 7	KEDI	z-score
G8ENG_Z	English score in grade 8	KEDI	z-score
G9ENG_Z	English score in grade 9	KEDI	z-score
G7MAT_Z	Math score in grade 7	KEDI	z-score
G8MAT_Z	Math score in grade 8	KEDI	z-score
G9MAT_Z	Math score in grade 9	KEDI	z-score
CSAT_avg	Average CSAT score	CSAT	decile rank
CSAT_V	Verbal score	CSAT	decile rank
CSAT_E	English score	CSAT	decile rank
CSAT_M	Math score	CSAT	decile rank

Table B.3. Control variables used in Chapter IV

Variable Name	Type of variable	Description
GENDER	dichotomous	1=female; 0=male
SES	continuous	socio-economic status
SELF-STUDY	dichotomous	whether a student spends more than 10 hours per week for independent study (1=yes; 0=no)
SELF-ESTEEM	continuous	level of self-esteem
PRESCORE	continuous	previous achievement score
SCHOOL TYPE	dichotomous	school type (1=private; 0=public)
SCHOOL TRACK	dichotomous	school track (1=general; 0=technical)
STU-TEA RATIO	continuous	student-teacher ratio
URBAN	dichotomous	urban residence (1=yes; 0=no)
SCHOOL CHOICE	dichotomous	residence with a school choice scheme (1=yes; 0=no)

Table C.1. Effects of one year of private tutoring on academic achievement in grade 9

VARIABLES	(1) OLS	(2) IV
1 year of PT in middle school	-0.03	0.16
	(0.046)	(0.131)
URBAN	-0.01	-0.06
	(0.072)	(0.089)
GENDER (1=female)	0.25***	0.26***
	(0.046)	(0.055)
SES	0.17***	0.18***
	(0.036)	(0.048)
SCHOOL TYPE	0.07	0.07
	(0.059)	(0.069)
STU-TEA RATIO	-0.00	-0.00
	(0.005)	(0.006)
SCHOOL CHOCIE	0.01	-0.04
	(0.069)	(0.087)
PRESCORE	0.15***	0.16***
	(0.014)	(0.016)
SELF-STUDY	0.15	0.12
	(0.102)	(0.121)
SELF-ESTEEM	0.10*	0.13**
	(0.042)	(0.050)
Constant	-1.25***	-1.19***
	(0.187)	(0.254)
Observations	778	521
R-squared	0.261	0.294

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VEM_Z (average score in grade 9)

Table C.2. Effects of two years of private tutoring on academic achievement in grade 9

VARIABLES	(1) OLS	(2) IV
2 years of PT in middle school	0.19***	0.25
	(0.048)	(0.132)
URBAN	-0.00	-0.02
	(0.068)	(0.081)
GENDER (1=female)	0.27***	0.28***
	(0.043)	(0.051)
SES	0.08**	0.11**
	(0.032)	(0.042)
SCHOOL TYPE	0.10	0.08
	(0.055)	(0.063)
STU-TEA RATIO	0.00	0.00
	(0.004)	(0.005)
SCHOOL CHOCIE	0.05	0.05
	(0.067)	(0.081)
PRESCORE	0.15***	0.16***
	(0.012)	(0.015)
SELF-STUDY	0.20*	0.15
	(0.086)	(0.100)
SELF-ESTEEM	0.11**	0.12*
	(0.041)	(0.050)
Constant	-1.43***	-1.47***
	(0.179)	(0.231)
Observations	1,084	763
R-squared	0.240	0.257

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VEM_Z (average score in grade 9)

Table C.3. Effects of three years of private tutoring on academic achievement in grade 9

VARIABLES	(1) OLS	(2) IV
3 years of PT in middle school	0.38***	0.54***
	(0.045)	(0.133)
URBAN	-0.07	-0.10*
	(0.039)	(0.045)
GENDER (1=female)	0.28***	0.27***
	(0.027)	(0.031)
SES	0.15***	0.15***
	(0.018)	(0.023)
SCHOOL TYPE	0.08*	0.10*
	(0.034)	(0.039)
STU-TEA RATIO	0.01*	0.01*
	(0.004)	(0.004)
SCHOOL CHOCIE	-0.04	-0.04
	(0.042)	(0.049)
PRESCORE	0.16***	0.15***
	(0.008)	(0.010)
SELF-STUDY	0.04	0.05
	(0.039)	(0.044)
SELF-ESTEEM	0.13***	0.13***
	(0.025)	(0.029)
Constant	-1.42***	-1.52***
	(0.124)	(0.166)
Observations	2,854	2,252
R-squared	0.294	0.267

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VEM_Z (average score in grade 9)

Table C.4. Effects of one year of verbal tutoring on verbal achievement in grade 9

VARIABLES	(1) OLS	(2) IV
1 year of Verbal PT in middle school	-0.17***	-0.07
	(0.043)	(0.121)
URBAN	-0.01	-0.08
	(0.064)	(0.074)
GENDER (1=female)	0.49***	0.49***
	(0.043)	(0.049)
SES	0.17***	0.17***
	(0.027)	(0.032)
SCHOOL TYPE	0.18***	0.20***
	(0.052)	(0.059)
STU-TEA RATIO	0.00	0.00
	(0.005)	(0.005)
SCHOOL CHOCIE	-0.00	-0.06
	(0.067)	(0.078)
PRESCORE	0.17***	0.17***
	(0.012)	(0.014)
SELF-STUDY	0.17*	0.16
	(0.071)	(0.080)
SELF-ESTEEM	0.06	0.10*
	(0.038)	(0.044)
Constant	-1.79***	-1.66***
	(0.188)	(0.224)
Observations	1,768	1,304
R-squared	0.249	0.259

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VER_Z (verbal score in grade 9)

Table C.5. Effects of two years of verbal tutoring on verbal achievement in grade 9

VARIABLES	(1) OLS	(2) IV
2 years of Verbal PT in middle school	-0.05	-0.11
	(0.042)	(0.087)
URBAN	-0.06	-0.06
	(0.060)	(0.069)
GENDER (1=female)	0.48***	0.47***
	(0.041)	(0.049)
SES	0.13***	0.16***
	(0.027)	(0.031)
SCHOOL TYPE	0.11*	0.13*
	(0.051)	(0.059)
STU-TEA RATIO	0.01	0.00
	(0.005)	(0.005)
SCHOOL CHOCIE	-0.05	-0.06
	(0.062)	(0.072)
PRESCORE	0.16***	0.14***
	(0.012)	(0.014)
SELF-STUDY	0.11	0.11
	(0.064)	(0.073)
SELF-ESTEEM	0.12***	0.16***
	(0.037)	(0.043)
Constant	-1.61***	-1.43***
	(0.181)	(0.216)
Observations	1,900	1,394
R-squared	0.215	0.207

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VER_Z (verbal score in grade 9)

Table C.6. Effects of three years of verbal tutoring on verbal achievement in grade 9

VARIABLES	(1) OLS	(2) IV
3 years of Verbal PT in middle school	0.02	-0.12
	(0.040)	(0.083)
URBAN	-0.05	-0.10
	(0.055)	(0.062)
GENDER (1=female)	0.47***	0.44***
	(0.038)	(0.044)
SES	0.06*	0.09**
	(0.025)	(0.029)
SCHOOL TYPE	0.03	0.03
	(0.047)	(0.052)
STU-TEA RATIO	0.01	0.01
	(0.005)	(0.005)
SCHOOL CHOCIE	-0.06	-0.11
	(0.058)	(0.066)
PRESCORE	0.16***	0.16***
	(0.011)	(0.013)
SELF-STUDY	-0.00	0.02
	(0.058)	(0.064)
SELF-ESTEEM	0.14***	0.14***
	(0.034)	(0.039)
Constant	-1.66***	-1.42***
	(0.172)	(0.200)
Observations	2,207	1,714
R-squared	0.203	0.194

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VER_Z (verbal score in grade 9)

Table C.7. Effects of one year of English tutoring on English achievement in grade 9

VARIABLES	(1) OLS	(2) IV
1 year of English PT in middle school	0.05	0.24
	(0.050)	(0.156)
URBAN	0.12	0.08
	(0.075)	(0.093)
GENDER (1=female)	0.34***	0.34***
	(0.049)	(0.059)
SES	0.22***	0.27***
	(0.037)	(0.048)
SCHOOL TYPE	0.14*	0.07
	(0.062)	(0.072)
STU-TEA RATIO	-0.00	-0.00
	(0.005)	(0.006)
SCHOOL CHOCIE	0.13	0.07
	(0.074)	(0.093)
PRESCORE	0.14***	0.16***
	(0.015)	(0.017)
SELF-STUDY	0.03	-0.08
	(0.103)	(0.120)
SELF-ESTEEM	0.13**	0.16**
	(0.044)	(0.051)
Constant	-1.82***	-1.83***
	(0.215)	(0.280)
Observations	993	687
R-squared	0.231	0.274

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9ENG_Z (English score in grade 9)

Table C.8. Effects of two year of English tutoring on English achievement in grade 9

VARIABLES	(1) OLS	(2) IV
2 years of English PT in middle school	0.23***	0.11
	(0.049)	(0.293)
URBAN	0.06	0.10
	(0.065)	(0.080)
GENDER (1=female)	0.31***	0.30***
	(0.044)	(0.053)
SES	0.19***	0.23***
	(0.032)	(0.053)
SCHOOL TYPE	0.11*	0.08
	(0.055)	(0.065)
STU-TEA RATIO	0.00	0.01
	(0.005)	(0.006)
SCHOOL CHOCIE	0.04	0.09
	(0.067)	(0.080)
PRESCORE	0.14***	0.15***
	(0.013)	(0.018)
SELF-STUDY	0.22**	0.11
	(0.082)	(0.097)
SELF-ESTEEM	0.16***	0.19***
	(0.040)	(0.051)
Constant	-1.79***	-1.83***
	(0.192)	(0.280)
Observations	1,377	993
R-squared	0.274	0.270

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9ENG_Z (English score in grade 9)

Table C.9 Effects of three year of English tutoring on English achievement in grade 9

VARIABLES	(1) OLS	(2) IV
3 years of English PT in middle school	0.41***	1.06***
	(0.046)	(0.137)
URBAN	-0.07	-0.10*
	(0.043)	(0.051)
GENDER (1=female)	0.35***	0.37***
	(0.030)	(0.035)
SES	0.21***	0.17***
	(0.020)	(0.027)
SCHOOL TYPE	0.07	0.08
	(0.038)	(0.044)
STU-TEA RATIO	0.00	0.00
	(0.004)	(0.005)
SCHOOL CHOCIE	-0.11*	-0.10
	(0.047)	(0.055)
PRESCORE	0.16***	0.14***
	(0.009)	(0.011)
SELF-STUDY	-0.00	-0.05
	(0.043)	(0.049)
SELF-ESTEEM	0.25***	0.21***
	(0.027)	(0.032)
Constant	-1.58***	-2.11***
	(0.141)	(0.186)
Observations	3,142	2,492
R-squared	0.310	0.252

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9ENG_Z (English score in grade 9)

Table C.10. Effects of one year of math tutoring on math achievement in grade 9

VARIABLES	(1) OLS	(2) IV
1 year of Math PT in middle school	0.05	0.21
	(0.048)	(0.128)
URBAN	-0.18*	-0.19*
	(0.074)	(0.089)
GENDER (1=female)	-0.02	-0.05
	(0.048)	(0.056)
SES	0.16***	0.14**
	(0.035)	(0.042)
SCHOOL TYPE	0.07	0.10
	(0.061)	(0.070)
STU-TEA RATIO	0.00	-0.00
	(0.005)	(0.006)
SCHOOL CHOCIE	-0.02	-0.03
	(0.072)	(0.088)
PRESCORE	0.18***	0.18***
	(0.014)	(0.016)
SELF-STUDY	0.17	0.20
	(0.095)	(0.111)
SELF-ESTEEM	0.07	0.12*
	(0.044)	(0.051)
Constant	-1.28***	-1.24***
	(0.206)	(0.261)
Observations	992	693
R-squared	0.242	0.272

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9MAT_Z (math score in grade 9)

Table C.11. Effects of two year of math tutoring on math achievement in grade 9

VARIABLES	(1) OLS	(2) IV
2 years of Math PT in middle school	0.29***	0.01
	(0.049)	(0.307)
URBAN	-0.19**	-0.24**
	(0.067)	(0.081)
GENDER (1=female)	0.00	-0.02
	(0.044)	(0.052)
SES	0.15***	0.21***
	(0.031)	(0.051)
SCHOOL TYPE	0.15**	0.18**
	(0.055)	(0.066)
STU-TEA RATIO	0.00	0.01
	(0.005)	(0.006)
SCHOOL CHOCIE	-0.05	-0.10
	(0.067)	(0.080)
PRESCORE	0.16***	0.18***
	(0.013)	(0.017)
SELF-STUDY	0.08	0.09
	(0.080)	(0.094)
SELF-ESTEEM	0.13**	0.15**
	(0.040)	(0.051)
Constant	-1.22***	-1.00***
	(0.193)	(0.283)
Observations	1,423	1,031
R-squared	0.244	0.245

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9MAT_Z (math score in grade 9)

Table C.12 Effects of three year of math tutoring on math achievement in grade 9

VARIABLES	(1) OLS	(2) IV
3 years of Math PT in middle school	0.46***	0.88***
	(0.048)	(0.136)
URBAN	-0.14**	-0.17***
	(0.044)	(0.051)
GENDER (1=female)	0.01	0.01
	(0.031)	(0.036)
SES	0.17***	0.17***
	(0.021)	(0.026)
SCHOOL TYPE	0.15***	0.14**
	(0.039)	(0.045)
STU-TEA RATIO	0.01	0.00
	(0.004)	(0.005)
SCHOOL CHOCIE	-0.06	-0.03
	(0.048)	(0.056)
PRESCORE	0.18***	0.16***
	(0.010)	(0.011)
SELF-STUDY	0.04	0.03
	(0.044)	(0.049)
SELF-ESTEEM	0.11***	0.09**
	(0.028)	(0.032)
Constant	-1.34***	-1.58***
	(0.146)	(0.188)
Observations	3,198	2,531
R-squared	0.254	0.215

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9MAT_Z (math score in grade 9)

Table C.13. Effects of private tutoring in grade 7 on academic achievement for 3 years

	Year 0		Year 1		Year 2	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
PT in G7	0.22***	0.53***	0.09**	0.33***	0.05	0.22*
	(0.022)	(0.066)	(0.026)	(0.076)	(0.033)	(0.094)
URBANICITY	0.07**	0.04	0.01	-0.01	-0.05	-0.06
	(0.025)	(0.026)	(0.028)	(0.029)	(0.034)	(0.035)
GENDER (1=female)	0.25***	0.26***	0.29***	0.29***	0.28***	0.28***
	(0.017)	(0.018)	(0.019)	(0.020)	(0.023)	(0.024)
SES	0.19***	0.16***	0.16***	0.16***	0.15***	0.14***
	(0.011)	(0.013)	(0.013)	(0.014)	(0.016)	(0.017)
SCHOOL TYPE (1=private)	0.06**	0.04	0.06*	0.05	0.09**	0.07*
	(0.021)	(0.022)	(0.024)	(0.025)	(0.029)	(0.030)
STU-TEA RATIO	0.01***	0.01***	0.01***	0.01***	0.01*	0.01*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
SCHOOL CHOICE	-0.07**	-0.07**	-0.09**	-0.10***	-0.02	-0.02
	(0.026)	(0.028)	(0.029)	(0.031)	(0.036)	(0.037)
PRESCORE (G6)	0.20***	0.19***	0.17***	0.16***	0.16***	0.16***
	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
STUDY HOUR	0.10***	0.09***	0.09**	0.08**	0.07	0.05
(1= >10hrs per week)	(0.025)	(0.026)	(0.028)	(0.029)	(0.035)	(0.036)
SELF ESTEEM	0.19***	0.19***	0.18***	0.18***	0.12***	0.12***
	(0.015)	(0.016)	(0.017)	(0.018)	(0.021)	(0.022)
PT in G8			0.24***	0.15***	0.18***	0.12**
			(0.027)	(0.040)	(0.035)	(0.045)
PT in G9					0.23***	0.20***
					(0.033)	(0.038)
Constant	-1.92***	-2.06***	-1.77***	-1.83***	-1.78***	-1.85***
	(0.078)	(0.090)	(0.088)	(0.096)	(0.106)	(0.115)
Observations	5,895	5,473	5,380	5,022	3,990	3,716
R-squared	0.444	0.419	0.364	0.351	0.315	0.307

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Dependent variables: G7VEM_Z (average score in grade 7) for (1) and (2); G8VEM_Z (average score in grade 8) for (3) and (4); G9VEM_Z (average score in grade 9) for (5) and (6)

Table C.14. Effects of private tutoring in grade 8 on academic achievement for 2 years

	Year 0 (Grade 8)		Year 1 (Grade 9)	
	(1)	(2)	(3)	(4)
VARIABLES	OLS	IV	OLS	IV
PT in G8	0.12***	0.27***	0.09**	0.13
	(0.020)	(0.066)	(0.028)	(0.097)
URBANICITY	-0.04	-0.05*	-0.09**	-0.09**
	(0.021)	(0.022)	(0.028)	(0.029)
GENDER (1=female)	0.10***	0.11***	0.09***	0.09***
	(0.014)	(0.015)	(0.019)	(0.020)
SES	0.04***	0.04***	0.05***	0.06***
	(0.010)	(0.011)	(0.013)	(0.014)
SCHOOL TYPE (1=private)	0.03	0.03	0.06*	0.07**
	(0.018)	(0.019)	(0.023)	(0.025)
STU-TEA RATIO	0.00	0.00	-0.00	-0.00
	(0.002)	(0.002)	(0.002)	(0.002)
SCHOOL CHOICE	-0.05*	-0.05*	0.01	0.01
	(0.022)	(0.023)	(0.029)	(0.031)
PRESCORE (G7)	0.73***	0.72***	0.68***	0.68***
	(0.010)	(0.011)	(0.013)	(0.014)
STUDY HOUR	0.03	0.01	0.01	-0.01
(1= >10hrs per week)	(0.021)	(0.023)	(0.029)	(0.030)
SELF ESTEEM	0.07***	0.06***	0.03	0.03
	(0.013)	(0.013)	(0.017)	(0.018)
PT in G7	-0.03	-0.08**	-0.06*	-0.08*
	(0.020)	(0.031)	(0.027)	(0.039)
PT in G9			0.16***	0.15***
			(0.027)	(0.040)
Constant	-0.18**	-0.25***	-0.25**	-0.24**
	(0.062)	(0.073)	(0.082)	(0.092)
Observations	5,501	4,953	4,077	3,657
R-squared	0.633	0.623	0.540	0.530

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8VEM_Z (average score in grade 8) for (1) and (2); G9VEM_Z (average score in grade 9) for (3) and (4)

Table C.15. Effects of private tutoring in grade 9 on academic achievement in grade 9

	Year 0 (Grade 9)	
	(1)	(2)
VARIABLES	OLS	IV
PT in G9	0.16***	0.19*
	(0.023)	(0.090)
URBANICITY	-0.07**	-0.07**
	(0.025)	(0.028)
GENDER (1=female)	0.06**	0.06**
	(0.018)	(0.019)
SES	0.05***	0.06***
	(0.012)	(0.014)
SCHOOL TYPE (1=private)	0.06**	0.07**
	(0.021)	(0.023)
STU-TEA RATIO	-0.00	0.00
	(0.002)	(0.002)
SCHOOL CHOICE	0.03	0.02
	(0.027)	(0.029)
PRESCORE (G8)	0.70***	0.69***
	(0.012)	(0.013)
STUDY HOURS (1= >10hrs per week)	0.00	0.00
	(0.027)	(0.029)
SELF ESTEEM	0.05***	0.05**
	(0.015)	(0.017)
PT in G8	0.05*	0.01
	(0.024)	(0.046)
Constant	-0.23**	-0.25**
	(0.074)	(0.086)
Observations	4,378	3,761
R-squared	0.585	0.579

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VEM_Z (average score in grade 9)

Table D.1. Effects of verbal tutoring in grade 7 on verbal achievement for 3 years

	Year 0 (Grade 7)		Year 1 (Grade 8)		Year 2 (Grade 9)	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
VERBAL PT in G7	-0.01	0.01	-0.05	-0.08	-0.02	-0.12
	(0.022)	(0.056)	(0.025)	(0.071)	(0.031)	(0.087)
URBANICITY	0.05	0.05	0.02	0.01	-0.04	-0.04
	(0.031)	(0.032)	(0.034)	(0.035)	(0.041)	(0.042)
GENDER (1=female)	0.45***	0.45***	0.47***	0.47***	0.47***	0.47***
	(0.021)	(0.022)	(0.023)	(0.024)	(0.028)	(0.029)
SES	0.14***	0.13***	0.10***	0.11***	0.11***	0.12***
	(0.014)	(0.015)	(0.015)	(0.016)	(0.018)	(0.019)
SCHOOL TYPE	0.04	0.02	0.05	0.04	0.08*	0.08*
(1=private)	(0.026)	(0.027)	(0.029)	(0.030)	(0.035)	(0.036)
STU/TEA RATIO	0.02***	0.01***	0.02***	0.02***	0.01**	0.01**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
SCHOOL CHOICE	-0.05	-0.05	-0.08*	-0.09*	-0.03	-0.03
	(0.033)	(0.034)	(0.036)	(0.037)	(0.043)	(0.045)
PRESCORE (G6)	0.20***	0.20***	0.17***	0.17***	0.15***	0.15***
	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)	(0.009)
STUDY HOUR	0.06*	0.07*	0.05	0.04	0.08	0.07
(1= >10hrs per week)	(0.032)	(0.032)	(0.035)	(0.036)	(0.043)	(0.044)
SELF ESTEEM	0.19***	0.19***	0.17***	0.17***	0.10***	0.11***
	(0.019)	(0.020)	(0.021)	(0.021)	(0.025)	(0.026)
VERBAL PT in G8			0.09***	0.09**	0.06	0.07
			(0.025)	(0.035)	(0.033)	(0.043)
VERBAL PT in G9					0.01	0.03
					(0.032)	(0.035)
Constant	-2.12***	-2.07***	-1.96***	-1.89***	-1.77***	-1.72***
	(0.096)	(0.102)	(0.105)	(0.110)	(0.126)	(0.133)
Observations	5,855	5,435	5,357	5,004	4,073	3,790
R-squared	0.316	0.307	0.257	0.250	0.198	0.192

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Dependent variables: G7VER_Z (verbal score in grade 7) (1) and (2); G8VER_Z (verbal score in grade 8) for (3) and (4); G9VER_Z (verbal score in grade 9) for (5) and (6)

Table D.2. Effects of verbal tutoring in grade 8 on verbal achievement for 2 years

	Year 0 (Grade 8)		Year 1 (Grade 9)	
	(1)	(2)	(3)	(4)
VARIABLES	OLS	IV	OLS	IV
VERBAL PT in G8	0.04*	-0.00	0.00	-0.11
	(0.021)	(0.053)	(0.028)	(0.075)
URBANICITY	-0.04	-0.04	-0.08*	-0.08*
	(0.028)	(0.029)	(0.034)	(0.036)
GENDER (1=female)	0.29***	0.30***	0.26***	0.25***
	(0.020)	(0.021)	(0.024)	(0.026)
SES	-0.04**	-0.04**	-0.01	0.00
	(0.013)	(0.014)	(0.016)	(0.017)
SCHOOL TYPE (1=private)	0.02	0.02	0.05	0.06
	(0.024)	(0.025)	(0.029)	(0.031)
STU-TEA RATIO	0.01**	0.01**	0.00	0.00
	(0.002)	(0.002)	(0.003)	(0.003)
SCHOOL CHOICE	-0.03	-0.04	0.02	0.00
	(0.030)	(0.031)	(0.036)	(0.038)
PRESCORE (G7)	0.73***	0.72***	0.71***	0.71***
	(0.013)	(0.014)	(0.015)	(0.016)
STUDY HOURS	-0.02	-0.03	0.00	-0.01
(1= >10hrs per week)	(0.029)	(0.030)	(0.036)	(0.038)
SELF ESTEEM	0.05**	0.04*	0.01	0.01
	(0.017)	(0.018)	(0.021)	(0.022)
VERBAL PT in G7	-0.06**	-0.04	-0.02	0.02
	(0.021)	(0.029)	(0.026)	(0.035)
VERBAL PT in G9			-0.00	0.02
			(0.027)	(0.036)
Constant	-0.49***	-0.49***	-0.38***	-0.32**
	(0.082)	(0.089)	(0.100)	(0.107)
Observations	5,478	4,935	4,133	3,701
R-squared	0.469	0.462	0.425	0.420

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8VER_Z (verbal score in grade 8) for (1) and (2); G9VER_Z (verbal score in grade 9) for (3) and (4)

Table D.3. Effects of verbal tutoring in grade 9 on verbal achievement in grade 9

	Year 0 (Grade 9)	
	(1)	(2)
VARIABLES	OLS	IV
VERBAL PT in G9	-0.00	-0.04
	(0.027)	(0.093)
URBANICITY	-0.08*	-0.09*
	(0.034)	(0.037)
GENDER (1=female)	0.26***	0.27***
	(0.024)	(0.027)
SES	-0.01	-0.01
	(0.016)	(0.017)
SCHOOL TYPE (1=private)	0.05	0.07*
	(0.029)	(0.031)
STU-TEA RATIO	0.00	0.00
	(0.003)	(0.003)
SCHOOL CHOICE	0.02	0.00
	(0.036)	(0.039)
PRESCORE (G8)	0.71***	0.69***
	(0.015)	(0.017)
STUDY HOURS (1= >10hrs per week)	0.00	0.01
	(0.036)	(0.039)
SELF-ESTEEM	0.01	0.01
	(0.021)	(0.023)
VERBAL PT in G7	-0.02	-0.01
	(0.026)	(0.031)
VERBAL PT in G8	0.00	-0.01
	(0.028)	(0.043)
Constant	-0.38***	-0.40***
	(0.100)	(0.112)
Observations	4,133	3,556
R-squared	0.425	0.414

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VER_Z (verbal score in grade 9)

Table D.4. Effects of English tutoring in grade 7 on English achievement for 3 years

	Year 0 (Grade 7)		Year 1 (Grade 8)		Year 2 (Grade 9)	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
ENGLISH PT in G7	0.25***	0.72***	0.12***	0.61***	0.07*	0.64***
	(0.024)	(0.071)	(0.029)	(0.086)	(0.033)	(0.098)
URBANICITY	0.10***	0.05	0.05	0.01	0.00	-0.03
	(0.029)	(0.032)	(0.032)	(0.034)	(0.036)	(0.039)
GENDER (1=female)	0.28***	0.30***	0.36***	0.37***	0.34***	0.35***
	(0.020)	(0.022)	(0.022)	(0.024)	(0.025)	(0.027)
SES	0.28***	0.25***	0.25***	0.23***	0.21***	0.19***
	(0.013)	(0.016)	(0.015)	(0.017)	(0.017)	(0.019)
SCHOOL TYPE (1=private)	0.08**	0.06*	0.06*	0.04	0.09**	0.06
	(0.025)	(0.027)	(0.028)	(0.029)	(0.031)	(0.033)
STU-TEA RATIO	0.01***	0.01***	0.01***	0.01**	0.01	0.01*
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
SCHOOL CHOICE	-0.11***	-0.12***	-0.08*	-0.10**	-0.05	-0.05
	(0.031)	(0.033)	(0.034)	(0.036)	(0.038)	(0.041)
PRESCORE (G6)	0.18***	0.17***	0.15***	0.14***	0.16***	0.15***
	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)
STUDY HOURS	0.13***	0.10**	0.11**	0.09*	0.03	-0.01
(1= >10hrs per week)	(0.030)	(0.032)	(0.033)	(0.035)	(0.037)	(0.040)
SELF ESTEEM	0.23***	0.21***	0.23***	0.22***	0.21***	0.20***
	(0.018)	(0.020)	(0.020)	(0.021)	(0.022)	(0.024)
ENGLISH PT in G8			0.25***	0.05	0.18***	-0.02
			(0.029)	(0.045)	(0.036)	(0.050)
ENGLISH PT in G9					0.23***	0.13**
					(0.035)	(0.041)
Constant	-1.82***	-2.02***	-1.77***	-1.90***	-1.81***	-1.99***
	(0.092)	(0.105)	(0.102)	(0.112)	(0.114)	(0.126)
Observations	5,910	5,487	5,380	5,023	4,546	4,248
R-squared	0.403	0.362	0.338	0.301	0.314	0.269

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Dependent variables: G7ENG_Z (English score in grade 7) for (1) and (2); G8ENG_Z (English score in grade 8) for (3) and (4); G9ENG_Z (English score in grade 9) for (5) and (6)

Table D.5. Effects of English tutoring in grade 8 on English achievement for 2 years

	Year 0 (Grade 8)		Year 1 (Grade 9)	
	(1)	(2)	(3)	(4)
VARIABLES	OLS	IV	OLS	IV
ENGLISH PT in G8	0.14***	0.31***	0.09**	0.18
	(0.024)	(0.073)	(0.030)	(0.102)
URBANICITY	0.00	-0.01	-0.04	-0.04
	(0.026)	(0.027)	(0.030)	(0.032)
GENDER (1=female)	0.17***	0.17***	0.15***	0.16***
	(0.018)	(0.019)	(0.021)	(0.022)
SES	0.11***	0.12***	0.10***	0.10***
	(0.012)	(0.014)	(0.015)	(0.016)
SCHOOL TYPE (1=private)	0.03	0.04	0.06*	0.07**
	(0.022)	(0.023)	(0.026)	(0.027)
STU-TEA RATIO	-0.00	-0.00	-0.00	-0.00
	(0.002)	(0.002)	(0.003)	(0.003)
SCHOOL CHOICE	-0.03	-0.04	-0.01	-0.00
	(0.027)	(0.029)	(0.032)	(0.034)
PRESCORE (G7)	0.74***	0.73***	0.70***	0.70***
	(0.012)	(0.014)	(0.014)	(0.016)
STUDY HOURS	0.05	0.03	-0.02	-0.05
(1= >10hrs per week)	(0.027)	(0.028)	(0.031)	(0.033)
SELF ESTEEM	0.09***	0.09***	0.11***	0.10***
	(0.016)	(0.017)	(0.018)	(0.019)
ENGLISH PT in G7	0.00	-0.06	-0.03	-0.07
	(0.023)	(0.035)	(0.028)	(0.040)
ENGLISH PT in G9			0.17***	0.14**
			(0.029)	(0.045)
Constant	-0.30***	-0.37***	-0.29**	-0.33**
	(0.077)	(0.090)	(0.091)	(0.102)
Observations	5,502	4,955	4,643	4,188
R-squared	0.561	0.555	0.504	0.499

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables:G8ENG_Z (English score in grade 8) for (1) and (2); G9ENG_Z (English score in grade 9) for (3) and (4)

Table D.6. Effects of English tutoring in grade 9 on English achievement in grade 9

	Year 0 (Grade 9)	
	(1)	(2)
VARIABLES	OLS	IV
ENGLISH PT in G9	0.16***	-0.15
	(0.028)	(0.272)
URBANICITY	-0.02	-0.00
	(0.029)	(0.032)
GENDER (1=female)	0.12***	0.12***
	(0.021)	(0.024)
SES	0.11***	0.12***
	(0.014)	(0.018)
SCHOOL TYPE (1=private)	0.04	0.05
	(0.025)	(0.027)
STU/TEA RATIO	-0.00	-0.00
	(0.002)	(0.003)
SCHOOL CHOICE	0.01	0.02
	(0.031)	(0.035)
PRESCORE (G8)	0.73***	0.74***
	(0.014)	(0.018)
STUDY HOURS	-0.03	-0.04
(1= >10hrs per week)	(0.030)	(0.033)
SELF-ESTEEM	0.13***	0.13***
	(0.018)	(0.020)
ENGLISH PT in G7	0.01	0.07
	(0.027)	(0.050)
ENGLISH PT in G8	0.06*	0.14
	(0.029)	(0.100)
Constant	-0.27**	-0.22
	(0.088)	(0.119)
Observations	4,609	4,002
R-squared	0.536	0.524

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9ENG_Z (English score in grade 9)

Table D.7. Effects of math tutoring in grade 7 on math achievement for 3 years

	Year 0 (Grade 7)		Year 1 (Grade 8)		Year 2 (Grade 9)	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
MATH PT in G7	0.26***	0.53***	0.09**	0.36***	0.04	0.34**
	(0.024)	(0.081)	(0.030)	(0.085)	(0.033)	(0.132)
URBANICITY	0.05	0.03	-0.02	-0.06	-0.14***	-0.17***
	(0.031)	(0.032)	(0.034)	(0.035)	(0.037)	(0.039)
GENDER (1=female)	0.02	0.02	0.04	0.05*	0.01	0.01
	(0.021)	(0.022)	(0.023)	(0.024)	(0.026)	(0.027)
SES	0.16***	0.14***	0.16***	0.16***	0.16***	0.15***
	(0.014)	(0.016)	(0.016)	(0.017)	(0.017)	(0.019)
SCHOOL TYPE (1=private)	0.05	0.04	0.07*	0.06	0.15***	0.13***
	(0.026)	(0.028)	(0.029)	(0.030)	(0.032)	(0.033)
STU/TEA RATIO	0.01***	0.01***	0.01***	0.01**	0.01*	0.01
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
SCHOOL CHOICE	-0.06*	-0.07*	-0.11**	-0.12***	-0.04	-0.05
	(0.032)	(0.034)	(0.036)	(0.037)	(0.039)	(0.041)
PRESCORE (G6)	0.22***	0.21***	0.18***	0.18***	0.17***	0.17***
	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)
STUDY HOURS	0.11***	0.09**	0.11***	0.11**	0.06	0.06
(1= >10hrs per week)	(0.031)	(0.033)	(0.035)	(0.036)	(0.038)	(0.039)
SELF ESTEEM	0.17***	0.16***	0.15***	0.15***	0.10***	0.10***
	(0.019)	(0.020)	(0.021)	(0.022)	(0.023)	(0.024)
MATH PT in G8			0.28***	0.16***	0.20***	0.09
			(0.031)	(0.046)	(0.037)	(0.058)
MATH PT in G9					0.30***	0.25***
					(0.036)	(0.044)
Constant	-1.72***	-1.83***	-1.44***	-1.52***	-1.41***	-1.50***
	(0.096)	(0.108)	(0.106)	(0.114)	(0.117)	(0.128)
Observations	5,859	5,445	5,391	5,035	4,641	4,336
R-squared	0.348	0.330	0.286	0.275	0.259	0.244

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G7MAT_Z (math score in grade 7) for (1) and (2); G8MAT_Z (math score in grade 8) for (3) and (4); G9MAT_Z (math score in grade 9) for (5) and (6)

Table D.8. Effects of math tutoring in grade 8 on math achievement for 2 years

	Year 0 (Grade 8)		Year 1 (Grade 9)	
	(1)	(2)	(3)	(4)
VARIABLES	OLS	IV	OLS	IV
MATH PT in G8	0.17***	0.45***	0.11***	0.43***
	(0.026)	(0.083)	(0.032)	(0.111)
URBANICITY	-0.08**	-0.09**	-0.18***	-0.17***
	(0.029)	(0.030)	(0.032)	(0.034)
GENDER (1=female)	-0.15***	-0.14***	-0.18***	-0.18***
	(0.020)	(0.021)	(0.023)	(0.024)
SES	0.04**	0.03*	0.05***	0.05**
	(0.014)	(0.015)	(0.015)	(0.017)
SCHOOL TYPE (1=private)	0.04	0.04	0.12***	0.13***
	(0.025)	(0.026)	(0.028)	(0.030)
STU-TEA RATIO	0.00	-0.00	-0.00	-0.00
	(0.002)	(0.003)	(0.003)	(0.003)
SCHOOL CHOICE	-0.08*	-0.07*	-0.01	0.01
	(0.030)	(0.033)	(0.034)	(0.037)
PRESCORE (G7)	0.73***	0.71***	0.67***	0.67***
	(0.014)	(0.015)	(0.015)	(0.017)
STUDY HOURS	0.05	0.03	-0.00	-0.03
(1= >10hrs per week)	(0.029)	(0.031)	(0.033)	(0.035)
SELF ESTEEM	0.06**	0.05*	0.02	0.01
	(0.017)	(0.019)	(0.020)	(0.021)
MATH PT in G7	0.00	-0.09*	-0.03	-0.13**
	(0.025)	(0.040)	(0.029)	(0.044)
MATH PT in G9			0.25***	0.14**
			(0.032)	(0.048)
Constant	0.23**	0.09	0.14	0.04
	(0.085)	(0.099)	(0.097)	(0.108)
Observations	5,513	4,964	4,739	4,275
R-squared	0.471	0.455	0.419	0.405

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8MAT_Z (math score in grade 8) for (1) and (2); G9MAT_Z (math score in grade 9) for (3) and (4)

Table D.9. Effects of math tutoring in grade 9 on math achievement in grade 9

	Year 0 (Grade 9)	
	(1)	(2)
VARIABLES	OLS	IV
MATH PT in G9	0.24***	-0.09
	(0.031)	(0.287)
URBANICITY	-0.15***	-0.15***
	(0.032)	(0.035)
GENDER (1=female)	-0.21***	-0.22***
	(0.022)	(0.026)
SES	0.07***	0.09***
	(0.015)	(0.020)
SCHOOL TYPE (1=private)	0.11***	0.13***
	(0.027)	(0.030)
STU-TEA RATIO	-0.00	0.00
	(0.003)	(0.004)
SCHOOL CHOICE	0.01	0.01
	(0.034)	(0.037)
PRESCORE (G8)	0.68***	0.70***
	(0.015)	(0.019)
STUDY HOURS	-0.00	-0.00
(1= >10hrs per week)	(0.033)	(0.036)
SELF ESTEEM	0.04*	0.05*
	(0.019)	(0.023)
MATH PT in G7	0.01	0.05
	(0.029)	(0.053)
MATH PT in G8	0.08**	0.19
	(0.031)	(0.103)
Constant	0.11	0.22
	(0.095)	(0.136)
Observations	4,697	4,073
R-squared	0.443	0.427

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9MAT_Z (math score in grade 9)

Table E.1. Long-term cumulative effects of private tutoring in middle school on the CSAT achievement

	1 year of PT in MS		2 years of PT in MS		3 years of PT in MS	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.03	0.34	0.13	0.36	0.04	0.48
	(0.180)	(0.482)	(0.166)	(0.410)	(0.134)	(0.456)
URBANICITY	-0.63*	-0.91**	-0.07	-0.12	-0.03	-0.15
	(0.272)	(0.308)	(0.206)	(0.232)	(0.092)	(0.103)
GENDER (1=female)	-0.05	-0.24	0.13	0.09	0.05	0.03
	(0.178)	(0.207)	(0.138)	(0.162)	(0.064)	(0.072)
SES	0.02	-0.17	0.05	0.06	0.31***	0.25***
	(0.153)	(0.191)	(0.104)	(0.117)	(0.043)	(0.051)
SCHOOL TYPE (1=private)	-0.16	-0.13	0.31	0.17	0.05	-0.04
	(0.257)	(0.287)	(0.175)	(0.197)	(0.081)	(0.091)
STU-TEA RATIO	0.03	0.03	-0.00	-0.00	0.00	0.01
	(0.018)	(0.020)	(0.014)	(0.016)	(0.008)	(0.009)
SCHOOL CHOICE	-0.34	-0.53	-0.14	-0.21	-0.04	-0.12
	(0.280)	(0.315)	(0.213)	(0.238)	(0.100)	(0.110)
PRESCORE (G6)	0.27***	0.32***	0.24***	0.28***	0.26***	0.26***
	(0.054)	(0.061)	(0.039)	(0.046)	(0.020)	(0.022)
STUDY HOURS (1= >10hrs /week)	-0.24	-0.26	0.17	0.11	0.15	0.15
	(0.332)	(0.381)	(0.231)	(0.259)	(0.087)	(0.095)
SELF ESTEEM	0.23	0.07	0.24	0.11	0.31***	0.28***
	(0.155)	(0.177)	(0.130)	(0.152)	(0.057)	(0.065)
PT in G10	0.10	0.16	0.03	0.09	0.35***	0.32**
	(0.186)	(0.221)	(0.155)	(0.191)	(0.097)	(0.122)
PT in G11	0.35	0.23	0.21	-0.01	0.33***	0.32**
	(0.206)	(0.242)	(0.158)	(0.189)	(0.087)	(0.101)
PT in G12	0.54*	0.60*	0.36*	0.45*	0.29***	0.34***
	(0.253)	(0.298)	(0.175)	(0.199)	(0.072)	(0.079)
Constant	3.46***	3.68***	3.40***	3.36***	3.24***	2.95***
	(0.801)	(0.951)	(0.598)	(0.712)	(0.316)	(0.455)
Observations	246	181	421	325	1,452	1,190
R-squared	0.275	0.294	0.181	0.180	0.318	0.310

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_avg (average score on the CSAT)

Table E.2. Long-term single-year effects of private tutoring in middle school on the CSAT

	PT in G7		PT in G8		PT in G9	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.14	0.42	0.09	-0.18	-0.07	0.31
	(0.087)	(0.274)	(0.086)	(0.293)	(0.081)	(0.385)
URBANICITY	-0.00	-0.03	-0.03	-0.05	-0.04	-0.09
	(0.084)	(0.087)	(0.075)	(0.078)	(0.075)	(0.081)
GENDER (1=female)	0.07	0.06	-0.11*	-0.13*	-0.17**	-0.17**
	(0.058)	(0.060)	(0.053)	(0.055)	(0.052)	(0.059)
SES	0.28***	0.25***	0.18***	0.14***	0.18***	0.17***
	(0.040)	(0.043)	(0.036)	(0.038)	(0.036)	(0.039)
SCHOOL TYPE (1=private)	0.13	0.10	0.13*	0.10	0.13	0.10
	(0.074)	(0.077)	(0.067)	(0.069)	(0.065)	(0.070)
STU-TEA RATIO	0.00	0.01	-0.01	-0.01	-0.00	-0.00
	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)
SCHOOL CHOICE	-0.04	-0.05	0.04	0.03	0.02	-0.04
	(0.090)	(0.093)	(0.081)	(0.084)	(0.080)	(0.087)
PRESCORE (G6)	0.25***	0.25***	0.95***	0.97***	0.84***	0.82***
	(0.018)	(0.019)	(0.039)	(0.041)	(0.036)	(0.038)
STUDY HOURS (1= >10hrs /week)	0.13	0.14	0.08	0.09	0.09	0.10
	(0.082)	(0.084)	(0.074)	(0.077)	(0.073)	(0.078)
SELF ESTEEM	0.28***	0.27***	0.21***	0.20***	0.26***	0.22***
	(0.052)	(0.054)	(0.046)	(0.048)	(0.045)	(0.051)
PT in G7	-	-	-0.06	0.02	-	-
	-	-	(0.080)	(0.110)	-	-
PT in G8	0.17	0.14	-	-	0.02	-0.17
	(0.094)	(0.120)	-	-	(0.081)	(0.178)
PT in G9	-0.11	-0.22*	-0.12	-0.04	-	-
	(0.093)	(0.104)	(0.085)	(0.132)	-	-
PT in G10	0.19*	0.19*	0.08	0.09	0.16*	0.16
	(0.080)	(0.084)	(0.073)	(0.077)	(0.071)	(0.085)
PT in G11	0.31***	0.30***	0.30***	0.30***	0.31***	0.27**
	(0.075)	(0.078)	(0.068)	(0.070)	(0.066)	(0.083)
PT in G12	0.32***	0.32***	0.19**	0.21***	0.22***	0.25***
	(0.065)	(0.068)	(0.060)	(0.062)	(0.059)	(0.063)
Constant	3.14***	3.01***	5.24***	5.36***	5.25***	5.22***
	(0.276)	(0.306)	(0.236)	(0.254)	(0.229)	(0.270)
Observations	1,905	1,800	1,934	1,770	2,021	1,785
R-squared	0.296	0.287	0.405	0.403	0.390	0.378

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_avg (average score on the CSAT)

Table E.3. Long-term cumulative effects of verbal tutoring in middle school on the CSAT verbal achievement

	1 year of Verbal PT		2 years of Verbal PT		3 years of Verbal PT	
VARIABLES	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
Coefficient of interest	-0.17	0.52*	-0.21*	-0.28	-0.26**	-0.47*
	(0.106)	(0.256)	(0.103)	(0.222)	(0.098)	(0.192)
URBANICITY	-0.22	-0.28	-0.14	-0.14	-0.13	-0.14
	(0.158)	(0.180)	(0.144)	(0.160)	(0.127)	(0.140)
GENDER (1=female)	0.20	0.21	0.40***	0.39***	0.18*	0.13
	(0.107)	(0.121)	(0.100)	(0.115)	(0.088)	(0.099)
SES	0.29***	0.27***	0.26***	0.24**	0.19**	0.19**
	(0.068)	(0.079)	(0.067)	(0.075)	(0.060)	(0.066)
SCHOOL TYPE (1=private)	0.01	-0.17	0.03	0.01	-0.02	-0.15
	(0.133)	(0.154)	(0.128)	(0.144)	(0.114)	(0.126)
STU-TEA RATIO	0.02	0.01	0.01	0.01	0.02*	0.02*
	(0.012)	(0.014)	(0.011)	(0.013)	(0.011)	(0.012)
SCHOOL CHOICE	0.00	-0.08	-0.14	-0.14	-0.08	-0.04
	(0.174)	(0.198)	(0.154)	(0.171)	(0.139)	(0.151)
PRESCORE (G6)	0.31***	0.31***	0.31***	0.31***	0.29***	0.30***
	(0.032)	(0.037)	(0.029)	(0.033)	(0.027)	(0.030)
STUDY HOURS (1= >10hrs /week)	-0.06	-0.03	-0.06	-0.02	-0.02	0.05
	(0.158)	(0.176)	(0.141)	(0.156)	(0.127)	(0.137)
SELF ESTEEM	0.33***	0.28**	0.31***	0.25*	0.43***	0.38***
	(0.094)	(0.108)	(0.089)	(0.101)	(0.080)	(0.089)
VERBAL PT in G10	-0.10	-0.18	-0.01	0.07	0.10	0.15
	(0.115)	(0.136)	(0.106)	(0.126)	(0.095)	(0.113)
VERBAL PT in G11	0.13	0.05	-0.02	-0.11	0.04	0.02
	(0.143)	(0.163)	(0.129)	(0.145)	(0.113)	(0.124)
VERBAL PT in G12	0.57**	0.53**	0.40*	0.52**	0.32*	0.36*
	(0.180)	(0.200)	(0.167)	(0.181)	(0.141)	(0.150)
Constant	3.34***	3.35***	3.38***	3.38***	3.52***	3.55***
	(0.492)	(0.568)	(0.449)	(0.514)	(0.416)	(0.467)
Observations	791	635	925	722	1,114	909
R-squared	0.254	0.204	0.222	0.214	0.212	0.210

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_V (verbal score on the CSAT)

Table E.4. Long-term single-year effects of verbal tutoring in middle school on the CSAT verbal achievement

	VERBAL PT in G7		VERBAL PT in G8		VERBAL PT in G9	
VARIABLES	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
Coefficient of interest	-0.04	-0.08	-0.04	-0.33	-0.07	0.07
	(0.071)	(0.188)	(0.071)	(0.176)	(0.072)	(0.290)
URBANICITY	-0.01	-0.01	-0.05	-0.04	-0.03	-0.05
	(0.094)	(0.097)	(0.088)	(0.090)	(0.089)	(0.097)
GENDER (1=female)	0.25***	0.24***	0.07	0.06	0.03	0.04
	(0.065)	(0.067)	(0.061)	(0.063)	(0.063)	(0.072)
SES	0.23***	0.21***	0.11**	0.07	0.12**	0.12*
	(0.044)	(0.045)	(0.041)	(0.043)	(0.043)	(0.046)
SCHOOL TYPE (1=private)	0.09	0.08	0.10	0.07	0.11	0.08
	(0.081)	(0.084)	(0.076)	(0.078)	(0.078)	(0.083)
STU-TEA RATIO	0.01	0.01	-0.00	-0.00	0.00	0.00
	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
SCHOOL CHOICE	0.05	0.05	0.14	0.15	0.13	0.11
	(0.101)	(0.104)	(0.094)	(0.097)	(0.096)	(0.103)
PRESCORE (G6)	0.29***	0.29***	0.95***	0.96***	0.83***	0.82***
	(0.020)	(0.021)	(0.043)	(0.045)	(0.042)	(0.045)
STUDY HOURS (1= >10hrs /week)	0.03	0.04	-0.02	-0.00	-0.01	0.02
	(0.092)	(0.094)	(0.086)	(0.089)	(0.088)	(0.093)
SELF ESTEEM	0.30***	0.30***	0.24***	0.25***	0.33***	0.29***
	(0.058)	(0.060)	(0.053)	(0.055)	(0.054)	(0.059)
VERBAL PT in G7	-	-	-0.12	-0.03	-0.09	-0.12
	-	-	(0.067)	(0.084)	(0.069)	(0.078)
VERBAL PT in G8	-0.02	-0.03	-	-	-0.06	-0.10
	(0.076)	(0.095)	-	-	(0.073)	(0.133)
VERBAL PT in G9	-0.13	-0.12	-0.08	0.03	-	-
	(0.075)	(0.081)	(0.071)	(0.092)	-	-
VERBAL PT in G10	0.03	0.03	-0.02	-0.02	-0.02	-0.02
	(0.068)	(0.071)	(0.064)	(0.066)	(0.065)	(0.081)
VERBAL PT in G11	0.08	0.07	0.10	0.08	0.10	0.09
	(0.081)	(0.083)	(0.075)	(0.077)	(0.077)	(0.082)
VERBAL PT in G12	0.33***	0.35***	0.20*	0.23*	0.20*	0.20*
	(0.101)	(0.102)	(0.095)	(0.096)	(0.097)	(0.103)
Constant	3.32***	3.32***	5.39***	5.47***	5.40***	5.36***
	(0.301)	(0.313)	(0.263)	(0.272)	(0.268)	(0.298)
Observations	2,032	1,921	2,064	1,889	2,044	1,812
R-squared	0.198	0.194	0.282	0.278	0.252	0.243

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_V (verbal score on the CSAT)

Table E.5. Long-term cumulative effects of English tutoring in middle school on the CSAT English achievement

	1 year of English PT		2 years of English PT		3 years of English PT	
VARIABLES	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
Coefficient of interest	-0.18	-0.02	-0.13	0.54	0.09	1.23**
	(0.180)	(0.521)	(0.163)	(0.408)	(0.132)	(0.444)
URBANICITY	-0.44	-0.62*	0.03	-0.19	0.02	-0.06
	(0.273)	(0.305)	(0.189)	(0.220)	(0.103)	(0.115)
GENDER (1=female)	0.38*	0.17	0.14	0.18	0.21**	0.20*
	(0.178)	(0.203)	(0.132)	(0.154)	(0.071)	(0.081)
SES	0.15	0.03	0.30**	0.23*	0.41***	0.35***
	(0.139)	(0.167)	(0.096)	(0.112)	(0.049)	(0.058)
SCHOOL TYPE (1=private)	0.38	0.21	0.16	0.03	0.07	0.01
	(0.234)	(0.262)	(0.173)	(0.200)	(0.090)	(0.102)
STU/TEA RATIO	0.02	0.02	-0.00	-0.01	0.01	0.01
	(0.018)	(0.021)	(0.015)	(0.017)	(0.009)	(0.010)
SCHOOL CHOICE	-0.29	-0.29	-0.34	-0.49*	-0.11	-0.10
	(0.284)	(0.317)	(0.201)	(0.233)	(0.111)	(0.123)
PRESCORE (G6)	0.25***	0.30***	0.27***	0.28***	0.28***	0.28***
	(0.052)	(0.060)	(0.039)	(0.047)	(0.023)	(0.026)
STUDY HOURS (1= >10hrs /week)	-0.13	0.02	0.19	0.05	0.12	0.12
	(0.323)	(0.378)	(0.220)	(0.261)	(0.097)	(0.108)
SELF-ESTEEM	0.47**	0.32	0.30*	0.22	0.40***	0.31***
	(0.156)	(0.179)	(0.119)	(0.143)	(0.064)	(0.074)
ENGLISH PT in G10	0.04	0.09	0.05	0.01	0.13	0.02
	(0.188)	(0.221)	(0.142)	(0.174)	(0.087)	(0.107)
ENGLISH PT in G11	0.44*	0.42	0.42**	0.34	0.14	0.11
	(0.216)	(0.266)	(0.154)	(0.184)	(0.082)	(0.096)
ENGLISH PT in G12	0.35	0.15	0.15	0.12	0.23**	0.21*
	(0.289)	(0.338)	(0.183)	(0.213)	(0.082)	(0.092)
Constant	3.16***	3.14**	3.69***	3.58***	3.05***	2.22***
	(0.819)	(0.959)	(0.587)	(0.713)	(0.347)	(0.486)
Observations	343	260	595	462	1,678	1,375
R-squared	0.203	0.203	0.204	0.173	0.257	0.225

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_E (English score on the CSAT)

Table E.6. Long-term single-year effects of English tutoring in middle school on the CSAT English achievement

	ENGLISH PT in G7		ENGLISH PT in G8		ENGLISH PT in G9	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.10	0.65**	0.13	0.39	-0.05	0.51
	(0.085)	(0.251)	(0.090)	(0.317)	(0.092)	(0.389)
URBANICITY	0.03	-0.01	-0.02	-0.05	0.01	-0.02
	(0.090)	(0.094)	(0.083)	(0.086)	(0.083)	(0.089)
GENDER (1=female)	0.24***	0.23***	0.03	0.04	-0.05	-0.05
	(0.062)	(0.065)	(0.058)	(0.060)	(0.059)	(0.064)
SES	0.39***	0.37***	0.25***	0.20***	0.26***	0.25***
	(0.043)	(0.046)	(0.040)	(0.043)	(0.041)	(0.044)
SCHOOL TYPE (1=private)	0.15	0.12	0.14*	0.13	0.15*	0.14
	(0.079)	(0.083)	(0.073)	(0.076)	(0.073)	(0.079)
STU/TEA RATIO	0.01	0.01	-0.00	-0.00	-0.00	-0.00
	(0.008)	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)
SCHOOL CHOICE	-0.16	-0.17	-0.06	-0.08	-0.06	-0.10
	(0.097)	(0.101)	(0.089)	(0.093)	(0.090)	(0.096)
PRESCORE (G6)	0.26***	0.26***	0.99***	1.03***	0.92***	0.91***
	(0.020)	(0.020)	(0.042)	(0.045)	(0.040)	(0.043)
STUDY HOURS (1= >10hrs /week)	0.11	0.12	0.06	0.07	0.08	0.09
	(0.088)	(0.091)	(0.081)	(0.084)	(0.081)	(0.087)
SELF-ESTEEM	0.37***	0.35***	0.27***	0.24***	0.33***	0.30***
	(0.056)	(0.058)	(0.051)	(0.053)	(0.051)	(0.056)
ENGLISH PT in G7	-	-	-0.08	-0.09	-0.03	-0.09
	-	-	(0.079)	(0.107)	(0.079)	(0.092)
ENGLISH PT in G8	0.22*	0.05	-	-	0.12	-0.10
	(0.097)	(0.124)	-	-	(0.090)	(0.167)
ENGLISH PT in G9	-0.04	-0.14	-0.00	-0.11	-	-
	(0.099)	(0.109)	(0.091)	(0.148)	-	-
ENGLISH PT in G10	0.08	0.06	0.04	0.03	0.07	0.06
	(0.073)	(0.077)	(0.067)	(0.071)	(0.068)	(0.081)
ENGLISH PT in G11	0.24***	0.24**	0.21**	0.18*	0.22***	0.21**
	(0.071)	(0.074)	(0.065)	(0.069)	(0.066)	(0.073)
ENGLISH PT in G12	0.20**	0.20**	0.15*	0.17*	0.17*	0.16*
	(0.075)	(0.077)	(0.069)	(0.072)	(0.069)	(0.074)
Constant	3.08***	2.88***	5.13***	5.05***	5.18***	5.07***
	(0.299)	(0.323)	(0.258)	(0.287)	(0.259)	(0.303)
Observations	2,302	2,179	2,339	2,148	2,319	2,062
R-squared	0.247	0.229	0.342	0.342	0.337	0.326

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_E (English score on the CSAT)

Table E.7. Long-term cumulative effects of math tutoring in middle school on the CSAT math achievement

	1 year of Math PT		2 years of Math PT		3 years of Math PT	
VARIABLES	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
Coefficient of interest	-0.04	-0.34	-0.17	0.13	-0.15	0.56
	(0.192)	(0.475)	(0.172)	(0.442)	(0.143)	(0.461)
URBANICITY	-0.23	-0.47	-0.02	-0.17	-0.07	-0.19
	(0.291)	(0.322)	(0.209)	(0.238)	(0.109)	(0.120)
GENDER (1=female)	-0.52**	-0.74***	-0.25	-0.36*	-0.20**	-0.21*
	(0.192)	(0.216)	(0.142)	(0.161)	(0.076)	(0.086)
SES	0.19	0.14	0.13	0.14	0.23***	0.19**
	(0.140)	(0.151)	(0.101)	(0.112)	(0.052)	(0.060)
SCHOOL TYPE (1=private)	-0.11	-0.09	0.15	0.05	-0.05	-0.13
	(0.265)	(0.290)	(0.182)	(0.208)	(0.097)	(0.110)
STU-TEA RATIO	0.02	0.02	0.02	0.02	0.01	0.01
	(0.020)	(0.022)	(0.015)	(0.018)	(0.010)	(0.012)
SCHOOL CHOICE	0.07	-0.17	0.00	-0.07	-0.15	-0.26*
	(0.306)	(0.335)	(0.214)	(0.243)	(0.119)	(0.130)
PRESCORE (G6)	0.33***	0.35***	0.25***	0.25***	0.24***	0.24***
	(0.058)	(0.063)	(0.043)	(0.049)	(0.024)	(0.027)
STUDY HOURS (1= >10hrs /week)	0.06	0.15	0.11	0.03	0.21*	0.18
	(0.316)	(0.359)	(0.226)	(0.259)	(0.103)	(0.113)
SELF ESTEEM	0.03	-0.12	0.33**	0.23	0.23***	0.19*
	(0.173)	(0.194)	(0.127)	(0.147)	(0.069)	(0.077)
MATH PT in G10	0.13	0.33	0.30	0.35	0.42***	0.38**
	(0.206)	(0.239)	(0.159)	(0.197)	(0.107)	(0.133)
MATH PT in G11	0.66**	0.69**	0.54**	0.41*	0.59***	0.49***
	(0.230)	(0.255)	(0.166)	(0.194)	(0.099)	(0.116)
MATH PT in G12	0.39	0.06	0.84***	0.89***	0.55***	0.55***
	(0.291)	(0.325)	(0.189)	(0.214)	(0.087)	(0.096)
Constant	3.06***	3.89***	3.03***	3.30***	3.56***	3.31***
	(0.858)	(0.974)	(0.622)	(0.730)	(0.374)	(0.491)
Observations	344	266	594	466	1,668	1,369
R-squared	0.235	0.258	0.243	0.230	0.256	0.242

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_M (math score on the CSAT)

Table E.8. Long-term single-year effects of math tutoring in middle school on the CSAT math achievement

	MATH PT in G7		MATH PT in G8		MATH PT in G9	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.11	-0.13	-0.07	0.01	-0.14	0.44
	(0.091)	(0.450)	(0.098)	(0.362)	(0.102)	(0.437)
URBANICITY	-0.05	-0.07	-0.09	-0.12	-0.06	-0.12
	(0.097)	(0.102)	(0.091)	(0.094)	(0.092)	(0.098)
GENDER (1=female)	-0.21**	-0.25***	-0.39***	-0.41***	-0.46***	-0.47***
	(0.067)	(0.071)	(0.065)	(0.067)	(0.066)	(0.072)
SES	0.21***	0.21***	0.10*	0.08	0.10*	0.09
	(0.046)	(0.051)	(0.045)	(0.047)	(0.045)	(0.048)
SCHOOL TYPE (1=private)	0.05	0.07	0.09	0.06	0.08	0.05
	(0.085)	(0.090)	(0.081)	(0.084)	(0.081)	(0.086)
STU-TEA RATIO	0.00	0.01	-0.00	-0.00	-0.00	-0.00
	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)	(0.009)
SCHOOL CHOICE	-0.09	-0.13	-0.04	-0.06	-0.04	-0.14
	(0.104)	(0.108)	(0.099)	(0.102)	(0.099)	(0.106)
PRESCORE (G6)	0.23***	0.22***	0.87***	0.90***	0.81***	0.79***
	(0.021)	(0.022)	(0.048)	(0.050)	(0.045)	(0.048)
STUDY HOURS (1= >10hrs /week)	0.14	0.16	0.06	0.03	0.08	0.09
	(0.094)	(0.097)	(0.089)	(0.093)	(0.090)	(0.097)
SELF ESTEEM	0.24***	0.23***	0.15**	0.14*	0.21***	0.16**
	(0.060)	(0.062)	(0.056)	(0.058)	(0.056)	(0.062)
MATH PT in G7	-	-	-0.03	-0.06	0.01	-0.09
			(0.087)	(0.126)	(0.087)	(0.103)
MATH PT in G8	-0.04	0.04	-	-	-0.10	-0.25
	(0.104)	(0.176)	-	-	(0.099)	(0.175)
MATH PT in G9	-0.16	-0.17	-0.12	-0.19	-	-
	(0.107)	(0.131)	(0.102)	(0.159)	-	-
MATH PT in G10	0.30***	0.33***	0.18*	0.18*	0.20*	0.17
	(0.088)	(0.092)	(0.084)	(0.089)	(0.085)	(0.105)
MATH PT in G11	0.62***	0.65***	0.63***	0.61***	0.65***	0.61***
	(0.083)	(0.088)	(0.079)	(0.083)	(0.079)	(0.090)
MATH PT in G12	0.55***	0.58***	0.38***	0.38***	0.38***	0.37***
	(0.078)	(0.082)	(0.075)	(0.078)	(0.075)	(0.080)
Constant	3.57***	3.74***	5.44***	5.54***	5.45***	5.47***
	(0.320)	(0.354)	(0.284)	(0.309)	(0.285)	(0.332)
Observations	2,294	2,172	2,330	2,142	2,310	2,055
R-squared	0.238	0.236	0.298	0.297	0.296	0.284

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_M (math score on the CSAT)

Table F.1. Cumulative effects of private tutoring in high school on the CSAT achievement

	1 year of PT in HS		2 years of PT in HS		3 years of PT in HS	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.06	0.36	0.29**	0.51	0.59***	0.51*
	(0.104)	(0.376)	(0.101)	(0.304)	(0.105)	(0.251)
URBANICITY	-0.12	-0.27	-0.22	-0.20	-0.08	-0.11
	(0.159)	(0.189)	(0.119)	(0.137)	(0.108)	(0.120)
GENDER (1=female)	-0.15	-0.23	-0.12	-0.08	-0.04	-0.05
	(0.100)	(0.122)	(0.083)	(0.097)	(0.072)	(0.082)
SES	0.11	0.09	0.10	0.08	0.13**	0.13*
	(0.080)	(0.100)	(0.054)	(0.064)	(0.048)	(0.058)
SCHOOL TYPE (1=private)	0.03	0.09	0.05	0.07	0.21**	0.23**
	(0.105)	(0.124)	(0.085)	(0.098)	(0.074)	(0.082)
SCHOOL TRACK	0.34*	0.46*	0.54***	0.66***	0.52***	0.75***
	(0.141)	(0.181)	(0.134)	(0.170)	(0.132)	(0.165)
STU-TEA RATIO	-0.01	-0.02	-0.03	-0.05*	-0.05**	-0.04*
	(0.020)	(0.024)	(0.018)	(0.021)	(0.016)	(0.019)
SCHOOL CHOICE	-0.06	-0.23	-0.29*	-0.26	-0.11	-0.17
	(0.155)	(0.185)	(0.123)	(0.148)	(0.115)	(0.129)
PRESCORE (G9)	0.82***	0.80***	0.74***	0.70***	0.73***	0.68***
	(0.071)	(0.085)	(0.056)	(0.065)	(0.051)	(0.057)
STUDY HOURS (1= >10hrs /week)	0.46***	0.35*	0.40***	0.42***	0.26**	0.16
	(0.121)	(0.144)	(0.093)	(0.109)	(0.081)	(0.090)
SELF ESTEEM	0.28***	0.34**	0.31***	0.35***	0.43***	0.48***
	(0.084)	(0.104)	(0.067)	(0.080)	(0.061)	(0.068)
PT in middle school	-0.06	-0.10	0.02	0.03	-0.03	0.03
	(0.047)	(0.065)	(0.047)	(0.071)	(0.050)	(0.071)
Constant	5.09***	5.56***	5.51***	5.44***	5.44***	5.24***
	(0.449)	(0.561)	(0.386)	(0.459)	(0.356)	(0.407)
Observations	639	465	826	627	985	782
R-squared	0.327	0.319	0.407	0.402	0.453	0.442

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_avg (average score on the CSAT)

Table F.2. Single-year effects of private tutoring in high school on the CSAT achievement

	PT in G10		PT in G11		PT in G12	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.07	0.20	0.25***	0.36	0.26***	0.16
	(0.073)	(0.335)	(0.067)	(0.283)	(0.059)	(0.145)
URBANICITY	-0.06	-0.09	-0.06	-0.06	-0.06	-0.06
	(0.076)	(0.082)	(0.076)	(0.078)	(0.076)	(0.080)
GENDER (1=female)	-0.07	-0.10	-0.07	-0.08	-0.07	-0.06
	(0.052)	(0.060)	(0.052)	(0.054)	(0.052)	(0.055)
SES	0.13***	0.13***	0.13***	0.12***	0.13***	0.13***
	(0.035)	(0.039)	(0.035)	(0.037)	(0.035)	(0.037)
SCHOOL TYPE (1=private)	0.17**	0.17**	0.17**	0.18***	0.17**	0.15**
	(0.053)	(0.058)	(0.053)	(0.055)	(0.053)	(0.056)
SCHOOL TRACK	0.56***	0.59***	0.56***	0.56***	0.56***	0.61***
	(0.094)	(0.121)	(0.094)	(0.099)	(0.094)	(0.104)
STU-TEA RATIO	-0.03**	-0.04**	-0.03**	-0.03**	-0.03**	-0.03**
	(0.012)	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)
SCHOOL CHOICE	-0.09	-0.14	-0.09	-0.10	-0.09	-0.12
	(0.080)	(0.088)	(0.080)	(0.082)	(0.080)	(0.084)
PRESCORE (G9)	0.74***	0.72***	0.74***	0.72***	0.74***	0.73***
	(0.036)	(0.039)	(0.036)	(0.038)	(0.036)	(0.037)
STUDY HOURS (1= >10hrs /week)	0.34***	0.33***	0.34***	0.31***	0.34***	0.34***
	(0.057)	(0.062)	(0.057)	(0.059)	(0.057)	(0.060)
SELF ESTEEM	0.35***	0.34***	0.35***	0.37***	0.35***	0.38***
	(0.044)	(0.048)	(0.044)	(0.045)	(0.044)	(0.046)
PT in middle schoo	-0.01	-0.02	-0.01	-0.03	-0.01	-0.01
	(0.033)	(0.044)	(0.033)	(0.041)	(0.033)	(0.036)
PT in grade 10			0.07	0.04	0.07	0.06
			(0.073)	(0.107)	(0.073)	(0.078)
PT in grade 11	0.25***	0.22*			0.25***	0.31***
	(0.067)	(0.102)			(0.067)	(0.086)
PT in grade 12	0.26***	0.26***	0.26***	0.23*		
	(0.059)	(0.067)	(0.059)	(0.095)		
Constant	5.14***	5.28***	5.14***	5.16***	5.14***	5.16***
	(0.257)	(0.293)	(0.257)	(0.267)	(0.257)	(0.272)
Observations	1,940	1,680	1,940	1,827	1,940	1,752
R-squared	0.421	0.407	0.421	0.413	0.421	0.422

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_avg (average score on the CSAT)

Table F.3. Cumulative effects of verbal tutoring in high school on the CSAT verbal achievement

	1 year of Verbal PT in HS		2 years of Verbal PT in HS		3 years of Verbal PT in HS	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.01	0.54	0.24**	0.34	0.23	0.23
	(0.071)	(0.464)	(0.093)	(0.240)	(0.143)	(0.258)
URBANICITY	-0.03	-0.09	-0.17	-0.12	-0.16	-0.09
	(0.101)	(0.124)	(0.121)	(0.139)	(0.136)	(0.155)
GENDER (1=female)	0.12	0.03	0.14	0.11	0.17	0.15
	(0.072)	(0.090)	(0.081)	(0.093)	(0.092)	(0.107)
SES	0.08	0.04	0.10	0.09	0.07	0.08
	(0.047)	(0.060)	(0.053)	(0.066)	(0.061)	(0.073)
SCHOOL TYPE (1=private)	0.08	0.03	-0.01	-0.04	-0.08	-0.11
	(0.072)	(0.084)	(0.083)	(0.095)	(0.093)	(0.107)
SCHOOL TRACK	0.58***	0.68***	0.64***	0.81***	0.66***	0.82***
	(0.119)	(0.151)	(0.138)	(0.168)	(0.149)	(0.187)
STU-TEA RATIO	-0.02	-0.02	-0.01	-0.02	-0.03	-0.02
	(0.016)	(0.020)	(0.018)	(0.021)	(0.020)	(0.024)
SCHOOL CHOICE	-0.01	0.03	-0.08	-0.04	-0.19	-0.13
	(0.105)	(0.126)	(0.123)	(0.137)	(0.137)	(0.154)
PRESCORE (G9)	0.77***	0.76***	0.66***	0.66***	0.72***	0.66***
	(0.048)	(0.057)	(0.055)	(0.063)	(0.063)	(0.074)
STUDY HOURS (1= >10hrs /week)	0.11	0.11	0.20*	0.20	0.14	0.17
	(0.078)	(0.092)	(0.089)	(0.102)	(0.103)	(0.118)
SELF ESTEEM	0.31***	0.34***	0.42***	0.45***	0.41***	0.43***
	(0.060)	(0.071)	(0.065)	(0.075)	(0.074)	(0.087)
Verbal PT in middle school	-0.08*	-0.13*	-0.10**	-0.12*	-0.07	-0.06
	(0.031)	(0.052)	(0.036)	(0.046)	(0.039)	(0.047)
Constant	5.26***	5.07***	5.27***	5.15***	5.56***	5.22***
	(0.333)	(0.448)	(0.381)	(0.444)	(0.422)	(0.498)
Observations	1,596	1,227	1,208	938	988	760
R-squared	0.256	0.230	0.273	0.275	0.290	0.270

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_V (verbal score on the CSAT)

Table F.4. Single-year effects of verbal tutoring in high school on the CSAT verbal achievement

	Verbal PT in G10		Verbal PT in G11		Verbal PT in G12	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.00	0.11	0.13	0.05	0.21*	0.09
	(0.064)	(0.291)	(0.075)	(0.279)	(0.094)	(0.260)
URBANICITY	-0.04	-0.05	-0.04	-0.02	-0.04	-0.02
	(0.090)	(0.102)	(0.090)	(0.094)	(0.090)	(0.094)
GENDER (1=female)	0.10	0.04	0.10	0.09	0.10	0.09
	(0.062)	(0.069)	(0.062)	(0.064)	(0.062)	(0.065)
SES	0.08*	0.08	0.08*	0.08	0.08*	0.07
	(0.040)	(0.047)	(0.040)	(0.043)	(0.040)	(0.043)
SCHOOL TYPE (1=private)	0.09	0.07	0.09	0.11	0.09	0.08
	(0.063)	(0.068)	(0.063)	(0.065)	(0.063)	(0.066)
SCHOOL TRACK	0.66***	0.72***	0.66***	0.68***	0.66***	0.71***
	(0.110)	(0.126)	(0.110)	(0.114)	(0.110)	(0.121)
STU-TEA RATIO	-0.03*	-0.03	-0.03*	-0.03	-0.03*	-0.03*
	(0.014)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)
SCHOOL CHOICE	0.02	0.01	0.02	0.03	0.02	0.02
	(0.094)	(0.102)	(0.094)	(0.098)	(0.094)	(0.099)
PRESCORE (G9)	0.72***	0.72***	0.72***	0.71***	0.72***	0.72***
	(0.041)	(0.045)	(0.041)	(0.043)	(0.041)	(0.044)
STUDY HOURS (1= >10hrs /week)	0.17*	0.18*	0.17*	0.16*	0.17*	0.18*
	(0.068)	(0.073)	(0.068)	(0.069)	(0.068)	(0.072)
SELF ESTEEM	0.34***	0.32***	0.34***	0.35***	0.34***	0.38***
	(0.051)	(0.057)	(0.051)	(0.053)	(0.051)	(0.054)
Verbal PT in middle school	-0.08**	-0.11**	-0.08**	-0.07*	-0.08**	-0.08**
	(0.028)	(0.038)	(0.028)	(0.029)	(0.028)	(0.030)
Verbal PT in grade 10			0.00	0.00	0.00	-0.00
			(0.064)	(0.080)	(0.064)	(0.068)
Verbal PT in grade 11	0.13	0.11			0.13	0.15
	(0.075)	(0.102)			(0.075)	(0.094)
Verbal PT in grade 12	0.21*	0.23*	0.21*	0.23		
	(0.094)	(0.102)	(0.094)	(0.130)		
Constant	5.27***	5.31***	5.27***	5.25***	5.27***	5.31***
	(0.296)	(0.329)	(0.296)	(0.313)	(0.296)	(0.311)
Observations	2,070	1,790	2,070	1,952	2,070	1,870
R-squared	0.269	0.261	0.269	0.259	0.269	0.272

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_V (verbal score on the CSAT)

Table F.5. Cumulative effects of English tutoring in high school on the CSAT English achievement

	1 year of English PT		2 years of English PT		3 years of English PT	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	-0.12	0.41	0.22*	0.18	0.36***	0.29
	(0.090)	(0.349)	(0.090)	(0.221)	(0.100)	(0.164)
URBANICITY	0.04	-0.03	-0.21	-0.20	-0.16	-0.16
	(0.128)	(0.150)	(0.118)	(0.134)	(0.133)	(0.146)
GENDER (1=female)	0.16	0.14	0.02	0.02	0.10	0.09
	(0.088)	(0.104)	(0.081)	(0.093)	(0.088)	(0.100)
SES	0.26***	0.24**	0.18***	0.17**	0.25***	0.23**
	(0.066)	(0.082)	(0.052)	(0.063)	(0.064)	(0.077)
SCHOOL TYPE (1=private)	0.09	0.21	0.11	0.17	0.09	0.16
	(0.091)	(0.106)	(0.083)	(0.095)	(0.092)	(0.103)
SCHOOL TRACK	0.57***	0.67***	0.62***	0.76***	0.54***	0.66***
	(0.139)	(0.182)	(0.140)	(0.166)	(0.146)	(0.174)
STU-TEA RATIO	-0.02	-0.04	-0.04	-0.05*	-0.04*	-0.04
	(0.018)	(0.022)	(0.018)	(0.022)	(0.019)	(0.022)
SCHOOL CHOICE	-0.13	-0.22	-0.31*	-0.29*	-0.20	-0.25
	(0.131)	(0.154)	(0.121)	(0.137)	(0.135)	(0.149)
PRESCORE (G9)	0.79***	0.80***	0.79***	0.79***	0.80***	0.77***
	(0.059)	(0.072)	(0.057)	(0.064)	(0.061)	(0.068)
STUDY HOURS (1= >10hrs /week)	0.41***	0.28*	0.42***	0.36***	0.18	0.03
	(0.100)	(0.119)	(0.090)	(0.105)	(0.099)	(0.111)
SELF ESTEEM	0.44***	0.46***	0.40***	0.41***	0.51***	0.54***
	(0.074)	(0.089)	(0.066)	(0.076)	(0.074)	(0.083)
English PT in middle school	0.02	-0.02	0.01	0.05	0.03	0.09
	(0.043)	(0.059)	(0.045)	(0.060)	(0.048)	(0.057)
Constant	4.78***	4.88***	5.48***	5.45***	5.32***	5.29***
	(0.402)	(0.491)	(0.394)	(0.461)	(0.416)	(0.481)
Observations	1,157	878	1,228	956	963	757
R-squared	0.327	0.298	0.363	0.352	0.399	0.377

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_E (English score on the CSAT)

Table F.6. Single-year effects of English tutoring in high school on the CSAT English achievement

	English PT in G10		English PT in G11		English PT in G12	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.03	0.26	0.18**	0.33	0.19**	0.14
	(0.067)	(0.267)	(0.065)	(0.212)	(0.068)	(0.144)
URBANICITY	-0.02	-0.05	-0.02	-0.02	-0.02	-0.03
	(0.083)	(0.091)	(0.083)	(0.086)	(0.083)	(0.088)
GENDER (1=female)	0.07	0.05	0.07	0.07	0.07	0.07
	(0.058)	(0.063)	(0.058)	(0.060)	(0.058)	(0.061)
SES	0.24***	0.25***	0.24***	0.21***	0.24***	0.23***
	(0.039)	(0.044)	(0.039)	(0.041)	(0.039)	(0.042)
SCHOOL TYPE (1=private)	0.14*	0.19**	0.14*	0.16**	0.14*	0.14*
	(0.059)	(0.064)	(0.059)	(0.061)	(0.059)	(0.062)
SCHOOL TRACK	0.63***	0.67***	0.63***	0.64***	0.63***	0.69***
	(0.106)	(0.122)	(0.106)	(0.110)	(0.106)	(0.116)
STU-TEA RATIO	-0.03*	-0.04**	-0.03*	-0.03*	-0.03*	-0.03*
	(0.013)	(0.015)	(0.013)	(0.014)	(0.013)	(0.014)
SCHOOL CHOICE	-0.15	-0.18	-0.15	-0.14	-0.15	-0.19*
	(0.088)	(0.095)	(0.088)	(0.091)	(0.088)	(0.093)
PRESCORE (G9)	0.73***	0.72***	0.73***	0.71***	0.73***	0.72***
	(0.039)	(0.042)	(0.039)	(0.041)	(0.039)	(0.041)
STUDY HOURS (1= >10hrs /week)	0.38***	0.36***	0.38***	0.34***	0.38***	0.38***
	(0.063)	(0.068)	(0.063)	(0.065)	(0.063)	(0.066)
SELF ESTEEM	0.43***	0.42***	0.43***	0.45***	0.43***	0.45***
	(0.048)	(0.053)	(0.048)	(0.050)	(0.048)	(0.051)
English PT in middle school	0.02	0.01	0.02	0.01	0.02	0.02
	(0.034)	(0.043)	(0.034)	(0.037)	(0.034)	(0.037)
English PT in grade 10			0.03	0.01	0.03	0.03
			(0.067)	(0.086)	(0.067)	(0.071)
English PT in grade 11	0.18**	0.13			0.18**	0.20*
	(0.065)	(0.093)			(0.065)	(0.077)
English PT in grade 12	0.19**	0.17*	0.19**	0.14		
	(0.068)	(0.075)	(0.068)	(0.094)		
Constant	4.95***	4.99***	4.95***	4.91***	4.95***	4.96***
	(0.284)	(0.314)	(0.284)	(0.296)	(0.284)	(0.300)
Observations	2,344	2,032	2,344	2,212	2,344	2,114
R-squared	0.348	0.336	0.348	0.335	0.348	0.349

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_E (English score on the CSAT)

Table F.7. Cumulative effects of math tutoring in high school on the CSAT math achievement

	1 year of Math PT in HS		2 years of Math PT in HS		3 years of Math PT in HS	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.20	0.56	0.73***	1.01***	1.18***	1.08***
	(0.111)	(0.374)	(0.116)	(0.283)	(0.121)	(0.246)
URBANICITY	-0.05	-0.15	-0.21	-0.24	-0.03	-0.03
	(0.162)	(0.190)	(0.140)	(0.158)	(0.133)	(0.148)
GENDER (1=female)	-0.41***	-0.50***	-0.36***	-0.31**	-0.30***	-0.36***
	(0.107)	(0.128)	(0.097)	(0.111)	(0.090)	(0.102)
SES	0.00	-0.06	-0.00	-0.02	0.06	0.08
	(0.079)	(0.099)	(0.065)	(0.078)	(0.061)	(0.075)
SCHOOL TYPE (1=private)	0.17	0.19	0.11	0.11	0.06	0.04
	(0.110)	(0.128)	(0.099)	(0.113)	(0.092)	(0.103)
SCHOOL TRACK	0.25	0.28	0.44**	0.50*	0.39*	0.52**
	(0.156)	(0.200)	(0.163)	(0.206)	(0.157)	(0.193)
STU-TEA RATIO	-0.01	-0.02	-0.05*	-0.06*	-0.03	-0.02
	(0.022)	(0.026)	(0.021)	(0.025)	(0.021)	(0.024)
SCHOOL CHOICE	0.01	-0.11	-0.27	-0.36*	-0.10	-0.20
	(0.162)	(0.192)	(0.143)	(0.165)	(0.141)	(0.160)
PRESCORE (G9)	0.82***	0.78***	0.78***	0.70***	0.72***	0.66***
	(0.072)	(0.084)	(0.066)	(0.075)	(0.065)	(0.074)
STUDY HOURS (1= >10hrs /week)	0.72***	0.68***	0.58***	0.50***	0.46***	0.33**
	(0.125)	(0.147)	(0.106)	(0.125)	(0.100)	(0.114)
SELF ESTEEM	0.29**	0.37***	0.25**	0.27**	0.32***	0.37***
	(0.088)	(0.105)	(0.078)	(0.091)	(0.075)	(0.083)
Math PT in middle school	-0.08	-0.14*	-0.05	-0.06	-0.12*	-0.09
	(0.050)	(0.067)	(0.053)	(0.072)	(0.055)	(0.070)
Constant	4.97***	5.36***	5.81***	5.98***	5.40***	5.42***
	(0.483)	(0.597)	(0.443)	(0.517)	(0.440)	(0.500)
Observations	910	680	1,083	832	1,081	854
R-squared	0.259	0.247	0.324	0.308	0.401	0.386

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_M (math score on the CSAT)

Table F.8. Single-year effects of math tutoring in high school on the CSAT math achievement

	Math PT in G10		Math PT in G11		Math PT in G12	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS	IV	OLS	IV	OLS	IV
Coefficient of interest	0.14	0.14	0.55***	0.63**	0.43***	0.42**
	(0.082)	(0.322)	(0.076)	(0.241)	(0.072)	(0.157)
URBANICITY	-0.08	-0.10	-0.08	-0.09	-0.08	-0.07
	(0.089)	(0.096)	(0.089)	(0.092)	(0.089)	(0.095)
GENDER (1=female)	-0.35***	-0.39***	-0.35***	-0.38***	-0.35***	-0.34***
	(0.063)	(0.069)	(0.063)	(0.065)	(0.063)	(0.066)
SES	0.04	0.04	0.04	0.04	0.04	0.04
	(0.042)	(0.047)	(0.042)	(0.044)	(0.042)	(0.045)
SCHOOL TYPE (1=private)	0.17**	0.16*	0.17**	0.18**	0.17**	0.19**
	(0.064)	(0.068)	(0.064)	(0.065)	(0.064)	(0.067)
SCHOOL TRACK	0.41***	0.41**	0.41***	0.39**	0.41***	0.45***
	(0.116)	(0.139)	(0.116)	(0.121)	(0.116)	(0.127)
STU-TEA RATIO	-0.04*	-0.04**	-0.04*	-0.04*	-0.04*	-0.04*
	(0.014)	(0.016)	(0.014)	(0.015)	(0.014)	(0.015)
SCHOOL CHOICE	-0.13	-0.21*	-0.13	-0.17	-0.13	-0.16
	(0.094)	(0.101)	(0.094)	(0.098)	(0.094)	(0.100)
PRESCORE (G9)	0.75***	0.71***	0.75***	0.75***	0.75***	0.75***
	(0.043)	(0.046)	(0.043)	(0.045)	(0.043)	(0.045)
STUDY HOURS (1= >10hrs /week)	0.50***	0.49***	0.50***	0.48***	0.50***	0.47***
	(0.068)	(0.074)	(0.068)	(0.071)	(0.068)	(0.072)
SELF ESTEEM	0.26***	0.26***	0.26***	0.28***	0.26***	0.29***
	(0.052)	(0.056)	(0.052)	(0.054)	(0.052)	(0.055)
Math PT in middle school	-0.05	-0.05	-0.05	-0.07	-0.05	-0.06
	(0.037)	(0.047)	(0.037)	(0.042)	(0.037)	(0.040)
Math PT in grade 10			0.14	0.12	0.14	0.11
			(0.082)	(0.103)	(0.082)	(0.088)
Math PT in grade 11	0.55***	0.58***			0.55***	0.60***
	(0.076)	(0.105)			(0.076)	(0.094)
Math PT in grade 12	0.43***	0.45***	0.43***	0.40***		
	(0.072)	(0.080)	(0.072)	(0.097)		
Constant	5.40***	5.67***	5.40***	5.56***	5.40***	5.43***
	(0.305)	(0.336)	(0.305)	(0.319)	(0.305)	(0.323)
Observations	2,338	2,033	2,338	2,209	2,338	2,117
R-squared	0.345	0.334	0.345	0.341	0.345	0.343

*** p<0.001, ** p<0.01, * p<0.05

Dependent variable: CSAT_M (math score on the CSAT)

Table G.1. Balance diagnostics using the sample in grade 7

		Mean		SD	
Variable	Sample	Treated	Control	Treated	Control
PRESCORE_squared	Unmatched	42.639	32.800	21.6	20.9
	Matched	42.639	43.290	21.6	22.6
SEOUL_G7	Unmatched	0.201	0.118	0.4	0.3
	Matched	0.201	0.198	0.4	0.4
URBANICITY_G7	Unmatched	0.503	0.364	0.5	0.5
	Matched	0.503	0.505	0.5	0.5
GENDER	Unmatched	1.474	1.533	0.5	0.5
	Matched	1.474	1.459	0.5	0.5
HOUSEHOLD INCOME_G7 (log)	Unmatched	5.826	5.441	0.5	0.6
	Matched	5.826	5.799	0.5	0.6
DADEDU	Unmatched	3.877	3.283	1.2	1.2
	Matched	3.877	3.920	1.2	1.3
PARENTAL ASPIRATION_G7	Unmatched	4.678	4.297	0.9	0.9
	Matched	4.678	4.717	0.9	1.0
SCHOOL TYPE_G7	Unmatched	0.207	0.191	0.4	0.4
	Matched	0.207	0.186	0.4	0.4
STU-TEA RATIO	Unmatched	20.901	19.448	4.0	5.3
	Matched	20.901	20.960	4.0	4.2
SCHOOL CHOICE_G7	Unmatched	1.338	1.477	0.5	0.5
	Matched	1.338	1.339	0.5	0.5

Table G.2. Balance diagnostics using the sample in grade 8

		Mean		SD	
Variable	Sample	Treated	Control	Treated	Control
VERBAL SCORE_G7	Unmatched	68.515	59.964	17.5	18.5
	Matched	68.515	68.821	17.5	17.1
ENGLISH SCORE_G7	Unmatched	60.872	45.397	22.2	18.9
	Matched	60.872	59.616	22.2	21.6
MATH SCORE_G7	Unmatched	63.026	47.020	22.7	21.9
	Matched	63.026	63.321	22.7	22.4
URBANICITY_G8	Unmatched	0.500	0.358	0.5	0.5
	Matched	0.500	0.494	0.5	0.5
GENDER	Unmatched	1.480	1.517	0.5	0.5
	Matched	1.480	1.432	0.5	0.5
HOUSEHOLD INCOME_G7	Unmatched	5.805	5.416	0.5	0.6
	Matched	5.805	5.812	0.5	0.6
DADEDU	Unmatched	3.848	3.200	1.2	1.1
	Matched	3.848	3.834	1.2	1.2
ACADEMIC MOTIVATION_G8	Unmatched	4.180	3.854	0.8	0.8
	Matched	4.180	4.170	0.8	0.9
PARENTAL ASPIRATION_G8	Unmatched	4.635	4.141	0.9	0.9
	Matched	4.635	4.679	0.9	1.0
STU-TEA RATIO_G8	Unmatched	20.890	19.126	4.0	5.3
	Matched	20.890	20.688	4.0	4.4
SCHOOL CHOICE_G8	Unmatched	1.343	1.494	0.5	0.5
	Matched	1.343	1.354	0.5	0.5

Table G.3. Balance diagnostics using the sample in grade 9

		Mean		SD	
Variable	Sample	Treated	Control	Treated	Control
VERBAL SCORE_G8	Unmatched	62.270	53.399	18.7	18.4
	Matched	62.270	62.430	18.7	19.1
ENGLISH SCORE_G8	Unmatched	60.099	43.988	24.4	20.5
	Matched	60.099	58.980	24.4	24.3
MATH SCORE_G8	Unmatched	55.477	39.517	24.7	20.2
	Matched	55.477	55.218	24.7	23.0
SEOUL_G9	Unmatched	0.195	0.129	0.4	0.3
	Matched	0.195	0.153	0.4	0.4
URBANICITY_G9	Unmatched	0.484	0.361	0.5	0.5
	Matched	0.484	0.451	0.5	0.5
GENDER	Unmatched	1.469	1.509	0.5	0.5
	Matched	1.469	1.468	0.5	0.5
HOUSEHOLD INCOME_G9	Unmatched	5.940	5.470	0.6	0.7
	Matched	5.940	5.969	0.6	0.7
DADEDU	Unmatched	3.825	3.181	1.1	1.1
	Matched	3.825	3.872	1.1	1.3
PARENTAL ASPIRATION_G9	Unmatched	4.557	4.035	0.9	0.9
	Matched	4.557	4.551	0.9	1.0
SCHOOL TYPE_G9	Unmatched	0.205	0.208	0.4	0.4
	Matched	0.205	0.214	0.4	0.4
STU-TEA RATIO_G9	Unmatched	20.651	18.677	3.8	5.1
	Matched	20.651	20.450	3.8	3.9
SCHOOL CHOICE_G9	Unmatched	1.361	1.498	0.5	0.5
	Matched	1.361	1.353	0.5	0.5

Table G.4. Balance diagnostics using the sample in grade 10

		Mean		SD	
Variable	Sample	Treated	Control	Treated	Control
VERBAL SCORE_G9	Unmatched	61.771	51.969	20.0	20.1
	Matched	61.771	61.809	20.0	20.1
ENGLISH SCORE_G9	Unmatched	61.403	43.363	25.9	22.6
	Matched	61.403	61.329	25.9	26.0
MATH SCORE_G9	Unmatched	57.689	40.908	25.6	22.6
	Matched	57.689	58.109	25.6	25.6
SEOUL_G10	Unmatched	0.193	0.137	0.4	0.3
	Matched	0.193	0.187	0.4	0.4
URBANICITY_G10	Unmatched	0.502	0.379	0.5	0.5
	Matched	0.502	0.513	0.5	0.5
GENDER	Unmatched	1.503	1.459	0.5	0.5
	Matched	1.503	1.499	0.5	0.5
HOUSEHOLD INCOME_G10	Unmatched	5.939	5.523	0.6	0.6
	Matched	5.939	5.868	0.6	0.6
DADEDU	Unmatched	3.897	3.223	1.1	1.0
	Matched	3.897	3.992	1.1	1.2
ACADEMIC MOTIVATION_G10	Unmatched	3.234	2.839	0.8	0.8
	Matched	3.234	3.302	0.8	0.9
PARENTAL ASPIRATION_G10	Unmatched	3.533	3.072	0.9	0.8
	Matched	3.533	3.514	0.9	0.9
SCHOOL TYPE_G10	Unmatched	0.484	0.450	0.5	0.5
	Matched	0.484	0.449	0.5	0.5
SCHOOL TRACK_G10	Unmatched	0.874	0.526	0.3	0.5
	Matched	0.874	0.886	0.3	0.3
STU-TEA RATIO_G10	Unmatched	16.514	14.877	2.5	3.2
	Matched	16.514	16.349	2.5	2.9
SCHOOL CHOICE_G10	Unmatched	1.341	1.484	0.5	0.5
	Matched	1.341	1.339	0.5	0.5

Table G.5. Balance diagnostics using the sample in grade 11

		Mean		SD	
Variable	Sample	Treated	Control	Treated	Control
VERBAL SCORE_G9	Unmatched	62.441	53.706	19.9	19.9
	Matched	62.441	62.657	19.9	18.6
ENGLISH SCORE_G9	Unmatched	62.956	46.411	25.7	24.4
	Matched	62.956	63.48	25.7	25.9
MATH SCORE_G9	Unmatched	59.75	43.875	25.5	23.7
	Matched	59.75	60.495	25.5	25.4
SEOUL_G11	Unmatched	0.21863	0.11842	0.4	0.3
	Matched	0.21863	0.20352	0.4	0.4
URBANICITY_G11	Unmatched	0.517	0.40235	0.5	0.5
	Matched	0.517	0.50189	0.5	0.5
GENDER	Unmatched	1.4893	1.4931	0.5	0.5
	Matched	1.4893	1.4293	0.5	0.5
HOUSEHOLD INCOME_G11	Unmatched	5.9098	5.4449	0.7	0.7
	Matched	5.9098	5.9435	0.7	0.8
DADEDU	Unmatched	3.9261	3.3255	1.2	1.0
	Matched	3.9261	3.8196	1.2	1.1
ACADEMIC MOTIVATION_G11	Unmatched	3.2673	2.8324	0.7	0.8
	Matched	3.2673	3.2497	0.7	0.8
GENDER*MOTIVATION	Unmatched	4.8586	4.2306	2.0	1.8
	Matched	4.8586	4.6425	2.0	2.0
PARENTAL ASPIRATION_G11	Unmatched	3.4461	3.0332	0.9	0.8
	Matched	3.4461	3.4473	0.9	0.9
SCHOOL TYPE_G11	Unmatched	0.50105	0.45776	0.5	0.5
	Matched	0.50105	0.51951	0.5	0.5
SCHOOL TRACK_G11	Unmatched	0.89005	0.58241	0.3	0.5
	Matched	0.89005	0.8888	0.3	0.3
STU-TEA RATIO_G11	Unmatched	16.945	15.318	2.6	3.1
	Matched	16.945	16.797	2.6	2.8
SCHOOL CHOICE_G11	Unmatched	1.3273	1.4404	0.5	0.5
	Matched	1.3273	1.3525	0.5	0.5

Table G.6. Balance diagnostics using the sample in grade 12

		Mean		SD	
Variable	Sample	Treated	Control	Treated	Control
VERBAL SCORE_G9	Unmatched	64.243	57.291	19.1	20.2
	Matched	64.243	64.422	19.1	20.2
ENGLISH SCORE_G9	Unmatched	66.993	51.782	24.9	25.5
	Matched	66.993	67.384	24.9	25.6
MATH SCORE_G9	Unmatched	62.818	49.384	24.7	25.5
	Matched	62.818	63.569	24.7	26.2
SEOUL_G12	Unmatched	0.24758	0.11873	0.4	0.3
	Matched	0.24758	0.21859	0.4	0.4
URBANICITY_G12	Unmatched	0.58067	0.4312	0.5	0.5
	Matched	0.58067	0.57844	0.5	0.5
GENDER	Unmatched	1.51	1.4824	0.5	0.5
	Matched	1.51	1.4952	0.5	0.5
HOUSEHOLD INCOME_G12	Unmatched	5.9986	5.5716	0.6	0.6
	Matched	5.9986	5.988	0.6	0.7
DADEDU	Unmatched	4.0825	3.5147	1.1	1.1
	Matched	4.0825	4.1524	1.1	1.1
ACADEMIC MOTIVATION_G12	Unmatched	3.3673	2.9553	0.7	0.9
	Matched	3.3673	3.4112	0.7	0.9
PARENTAL ASPIRATION_G12	Unmatched	3.5546	3.1207	0.8	0.9
	Matched	3.5546	3.5933	0.8	0.9
SCHOOL TYPE_G12	Unmatched	0.51673	0.46349	0.5	0.5
	Matched	0.51673	0.52119	0.5	0.5
SCHOOL TRACK_G12	Unmatched	0.9316	0.7228	0.3	0.4
	Matched	0.9316	0.94052	0.3	0.2
STU-TEA RATIO_G12	Unmatched	17.118	15.691	2.4	3.1
	Matched	17.118	17.159	2.4	2.3
SCHOOL CHOICE_G12	Unmatched	1.2669	1.4406	0.4	0.5
	Matched	1.2669	1.2743	0.4	0.4

Table H.1. Ordered Logit estimation of the effect of private tutoring on students' attention to lessons in formal schools in grade 7

	Average Effect		Heterogeneous Effect		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Empty	Full	Q1	Q2	Q3
PT_G7	-0.03	-0.08	-0.10	-0.10	-0.02
	(0.060)	(0.080)	(0.117)	(0.140)	(0.184)
PRESCORE (6th)		0.00	-0.04	0.02	0.28*
		(0.018)	(0.051)	(0.102)	(0.119)
SEOUL		0.05	-0.08	0.08	0.14
		(0.089)	(0.151)	(0.148)	(0.173)
URBANICITY		-0.22*	-0.25	-0.07	-0.34
		(0.095)	(0.165)	(0.156)	(0.177)
GENDER		-0.01	-0.01	0.01	0.00
		(0.061)	(0.101)	(0.102)	(0.116)
HHINCOME		0.00	0.00	-0.00	0.00
		(0.000)	(0.000)	(0.000)	(0.000)
DADEDU		0.02	0.02	0.03	0.00
		(0.030)	(0.051)	(0.049)	(0.055)
ACADEMIC MOTIVATION		0.09*	0.16*	0.12	0.01
		(0.040)	(0.067)	(0.070)	(0.071)
PARENTAL ASIPRATION		-0.02	0.04	-0.04	-0.04
		(0.035)	(0.063)	(0.057)	(0.063)
SCHOOL TYPE (1=private)		-0.12	0.07	-0.31*	-0.06
		(0.075)	(0.126)	(0.127)	(0.142)
STU-TEA RATIO		-0.01	-0.03*	-0.00	-0.00
		(0.008)	(0.012)	(0.014)	(0.016)
SCHOOL CHOICE		-0.20*	-0.40*	0.02	-0.18
		(0.095)	(0.162)	(0.157)	(0.183)
cut1					
Constant	-4.20***	-4.39***	-4.52***	-3.84***	-2.32
	(0.117)	(0.350)	(0.595)	(0.858)	(1.200)
cut2					
Constant	-2.28***	-2.49***	-2.65***	-1.95*	-0.34
	(0.065)	(0.331)	(0.566)	(0.834)	(1.178)
cut3					
Constant	-1.27***	-1.53***	-1.64**	-0.99	0.56
	(0.057)	(0.328)	(0.563)	(0.831)	(1.177)
cut4					
Constant	0.04	-0.22	-0.39	0.36	1.92
	(0.054)	(0.328)	(0.562)	(0.831)	(1.179)
Observations	5,810	3,947	1,433	1,428	1,086

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G7ATTN (degree of attention to lessons in grade 7)

Table H.2. Ordered Logit estimation of the effect of private tutoring on students' attention to lessons in formal schools in grade 8

	Average Effect		Heterogeneous Effect		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Empty	Full	Q1	Q2	Q3
PT_G8	0.81***	0.27**	0.27*	0.22	0.32
	(0.058)	(0.083)	(0.121)	(0.139)	(0.208)
VERBAL SCORE_G7		0.02***	0.03***	0.03***	0.03***
		(0.002)	(0.004)	(0.005)	(0.007)
ENGLISH SCORE_G7		0.02***	0.02***	0.02***	0.02***
		(0.002)	(0.005)	(0.004)	(0.005)
MATH SCORE_G7		0.02***	0.02***	0.02***	0.03***
		(0.002)	(0.004)	(0.004)	(0.005)
SEOUL		-0.03	-0.17	-0.05	0.04
		(0.097)	(0.183)	(0.153)	(0.177)
URBANICITY		0.14	0.33	0.09	0.00
		(0.100)	(0.189)	(0.159)	(0.179)
GENDER (1=female)		0.40***	0.34**	0.44***	0.42**
		(0.067)	(0.113)	(0.109)	(0.129)
HHINCOME		-0.00*	-0.00	-0.00*	0.00
		(0.000)	(0.000)	(0.000)	(0.000)
DADEDU		-0.03	-0.06	-0.00	-0.06
		(0.032)	(0.057)	(0.050)	(0.061)
ACADEMIC MOTIVATION		0.19***	0.14*	0.22**	0.19*
		(0.045)	(0.070)	(0.080)	(0.086)
PARENTAL ASIPRATION		0.14***	0.07	0.11	0.22**
		(0.039)	(0.068)	(0.066)	(0.070)
SCHOOL TYPE (1=private)		0.01	-0.18	0.04	0.17
		(0.078)	(0.134)	(0.127)	(0.156)
STU-TEA RATIO		-0.03**	0.00	-0.05**	-0.07**
		(0.008)	(0.012)	(0.014)	(0.022)
SCHOOL CHOICE		0.26**	0.30	0.25	0.17
		(0.097)	(0.169)	(0.161)	(0.188)
cut1					
Constant	-3.16***	0.87*	0.94	0.85	1.73
	(0.094)	(0.360)	(0.585)	(0.848)	(1.148)
cut2					
Constant	-1.61***	2.53***	2.59***	2.62**	3.32**
	(0.059)	(0.348)	(0.580)	(0.811)	(1.078)
cut3					
Constant	-0.57***	3.78***	3.71***	4.06***	4.77***
	(0.052)	(0.349)	(0.585)	(0.807)	(1.065)
cut4					
Constant	0.76***	5.45***	5.32***	5.79***	6.49***
	(0.053)	(0.355)	(0.595)	(0.816)	(1.069)
Observations	5,954	4,044	1,161	1,393	1,490

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G8ATTN (degree of attention to lessons in grade 8)

Table H.3. Ordered Logit estimation of the effect of private tutoring on students' attention to lessons in formal schools in grade 9

	Average Effect		Heterogeneous Effect		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Empty	Full	Q1	Q2	Q3
PT_G9	0.84***	0.17*	0.19	0.23	-0.13
	(0.061)	(0.086)	(0.126)	(0.142)	(0.227)
VERBAL SCORE_G8		0.02***	0.03***	0.02***	0.02**
		(0.003)	(0.005)	(0.005)	(0.007)
ENGLISH SCORE_G8		0.01***	0.02***	0.01	0.01
		(0.002)	(0.006)	(0.005)	(0.006)
MATH SCORE_G8		0.01***	0.02***	0.01**	0.02***
		(0.002)	(0.005)	(0.004)	(0.005)
SEOUL		0.14	-0.01	0.26	0.15
		(0.108)	(0.195)	(0.182)	(0.190)
URBANICITY		-0.25*	-0.37	-0.25	-0.21
		(0.113)	(0.209)	(0.186)	(0.197)
GENDER (1=female)		0.49***	0.28*	0.54***	0.59***
		(0.074)	(0.126)	(0.122)	(0.139)
HHINCOME		-0.00	0.00	0.00	-0.00
		(0.000)	(0.000)	(0.000)	(0.000)
DADEDU		-0.08*	-0.02	-0.09	-0.10
		(0.034)	(0.061)	(0.057)	(0.062)
ACADEMIC MOTIVATION		0.28***	0.22**	0.36***	0.31***
		(0.047)	(0.071)	(0.093)	(0.087)
PARENTAL ASIPRATION		0.21***	0.21**	0.19*	0.24**
		(0.043)	(0.073)	(0.075)	(0.077)
SCHOOL TYPE (1=private)		-0.09	-0.08	-0.13	-0.10
		(0.085)	(0.149)	(0.140)	(0.159)
STU-TEA RATIO		-0.00	0.00	-0.01	-0.02
		(0.009)	(0.014)	(0.015)	(0.021)
SCHOOL CHOICE		0.10	-0.01	-0.06	0.41*
		(0.106)	(0.176)	(0.178)	(0.207)
cut1					
Constant	-2.76***	1.12**	1.46*	0.22	1.01
	(0.088)	(0.371)	(0.606)	(0.854)	(1.017)
cut2					
Constant	-1.30***	2.73***	3.03***	2.16**	2.47**
	(0.059)	(0.363)	(0.606)	(0.822)	(0.954)
cut3					
Constant	-0.28***	3.89***	4.12***	3.38***	3.92***
	(0.054)	(0.366)	(0.613)	(0.821)	(0.942)
cut4					
Constant	1.02***	5.56***	5.72***	5.03***	5.77***
	(0.056)	(0.372)	(0.625)	(0.829)	(0.949)
Observations	4,721	3,114	972	1,075	1,067

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9ATTN (degree of attention to lessons in grade 9)

Table H.4. Ordered Logit estimation of the effect of private tutoring on students' attention to lessons in formal schools in grade 10

	Average Effect		Heterogeneous Effect		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Empty	Full	Q1	Q2	Q3
PT_G10	0.65***	0.16*	0.16	0.15	0.18
	(0.051)	(0.078)	(0.123)	(0.124)	(0.178)
VERBAL SCORE_G9		0.02***	0.02***	0.01*	0.03***
		(0.002)	(0.004)	(0.004)	(0.006)
ENGLISH SCORE_G9		0.01***	0.01*	0.01	0.02***
		(0.002)	(0.005)	(0.003)	(0.005)
MATH SCORE_G9		0.01***	0.01	0.01**	0.01***
		(0.002)	(0.005)	(0.003)	(0.004)
SEOUL		0.09	-0.25	0.14	0.48**
		(0.097)	(0.178)	(0.158)	(0.179)
URBANICITY		-0.23*	-0.49*	-0.14	-0.15
		(0.101)	(0.192)	(0.171)	(0.171)
GENDER (1=female)		0.35***	0.25*	0.46***	0.30*
		(0.067)	(0.119)	(0.112)	(0.123)
HHINCOME		-0.00	-0.00	-0.00	-0.00
		(0.000)	(0.000)	(0.000)	(0.000)
DADEDU		0.01	0.04	-0.01	-0.01
		(0.031)	(0.059)	(0.052)	(0.053)
ACADEMIC MOTIVATION		0.27***	0.23**	0.27**	0.25**
		(0.048)	(0.079)	(0.084)	(0.087)
PARENTAL ASIPRATION		0.09*	0.14	0.15*	-0.01
		(0.041)	(0.078)	(0.068)	(0.070)
SCHOOL TYPE (1=private)		0.16*	0.31*	-0.02	0.22
		(0.067)	(0.123)	(0.111)	(0.119)
SCHOOL TRACK (1=academic)		-0.36***	-0.38**	-0.31	-0.21
		(0.096)	(0.139)	(0.158)	(0.278)
STU-TEA RATIO		-0.01	0.00	-0.00	-0.02
		(0.014)	(0.023)	(0.025)	(0.028)
SCHOOL CHOICE		0.05	-0.21	0.29	-0.01
		(0.098)	(0.177)	(0.165)	(0.175)
cut1					
Constant	-3.61***	-0.88*	-1.05	-1.53*	0.54
	(0.101)	(0.344)	(0.591)	(0.736)	(0.936)
cut2					
Constant	-1.88***	0.88**	0.60	0.74	2.24**
	(0.054)	(0.325)	(0.580)	(0.666)	(0.845)
cut3					
Constant	-0.50***	2.34***	1.91**	2.41***	3.96***
	(0.043)	(0.325)	(0.581)	(0.663)	(0.830)
cut4					
Constant	1.00***	4.11***	3.51***	4.22***	5.89***
	(0.045)	(0.330)	(0.588)	(0.672)	(0.837)
Observations	6,096	3,635	1,068	1,265	1,302

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G10ATTN (degree of attention to lessons in grade 10)

Table H.5. Ordered Logit estimation of the effect of private tutoring on students' attention to lessons in formal schools in grade 11

	Average Effect		Heterogeneous Effect		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Empty	Full	Q1	Q2	Q3
PT_G11	0.46***	0.15*	0.04	0.01	0.44***
	(0.051)	(0.070)	(0.125)	(0.118)	(0.126)
VERBAL SCORE_G9		0.02***	0.01*	0.01***	0.02***
		(0.002)	(0.004)	(0.004)	(0.005)
ENGLISH SCORE_G9		0.01***	0.00	0.00	0.02***
		(0.002)	(0.005)	(0.003)	(0.005)
MATH SCORE_G9		0.00**	-0.00	-0.00	0.01**
		(0.002)	(0.005)	(0.003)	(0.004)
SEOUL		0.06	-0.05	0.16	0.17
		(0.092)	(0.174)	(0.158)	(0.154)
URBANICITY		-0.05	0.04	-0.07	-0.06
		(0.095)	(0.191)	(0.167)	(0.150)
GENDER (1=female)		0.43***	0.44***	0.50***	0.34**
		(0.065)	(0.121)	(0.113)	(0.109)
HHINCOME		-0.00	0.00	0.00	-0.00
		(0.000)	(0.000)	(0.000)	(0.000)
DADEDU		-0.08**	-0.07	-0.05	-0.15**
		(0.030)	(0.059)	(0.053)	(0.048)
ACADEMIC MOTIVATION		0.31***	0.24**	0.39***	0.28***
		(0.046)	(0.079)	(0.091)	(0.076)
PARENTAL ASIPRATION		0.18***	0.21*	0.13	0.21**
		(0.042)	(0.086)	(0.073)	(0.066)
SCHOOL TYPE (1=private)		0.07	0.05	0.07	0.03
		(0.064)	(0.122)	(0.110)	(0.106)
SCHOOL TRACK (1=academic)		-0.45***	-0.60***	-0.32*	0.02
		(0.095)	(0.148)	(0.161)	(0.236)
STU-TEA RATIO		-0.00	0.05*	-0.02	-0.04
		(0.013)	(0.022)	(0.025)	(0.023)
SCHOOL CHOICE		0.05	0.15	0.15	-0.11
		(0.093)	(0.176)	(0.164)	(0.152)
cut1					
Constant	-3.10***	-0.41	-0.20	-0.91	0.21
	(0.080)	(0.313)	(0.567)	(0.695)	(0.759)
cut2					
Constant	-1.34***	1.54***	1.70**	1.12	2.32**
	(0.046)	(0.302)	(0.560)	(0.675)	(0.706)
cut3					
Constant	0.20***	3.31***	3.39***	2.87***	4.26***
	(0.041)	(0.306)	(0.568)	(0.679)	(0.705)
cut4					
Constant	2.00***	5.36***	5.54***	4.96***	6.31***
	(0.050)	(0.313)	(0.585)	(0.689)	(0.718)
Observations	5,415	3,682	1,069	1,233	1,380

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G11ATTN (degree of attention to lessons in grade 11)

Table H.6. Ordered Logit estimation of the effect of private tutoring on students' attention to lessons in formal schools in grade 12

	Average Effect		Heterogeneous Effect		
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Empty	Full	Q1	Q2	Q3
PT_G12	0.44***	0.12	0.26	0.26*	-0.03
	(0.053)	(0.073)	(0.162)	(0.127)	(0.111)
VERBAL SCORE_G9		0.01***	0.00	0.01	0.01**
		(0.002)	(0.005)	(0.004)	(0.005)
ENGLISH SCORE_G9		0.01***	0.01	0.00	0.02***
		(0.002)	(0.006)	(0.004)	(0.005)
MATH SCORE_G9		0.01***	0.00	-0.00	0.01**
		(0.002)	(0.005)	(0.004)	(0.004)
SEOUL		0.04	0.11	-0.29	0.36*
		(0.100)	(0.192)	(0.170)	(0.167)
URBANICITY		0.06	0.21	0.30	-0.14
		(0.105)	(0.224)	(0.183)	(0.163)
GENDER (1=female)		0.26***	0.20	0.23	0.33**
		(0.070)	(0.134)	(0.119)	(0.115)
HHINCOME		0.00	0.00	0.00	0.00
		(0.000)	(0.000)	(0.000)	(0.000)
DADEDU		-0.08*	-0.09	-0.13*	-0.05
		(0.031)	(0.063)	(0.056)	(0.049)
ACADEMIC MOTIVATION		0.32***	0.18*	0.43***	0.34***
		(0.050)	(0.093)	(0.090)	(0.079)
PARENTAL ASIPRATION		0.16***	0.07	0.16	0.17*
		(0.046)	(0.090)	(0.083)	(0.072)
SCHOOL TYPE (1=private)		0.22**	0.03	0.37**	0.20
		(0.069)	(0.135)	(0.118)	(0.111)
SCHOOL TRACK (1=academic)		-0.51***	-0.70***	-0.41*	0.23
		(0.104)	(0.158)	(0.170)	(0.299)
STU-TEA RATIO		-0.01	0.03	-0.02	-0.03
		(0.014)	(0.025)	(0.025)	(0.024)
SCHOOL CHOICE		0.22*	0.46*	0.47**	-0.06
		(0.105)	(0.213)	(0.181)	(0.167)
cut1					
Constant	-3.64***	-1.18***	-1.22	-1.62*	-0.08
	(0.096)	(0.350)	(0.680)	(0.730)	(0.818)
cut2					
Constant	-1.67***	0.86**	0.73	0.50	2.07**
	(0.043)	(0.331)	(0.665)	(0.700)	(0.751)
cut3					
Constant	-0.01	2.77***	2.47***	2.54***	4.15***
	(0.034)	(0.333)	(0.671)	(0.704)	(0.749)
cut4					
Constant	1.79***	4.75***	4.47***	4.63***	6.13***
	(0.043)	(0.340)	(0.683)	(0.713)	(0.760)
Observations	5,135	3,268	878	1,136	1,254

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G12ATTN (degree of attention to lessons in grade 12)

Table I.1. Heterogeneous effects of one year of private tutoring in middle school on overall academic achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of PT	-0.03	-0.06	-0.04	-0.10*	-0.04	0.15	0.16	-0.00	0.08	0.16***	0.26***	0.27***
	(0.046)	(0.056)	(0.042)	(0.053)	(0.070)	(0.116)	(0.131)	(0.028)	(0.064)	(0.050)	(0.043)	(0.038)
URBAN	-0.01	-0.01	0.09	0.07	-0.04	-0.07	-0.06	0.03	-0.04	-0.10**	-0.08*	-0.08
	(0.072)	(0.075)	(0.060)	(0.153)	(0.121)	(0.188)	(0.089)	(0.054)	(0.067)	(0.033)	(0.040)	(0.047)
GENDER (1=female)	0.25***	0.12	0.24***	0.29***	0.29***	0.15*	0.26***	0.23***	0.34***	0.32***	0.19***	0.07*
	(0.046)	(0.063)	(0.059)	(0.076)	(0.071)	(0.071)	(0.055)	(0.021)	(0.036)	(0.032)	(0.026)	(0.034)
SES	0.17***	0.04	0.10***	0.18***	0.19***	0.18***	0.18***	0.12***	0.21***	0.22***	0.20***	0.15***
	(0.036)	(0.048)	(0.028)	(0.047)	(0.048)	(0.054)	(0.048)	(0.029)	(0.029)	(0.022)	(0.018)	(0.018)
SCHOOL TYPE	0.07	0.10	0.12*	0.02	0.05	0.09	0.07	0.10*	0.13*	0.12***	0.10***	0.10**
	(0.059)	(0.072)	(0.060)	(0.057)	(0.085)	(0.179)	(0.069)	(0.041)	(0.052)	(0.028)	(0.028)	(0.036)
STU-TEA RATIO	-0.00	-0.00	-0.00	-0.01	-0.00	0.01	-0.00	0.01	0.01	0.01	0.01***	0.01**
	(0.005)	(0.005)	(0.005)	(0.006)	(0.008)	(0.012)	(0.006)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
SCHOOL CHOICE	0.01	-0.01	0.10	0.09	-0.08	-0.00	-0.04	-0.02	-0.04	-0.09*	-0.03	-0.00
	(0.069)	(0.053)	(0.058)	(0.149)	(0.101)	(0.220)	(0.087)	(0.041)	(0.063)	(0.039)	(0.035)	(0.041)
PRESCORE	0.15***	0.07***	0.11***	0.16***	0.19***	0.21***	0.16***	0.10***	0.16***	0.20***	0.19***	0.14***
	(0.014)	(0.016)	(0.011)	(0.019)	(0.018)	(0.025)	(0.016)	(0.015)	(0.009)	(0.006)	(0.006)	(0.010)
SELF-STUDY	0.15	0.12	0.28	0.18	0.09	0.02	0.12	-0.01	0.06	0.08	0.10*	0.06
	(0.102)	(0.179)	(0.197)	(0.118)	(0.153)	(0.166)	(0.121)	(0.058)	(0.068)	(0.057)	(0.039)	(0.037)
SELF-ESTEEM	0.10*	0.03	0.06	0.08	0.15*	0.01	0.13**	0.08*	0.19***	0.20***	0.14***	0.14***
	(0.042)	(0.048)	(0.035)	(0.052)	(0.065)	(0.094)	(0.050)	(0.035)	(0.034)	(0.020)	(0.018)	(0.021)
Constant	-1.25***	-1.57***	-1.68***	-1.40***	-0.86**	-0.87	-1.19***	-1.78***	-1.75***	-1.44***	-1.06***	-0.35**
	(0.187)	(0.126)	(0.168)	(0.328)	(0.291)	(0.655)	(0.254)	(0.118)	(0.151)	(0.135)	(0.104)	(0.133)
Observations	778	778	778	778	778	778	521	4,286	4,286	4,286	4,286	4,286
R-squared	0.261						0.294					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VEM_Z (average score in grade 9)

Table I.2. Heterogeneous effects of two years of private tutoring in middle school on overall academic achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of PT	0.19***	0.10*	0.14*	0.18**	0.30***	0.41***	0.25	-0.00	0.15	0.31***	0.49***	0.50***
	(0.048)	(0.044)	(0.059)	(0.069)	(0.060)	(0.063)	(0.132)	(0.054)	(0.108)	(0.086)	(0.096)	(0.081)
URBAN	-0.00	0.00	0.16	0.02	-0.02	-0.09	-0.02	0.03	-0.04	-0.10**	-0.08	-0.08*
	(0.068)	(0.072)	(0.089)	(0.109)	(0.111)	(0.146)	(0.081)	(0.061)	(0.050)	(0.032)	(0.044)	(0.034)
GENDER (1=female)	0.27***	0.18***	0.28***	0.31***	0.28***	0.16	0.28***	0.23***	0.34***	0.32***	0.20***	0.08**
	(0.043)	(0.044)	(0.070)	(0.062)	(0.060)	(0.091)	(0.051)	(0.041)	(0.022)	(0.029)	(0.031)	(0.031)
SES	0.08**	-0.05	0.02	0.14*	0.11***	0.13**	0.11**	0.12***	0.20***	0.20***	0.16***	0.12***
	(0.032)	(0.042)	(0.046)	(0.060)	(0.031)	(0.040)	(0.042)	(0.024)	(0.022)	(0.022)	(0.025)	(0.017)
SCHOOL TYPE	0.10	0.12*	0.09	0.04	-0.02	0.12	0.08	0.10*	0.13***	0.11***	0.08**	0.07*
	(0.055)	(0.053)	(0.082)	(0.070)	(0.085)	(0.136)	(0.063)	(0.042)	(0.030)	(0.029)	(0.025)	(0.033)
STU-TEA RATIO	0.00	0.00	-0.00	-0.00	-0.00	0.00	0.00	0.01	0.01	0.01	0.01*	0.01*
	(0.004)	(0.005)	(0.007)	(0.008)	(0.008)	(0.008)	(0.005)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
SCHOOL CHOICE	0.05	-0.03	0.08	0.06	0.07	0.03	0.05	-0.02	-0.04	-0.10*	-0.04	-0.01
	(0.067)	(0.066)	(0.090)	(0.134)	(0.110)	(0.142)	(0.081)	(0.039)	(0.049)	(0.044)	(0.036)	(0.039)
PRESCORE	0.15***	0.04**	0.10***	0.18***	0.20***	0.17***	0.16***	0.10***	0.15***	0.20***	0.18***	0.13***
	(0.012)	(0.013)	(0.017)	(0.016)	(0.012)	(0.017)	(0.015)	(0.015)	(0.013)	(0.007)	(0.008)	(0.009)
SELF-STUDY	0.20*	0.08	0.13	0.29**	0.30**	0.11	0.15	-0.01	0.05	0.08*	0.09*	0.05
	(0.086)	(0.139)	(0.145)	(0.093)	(0.094)	(0.133)	(0.100)	(0.055)	(0.042)	(0.033)	(0.035)	(0.030)
SELF-ESTEEM	0.11**	0.03	0.02	0.12	0.15**	0.14	0.12*	0.08*	0.18***	0.19***	0.13***	0.13***
	(0.041)	(0.053)	(0.093)	(0.064)	(0.057)	(0.085)	(0.050)	(0.036)	(0.029)	(0.019)	(0.025)	(0.026)
Constant	-1.43***	-1.61***	-1.80***	-1.53***	-1.22***	-0.73*	-1.47***	-1.78***	-1.78***	-1.49***	-1.14***	-0.43*
	(0.179)	(0.191)	(0.254)	(0.317)	(0.250)	(0.325)	(0.231)	(0.130)	(0.128)	(0.147)	(0.152)	(0.183)
Observations	1,084	1,084	1,084	1,084	1,084	1,084	763	4,286	4,286	4,286	4,286	4,286
R-squared	0.240						0.257					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VEM_Z (average score in grade 9)

Table I.3. Heterogeneous effects of three years of private tutoring in middle school on overall academic achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of PT	0.38***	0.21***	0.31***	0.37***	0.53***	0.57***	0.54***	-0.01	0.30	0.61**	0.98***	1.00***
	(0.045)	(0.061)	(0.060)	(0.045)	(0.050)	(0.075)	(0.133)	(0.097)	(0.246)	(0.201)	(0.199)	(0.151)
URBAN	-0.07	-0.08	-0.09	-0.11*	0.00	0.01	-0.10*	0.03	-0.04	-0.10**	-0.08**	-0.07*
	(0.039)	(0.055)	(0.068)	(0.051)	(0.056)	(0.072)	(0.045)	(0.040)	(0.052)	(0.030)	(0.026)	(0.037)
GENDER (1=female)	0.28***	0.30***	0.40***	0.33***	0.19***	0.11*	0.27***	0.23***	0.35***	0.33***	0.21***	0.09***
	(0.027)	(0.042)	(0.043)	(0.038)	(0.041)	(0.051)	(0.031)	(0.033)	(0.035)	(0.018)	(0.028)	(0.025)
SES	0.15***	0.09**	0.13**	0.17***	0.17***	0.13***	0.15***	0.12***	0.19***	0.20***	0.15***	0.10***
	(0.018)	(0.028)	(0.048)	(0.023)	(0.020)	(0.031)	(0.023)	(0.024)	(0.036)	(0.029)	(0.023)	(0.017)
SCHOOL TYPE	0.08*	0.04	0.06	0.11*	0.04	0.08	0.10*	0.10*	0.13*	0.11***	0.08**	0.08*
	(0.034)	(0.053)	(0.058)	(0.044)	(0.021)	(0.048)	(0.039)	(0.042)	(0.051)	(0.032)	(0.030)	(0.038)
STU-TEA RATIO	0.01*	0.01	0.01**	0.00	0.01	0.00	0.01*	0.01	0.00	0.00	0.00	0.00
	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.005)
SCHOOL CHOICE	-0.04	-0.11	-0.06	-0.08	0.03	0.01	-0.04	-0.02	-0.03	-0.09*	-0.02	0.01
	(0.042)	(0.066)	(0.085)	(0.052)	(0.052)	(0.080)	(0.049)	(0.043)	(0.049)	(0.039)	(0.033)	(0.042)
PRESCORE	0.16***	0.12***	0.18***	0.20***	0.17***	0.12***	0.15***	0.10***	0.15***	0.19***	0.17***	0.12***
	(0.008)	(0.009)	(0.013)	(0.009)	(0.008)	(0.009)	(0.010)	(0.014)	(0.013)	(0.009)	(0.012)	(0.012)
SELF-STUDY	0.04	-0.07	0.07	0.10	0.06	0.10*	0.05	-0.01	0.05	0.07	0.07*	0.04
	(0.039)	(0.110)	(0.106)	(0.061)	(0.048)	(0.046)	(0.044)	(0.072)	(0.068)	(0.050)	(0.035)	(0.032)
SELF-ESTEEM	0.13***	0.08	0.13***	0.14***	0.12***	0.12***	0.13***	0.08***	0.18***	0.18***	0.11***	0.11***
	(0.025)	(0.048)	(0.035)	(0.027)	(0.027)	(0.026)	(0.029)	(0.023)	(0.033)	(0.033)	(0.027)	(0.030)
Constant	-1.42***	-1.87***	-2.07***	-1.46***	-1.11***	-0.37*	-1.52***	-1.78***	-1.86***	-1.66***	-1.41***	-0.71***
	(0.124)	(0.172)	(0.214)	(0.158)	(0.102)	(0.183)	(0.166)	(0.128)	(0.186)	(0.204)	(0.157)	(0.161)
Observations	2,854	2,854	2,854	2,854	2,854	2,854	2,252	4,286	4,286	4,286	4,286	4,286
R-squared	0.294						0.267					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VEM_Z (average score in grade 9)

Table I.4. Heterogeneous effects of one year of verbal tutoring in middle school on verbal achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of Verbal PT	-0.17***	-0.17	-0.24**	-0.17**	-0.15**	-0.13**	-0.07	-0.05	-0.08	-0.08	-0.06	-0.07
	(0.043)	(0.088)	(0.082)	(0.066)	(0.049)	(0.045)	(0.121)	(0.052)	(0.066)	(0.044)	(0.049)	(0.039)
URBAN	-0.01	0.14	0.06	-0.11	-0.02	-0.05	-0.08	0.02	-0.06	-0.07	-0.04	-0.01
	(0.064)	(0.095)	(0.074)	(0.084)	(0.061)	(0.060)	(0.074)	(0.066)	(0.069)	(0.043)	(0.029)	(0.034)
GENDER (1=female)	0.49***	0.41***	0.64***	0.62***	0.38***	0.20***	0.49***	0.44***	0.69***	0.48***	0.32***	0.19***
	(0.043)	(0.058)	(0.059)	(0.065)	(0.050)	(0.048)	(0.049)	(0.045)	(0.050)	(0.025)	(0.027)	(0.021)
SES	0.17***	0.03	0.21***	0.21***	0.15***	0.11***	0.17***	0.08	0.18***	0.15***	0.13***	0.10***
	(0.027)	(0.046)	(0.031)	(0.029)	(0.026)	(0.022)	(0.032)	(0.041)	(0.027)	(0.023)	(0.020)	(0.017)
SCHOOL TYPE	0.18***	0.16	0.31***	0.26***	0.10*	0.04	0.20***	0.06	0.16**	0.14***	0.06*	0.03
	(0.052)	(0.094)	(0.088)	(0.057)	(0.040)	(0.048)	(0.059)	(0.061)	(0.048)	(0.035)	(0.031)	(0.024)
STU-TEA RATIO	0.00	-0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01*	0.01*	0.01	0.01*
	(0.005)	(0.007)	(0.008)	(0.007)	(0.006)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.004)	(0.003)
SCHOOL CHOICE	-0.00	0.03	-0.01	-0.10	-0.04	-0.03	-0.06	-0.08	-0.10	-0.09	0.02	0.07*
	(0.067)	(0.107)	(0.080)	(0.109)	(0.068)	(0.062)	(0.078)	(0.052)	(0.071)	(0.052)	(0.041)	(0.029)
PRESCORE	0.17***	0.09***	0.19***	0.21***	0.17***	0.15***	0.17***	0.07***	0.18***	0.19***	0.15***	0.12***
	(0.012)	(0.024)	(0.024)	(0.020)	(0.016)	(0.019)	(0.014)	(0.013)	(0.013)	(0.012)	(0.010)	(0.010)
SELF-STUDY	0.17*	0.23*	0.14	0.18***	0.16**	0.18**	0.16	0.06	0.01	0.08	0.12**	0.08*
	(0.071)	(0.115)	(0.151)	(0.044)	(0.057)	(0.069)	(0.080)	(0.070)	(0.046)	(0.050)	(0.039)	(0.034)
SELF-ESTEEM	0.06	-0.03	0.10	0.11*	0.05	0.02	0.10*	0.14***	0.19***	0.18***	0.10***	0.05
	(0.038)	(0.051)	(0.057)	(0.050)	(0.045)	(0.054)	(0.044)	(0.041)	(0.041)	(0.033)	(0.023)	(0.030)
Constant	-1.79***	-2.46***	-2.75***	-1.90***	-0.84**	-0.04	-1.66***	-2.34***	-2.62***	-1.69***	-0.75***	-0.05
	(0.188)	(0.314)	(0.192)	(0.270)	(0.264)	(0.212)	(0.224)	(0.133)	(0.196)	(0.175)	(0.102)	(0.081)
Observations	1,768	1,768	1,768	1,768	1,768	1,768	1,304	4,187	4,187	4,187	4,187	4,187
R-squared	0.249						0.259					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VER_Z (verbal score in grade 9)

Table I.5. Heterogeneous effects of two years of verbal tutoring in middle school on verbal achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of Verbal PT	-0.05	-0.02	-0.14*	-0.07	-0.07	-0.05	-0.11	-0.05	-0.08	-0.08	-0.06	-0.07
	(0.042)	(0.060)	(0.065)	(0.054)	(0.045)	(0.050)	(0.087)	(0.054)	(0.069)	(0.062)	(0.045)	(0.049)
URBAN	-0.06	-0.01	-0.04	-0.09	-0.04	-0.03	-0.06	0.02	-0.07	-0.07	-0.05	-0.01
	(0.060)	(0.080)	(0.105)	(0.109)	(0.071)	(0.066)	(0.069)	(0.092)	(0.080)	(0.043)	(0.044)	(0.037)
GENDER (1=female)	0.48***	0.41***	0.69***	0.52***	0.40***	0.18***	0.47***	0.44***	0.69***	0.47***	0.32***	0.19***
	(0.041)	(0.052)	(0.059)	(0.055)	(0.046)	(0.045)	(0.049)	(0.051)	(0.052)	(0.032)	(0.027)	(0.024)
SES	0.13***	0.02	0.14***	0.17***	0.12***	0.09***	0.16***	0.08*	0.18***	0.15***	0.13***	0.10***
	(0.027)	(0.054)	(0.041)	(0.028)	(0.025)	(0.024)	(0.031)	(0.034)	(0.029)	(0.021)	(0.015)	(0.015)
SCHOOL TYPE	0.11*	0.02	0.18**	0.16*	0.08	0.07	0.13*	0.06	0.16*	0.14***	0.07	0.04
	(0.051)	(0.069)	(0.060)	(0.066)	(0.052)	(0.051)	(0.059)	(0.068)	(0.073)	(0.036)	(0.046)	(0.037)
STU-TEA RATIO	0.01	0.01	0.01	0.01	0.01	-0.00	0.00	0.01*	0.01	0.01*	0.01*	0.01*
	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)	(0.007)	(0.004)	(0.003)	(0.003)
SCHOOL CHOICE	-0.05	-0.10	-0.06	-0.10	-0.02	-0.03	-0.06	-0.08	-0.10	-0.09*	0.02	0.07
	(0.062)	(0.081)	(0.106)	(0.104)	(0.069)	(0.060)	(0.072)	(0.070)	(0.070)	(0.040)	(0.048)	(0.037)
PRESCORE	0.16***	0.08**	0.19***	0.20***	0.16***	0.13***	0.14***	0.07***	0.18***	0.19***	0.15***	0.12***
	(0.012)	(0.024)	(0.027)	(0.015)	(0.016)	(0.015)	(0.014)	(0.020)	(0.018)	(0.009)	(0.012)	(0.011)
SELF-STUDY	0.11	0.16	0.13	0.14*	0.14	0.08	0.11	0.06	0.02	0.08	0.12**	0.09*
	(0.064)	(0.116)	(0.184)	(0.070)	(0.081)	(0.058)	(0.073)	(0.054)	(0.074)	(0.067)	(0.047)	(0.035)
SELF-ESTEEM	0.12***	0.09	0.15*	0.14**	0.07*	0.06	0.16***	0.14***	0.19***	0.18***	0.10***	0.05*
	(0.037)	(0.056)	(0.073)	(0.048)	(0.031)	(0.044)	(0.043)	(0.031)	(0.042)	(0.023)	(0.025)	(0.025)
Constant	-1.61***	-2.31***	-2.66***	-1.71***	-0.85**	0.17	-1.43***	-2.34***	-2.62***	-1.69***	-0.75***	-0.05
	(0.181)	(0.260)	(0.283)	(0.239)	(0.285)	(0.160)	(0.216)	(0.228)	(0.213)	(0.119)	(0.148)	(0.113)
Observations	1,900	1,900	1,900	1,900	1,900	1,900	1,394	4,187	4,187	4,187	4,187	4,187
R-squared	0.215						0.207					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VER_Z (verbal score in grade 9)

Table I.6. Heterogeneous effects of three years of verbal tutoring in middle school on verbal achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of Verbal PT	0.02	0.12	-0.02	0.02	-0.04	-0.05	-0.12	-0.07	-0.12	-0.12	-0.10	-0.11
	(0.040)	(0.071)	(0.087)	(0.065)	(0.042)	(0.033)	(0.083)	(0.069)	(0.104)	(0.062)	(0.051)	(0.060)
URBAN	-0.05	0.07	0.00	-0.12	-0.04	-0.06	-0.10	0.02	-0.06	-0.07	-0.05	-0.01
	(0.055)	(0.131)	(0.089)	(0.086)	(0.086)	(0.046)	(0.062)	(0.087)	(0.093)	(0.048)	(0.040)	(0.032)
GENDER (1=female)	0.47***	0.53***	0.71***	0.51***	0.33***	0.19***	0.44***	0.44***	0.68***	0.47***	0.31***	0.18***
	(0.038)	(0.085)	(0.058)	(0.036)	(0.034)	(0.042)	(0.044)	(0.059)	(0.040)	(0.037)	(0.038)	(0.030)
SES	0.06*	0.01	0.05	0.07*	0.09***	0.05	0.09**	0.08***	0.19***	0.15***	0.13***	0.10***
	(0.025)	(0.035)	(0.050)	(0.031)	(0.026)	(0.028)	(0.029)	(0.023)	(0.031)	(0.020)	(0.025)	(0.018)
SCHOOL TYPE	0.03	0.00	0.05	0.12*	0.06	0.02	0.03	0.06	0.16***	0.14***	0.07	0.04
	(0.047)	(0.080)	(0.095)	(0.055)	(0.048)	(0.040)	(0.052)	(0.060)	(0.049)	(0.030)	(0.036)	(0.024)
STU-TEA RATIO	0.01	-0.00	0.01	0.01	0.01	0.00	0.01	0.01*	0.01	0.01*	0.01	0.01
	(0.005)	(0.010)	(0.009)	(0.008)	(0.005)	(0.004)	(0.005)	(0.004)	(0.007)	(0.004)	(0.004)	(0.004)
SCHOOL CHOICE	-0.06	-0.04	-0.01	-0.14	-0.00	-0.04	-0.11	-0.08	-0.10	-0.09	0.01	0.06*
	(0.058)	(0.138)	(0.104)	(0.104)	(0.079)	(0.049)	(0.066)	(0.087)	(0.087)	(0.046)	(0.032)	(0.025)
PRESCORE	0.16***	0.07***	0.19***	0.20***	0.16***	0.13***	0.16***	0.07***	0.18***	0.19***	0.15***	0.12***
	(0.011)	(0.022)	(0.024)	(0.015)	(0.012)	(0.010)	(0.013)	(0.015)	(0.014)	(0.010)	(0.009)	(0.008)
SELF-STUDY	-0.00	-0.04	-0.13	0.04	0.04	0.02	0.02	0.06	0.02	0.08	0.12**	0.08**
	(0.058)	(0.069)	(0.086)	(0.088)	(0.065)	(0.055)	(0.064)	(0.078)	(0.067)	(0.064)	(0.043)	(0.030)
SELF-ESTEEM	0.14***	0.17**	0.24***	0.15**	0.08*	0.07*	0.14***	0.15***	0.19***	0.18***	0.10***	0.05*
	(0.034)	(0.058)	(0.065)	(0.051)	(0.031)	(0.029)	(0.039)	(0.035)	(0.047)	(0.034)	(0.027)	(0.024)
Constant	-1.66***	-2.43***	-2.89***	-1.75***	-0.78***	0.14	-1.42***	-2.33***	-2.61***	-1.68***	-0.74***	-0.04
	(0.172)	(0.381)	(0.291)	(0.271)	(0.154)	(0.161)	(0.200)	(0.229)	(0.206)	(0.128)	(0.129)	(0.123)
Observations	2,207	2,207	2,207	2,207	2,207	2,207	1,714	4,187	4,187	4,187	4,187	4,187
R-squared	0.203						0.194					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VER_Z (verbal score in grade 9)

Table I.7. Heterogeneous effects of one year of English tutoring in middle school on English achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of English PT	0.05	0.08	0.01	0.07	0.06	0.04	0.24	0.01	0.24*	0.35***	0.46***	0.33***
	(0.050)	(0.053)	(0.054)	(0.073)	(0.073)	(0.122)	(0.156)	(0.075)	(0.097)	(0.072)	(0.079)	(0.050)
URBAN	0.12	0.02	0.03	0.14	0.17	0.24	0.08	0.05	-0.02	-0.01	-0.07	-0.09*
	(0.075)	(0.056)	(0.074)	(0.104)	(0.088)	(0.130)	(0.093)	(0.055)	(0.056)	(0.051)	(0.050)	(0.038)
GENDER (1=female)	0.34***	0.16***	0.21***	0.39***	0.36***	0.44***	0.34***	0.19***	0.44***	0.37***	0.25***	0.12***
	(0.049)	(0.031)	(0.038)	(0.062)	(0.068)	(0.096)	(0.059)	(0.036)	(0.043)	(0.038)	(0.040)	(0.024)
SES	0.22***	0.03	0.12**	0.19*	0.35***	0.36***	0.27***	0.16***	0.26***	0.28***	0.24***	0.17***
	(0.037)	(0.029)	(0.039)	(0.073)	(0.060)	(0.064)	(0.048)	(0.028)	(0.027)	(0.019)	(0.018)	(0.023)
SCHOOL TYPE	0.14*	0.02	0.09	0.20	0.12	0.22	0.07	0.06	0.12*	0.11**	0.08*	0.11*
	(0.062)	(0.055)	(0.047)	(0.114)	(0.121)	(0.138)	(0.072)	(0.033)	(0.050)	(0.039)	(0.031)	(0.047)
STU-TEA RATIO	-0.00	-0.00	-0.01	-0.01	-0.01	-0.01	-0.00	0.01	0.01	0.01	0.01	0.01*
	(0.005)	(0.003)	(0.004)	(0.007)	(0.006)	(0.007)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)
SCHOOL CHOICE	0.13	-0.01	0.05	0.18*	0.08	0.05	0.07	0.00	-0.06	-0.05	-0.12	-0.07
	(0.074)	(0.066)	(0.060)	(0.084)	(0.089)	(0.135)	(0.093)	(0.062)	(0.045)	(0.060)	(0.070)	(0.043)
PRESCORE	0.14***	0.04**	0.08***	0.15***	0.18***	0.18***	0.16***	0.08***	0.15***	0.21***	0.17***	0.11***
	(0.015)	(0.016)	(0.018)	(0.026)	(0.024)	(0.023)	(0.017)	(0.010)	(0.010)	(0.012)	(0.011)	(0.008)
SELF-STUDY	0.03	-0.02	0.07	0.02	-0.03	0.09	-0.08	-0.00	0.03	0.05	-0.04	-0.03
	(0.103)	(0.099)	(0.095)	(0.147)	(0.184)	(0.199)	(0.120)	(0.084)	(0.100)	(0.045)	(0.033)	(0.037)
SELF-ESTEEM	0.13**	0.07	0.10*	0.15*	0.14*	0.13	0.16**	0.13***	0.24***	0.25***	0.23***	0.16***
	(0.044)	(0.036)	(0.043)	(0.067)	(0.068)	(0.085)	(0.051)	(0.034)	(0.045)	(0.036)	(0.033)	(0.029)
Constant	-1.82***	-1.75***	-1.77***	-2.10***	-1.31***	-0.86*	-1.83***	-2.02***	-2.38***	-2.09***	-1.06***	-0.09
	(0.215)	(0.170)	(0.181)	(0.309)	(0.245)	(0.368)	(0.280)	(0.214)	(0.160)	(0.157)	(0.196)	(0.151)
Observations	993	993	993	993	993	993	687	4,196	4,196	4,196	4,196	4,196
R-squared	0.231						0.274					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9ENG_Z (English score in grade 9)

Table I.8. Heterogeneous effects of two years of English tutoring in middle school on English achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of English PT	0.23***	0.13***	0.19***	0.21***	0.30***	0.27**	0.11	0.13	2.18*	3.16***	4.14***	2.96***
	(0.049)	(0.028)	(0.049)	(0.050)	(0.082)	(0.081)	(0.293)	(0.717)	(0.934)	(0.582)	(0.700)	(0.450)
URBAN	0.06	0.00	0.05	0.07	0.06	0.15	0.10	0.05	-0.13	-0.18**	-0.29***	-0.24***
	(0.065)	(0.040)	(0.055)	(0.096)	(0.079)	(0.076)	(0.080)	(0.074)	(0.073)	(0.055)	(0.053)	(0.049)
GENDER (1=female)	0.31***	0.17***	0.30***	0.44***	0.28***	0.18*	0.30***	0.19***	0.53***	0.50***	0.42***	0.24***
	(0.044)	(0.051)	(0.073)	(0.064)	(0.077)	(0.075)	(0.053)	(0.055)	(0.058)	(0.061)	(0.050)	(0.041)
SES	0.19***	0.06	0.15***	0.20***	0.22***	0.15***	0.23***	0.14	-0.00	-0.10	-0.26**	-0.18**
	(0.032)	(0.054)	(0.031)	(0.051)	(0.045)	(0.037)	(0.053)	(0.102)	(0.133)	(0.092)	(0.092)	(0.065)
SCHOOL TYPE	0.11*	0.04	0.12*	0.06	0.14	0.27**	0.08	0.06	0.10*	0.08*	0.04	0.09*
	(0.055)	(0.046)	(0.056)	(0.063)	(0.095)	(0.089)	(0.065)	(0.033)	(0.042)	(0.035)	(0.041)	(0.035)
STU-TEA RATIO	0.00	0.00	0.00	0.01	0.00	-0.01	0.01	0.01	-0.00	-0.01	-0.01*	-0.00
	(0.005)	(0.003)	(0.005)	(0.005)	(0.008)	(0.008)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)
SCHOOL CHOICE	0.04	-0.01	0.04	0.10	0.02	-0.05	0.09	0.00	-0.05	-0.03	-0.09**	-0.05
	(0.067)	(0.040)	(0.067)	(0.070)	(0.101)	(0.087)	(0.080)	(0.049)	(0.043)	(0.045)	(0.030)	(0.042)
PRESCORE	0.14***	0.05**	0.11***	0.16***	0.19***	0.14***	0.15***	0.07*	0.09*	0.11***	0.05	0.02
	(0.013)	(0.016)	(0.018)	(0.016)	(0.025)	(0.018)	(0.018)	(0.029)	(0.036)	(0.027)	(0.028)	(0.018)
SELF-STUDY	0.22**	0.12	0.36	0.37***	0.14	0.14	0.11	-0.00	0.03	0.04	-0.05	-0.04
	(0.082)	(0.173)	(0.200)	(0.082)	(0.129)	(0.102)	(0.097)	(0.057)	(0.083)	(0.045)	(0.037)	(0.043)
SELF-ESTEEM	0.16***	0.10*	0.08	0.17*	0.20**	0.20*	0.19***	0.12**	0.11	0.06	-0.01	-0.01
	(0.040)	(0.048)	(0.059)	(0.079)	(0.064)	(0.086)	(0.051)	(0.042)	(0.080)	(0.048)	(0.045)	(0.037)
Constant	-1.79***	-1.86***	-2.19***	-2.29***	-1.39***	-0.18	-1.83***	-2.08***	-3.31***	-3.44***	-2.82***	-1.35***
	(0.192)	(0.153)	(0.236)	(0.201)	(0.325)	(0.244)	(0.280)	(0.377)	(0.469)	(0.333)	(0.341)	(0.209)
Observations	1,377	1,377	1,377	1,377	1,377	1,377	993	4,196	4,196	4,196	4,196	4,196
R-squared	0.274						0.270					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9ENG_Z (English score in grade 9)

Table I.9. Heterogeneous effects of three years of English tutoring in middle school on English achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of English PT	0.41***	0.20***	0.29***	0.49***	0.65***	0.52***	1.06***	0.04	0.64*	0.93***	1.22***	0.87***
	(0.046)	(0.046)	(0.056)	(0.060)	(0.046)	(0.055)	(0.137)	(0.216)	(0.276)	(0.247)	(0.207)	(0.164)
URBAN	-0.07	0.02	-0.06	-0.08	-0.07*	-0.09**	-0.10*	0.05	-0.01	-0.00	-0.07	-0.08*
	(0.043)	(0.097)	(0.067)	(0.066)	(0.034)	(0.027)	(0.051)	(0.060)	(0.068)	(0.054)	(0.035)	(0.035)
GENDER (1=female)	0.35***	0.26***	0.52***	0.40***	0.22***	0.14***	0.37***	0.19***	0.46***	0.39***	0.28***	0.14***
	(0.030)	(0.067)	(0.043)	(0.036)	(0.039)	(0.030)	(0.035)	(0.046)	(0.036)	(0.037)	(0.039)	(0.029)
SES	0.21***	0.13***	0.24***	0.24***	0.22***	0.14***	0.17***	0.16***	0.23***	0.23***	0.18***	0.13***
	(0.020)	(0.033)	(0.042)	(0.033)	(0.019)	(0.014)	(0.027)	(0.030)	(0.040)	(0.028)	(0.026)	(0.024)
SCHOOL TYPE	0.07	0.03	0.09	0.09	0.06	0.05	0.08	0.06	0.11**	0.09*	0.06*	0.10**
	(0.038)	(0.044)	(0.053)	(0.071)	(0.043)	(0.039)	(0.044)	(0.034)	(0.036)	(0.042)	(0.030)	(0.038)
STU-TEA RATIO	0.00	-0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01
	(0.004)	(0.006)	(0.005)	(0.005)	(0.002)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
SCHOOL CHOICE	-0.11*	-0.07	-0.15*	-0.08	-0.11**	-0.09**	-0.10	0.00	-0.05	-0.03	-0.10*	-0.06
	(0.047)	(0.095)	(0.072)	(0.070)	(0.035)	(0.029)	(0.055)	(0.066)	(0.062)	(0.060)	(0.047)	(0.043)
PRESCORE	0.16***	0.09***	0.17***	0.20***	0.15***	0.09***	0.14***	0.08***	0.14***	0.19***	0.15***	0.10***
	(0.009)	(0.016)	(0.017)	(0.019)	(0.013)	(0.011)	(0.011)	(0.013)	(0.014)	(0.012)	(0.010)	(0.011)
SELF-STUDY	-0.00	-0.08	0.00	-0.01	-0.04	-0.03	-0.05	-0.00	0.03	0.04	-0.05	-0.04
	(0.043)	(0.062)	(0.083)	(0.047)	(0.040)	(0.040)	(0.049)	(0.077)	(0.075)	(0.056)	(0.032)	(0.040)
SELF-ESTEEM	0.25***	0.15***	0.31***	0.28***	0.18***	0.15***	0.21***	0.13***	0.22***	0.21***	0.19***	0.13***
	(0.027)	(0.031)	(0.046)	(0.043)	(0.033)	(0.029)	(0.032)	(0.028)	(0.035)	(0.051)	(0.049)	(0.028)
Constant	-1.58***	-2.03***	-2.40***	-1.97***	-0.93***	0.09	-2.11***	-2.04***	-2.61***	-2.42***	-1.49***	-0.39*
	(0.141)	(0.279)	(0.232)	(0.210)	(0.096)	(0.111)	(0.186)	(0.281)	(0.300)	(0.235)	(0.190)	(0.161)
Observations	3,142	3,142	3,142	3,142	3,142	3,142	2,492	4,196	4,196	4,196	4,196	4,196
R-squared	0.310						0.252					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9ENG_Z (English score in grade 9)

Table I.10. Heterogeneous effects of one year of math tutoring in middle school on math achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of Math PT	0.05	-0.04	0.01	0.03	0.11	0.29***	0.21	0.01	0.09	0.26***	0.33***	0.22***
	(0.048)	(0.036)	(0.042)	(0.049)	(0.069)	(0.070)	(0.128)	(0.055)	(0.073)	(0.069)	(0.076)	(0.062)
URBAN	-0.18*	-0.11*	-0.00	-0.14	-0.36**	-0.20	-0.19*	0.03	-0.08	-0.24***	-0.11**	-0.03
	(0.074)	(0.045)	(0.109)	(0.093)	(0.128)	(0.208)	(0.089)	(0.031)	(0.055)	(0.035)	(0.035)	(0.052)
GENDER (1=female)	-0.02	0.02	0.04	-0.01	0.02	-0.08	-0.05	0.04	0.04	0.02	-0.10**	-0.13***
	(0.048)	(0.037)	(0.047)	(0.063)	(0.072)	(0.077)	(0.056)	(0.039)	(0.040)	(0.038)	(0.034)	(0.039)
SES	0.16***	0.04	0.05	0.20***	0.18***	0.18***	0.14**	0.09**	0.21***	0.25***	0.22***	0.16***
	(0.035)	(0.026)	(0.041)	(0.043)	(0.046)	(0.053)	(0.042)	(0.030)	(0.030)	(0.026)	(0.028)	(0.028)
SCHOOL TYPE	0.07	-0.00	0.00	0.15*	0.04	-0.02	0.10	0.10	0.17**	0.18***	0.15***	0.14**
	(0.061)	(0.045)	(0.077)	(0.068)	(0.139)	(0.101)	(0.070)	(0.055)	(0.057)	(0.050)	(0.031)	(0.047)
STU-TEA RATIO	0.00	0.01	0.00	0.00	-0.00	0.00	-0.00	0.01**	0.00	0.01	0.01*	0.01
	(0.005)	(0.004)	(0.005)	(0.005)	(0.007)	(0.010)	(0.006)	(0.003)	(0.004)	(0.005)	(0.006)	(0.005)
SCHOOL CHOICE	-0.02	0.08	0.12	-0.03	-0.17	-0.12	-0.03	0.06	-0.04	-0.12*	0.01	0.11*
	(0.072)	(0.048)	(0.070)	(0.075)	(0.134)	(0.182)	(0.088)	(0.044)	(0.061)	(0.057)	(0.033)	(0.051)
PRESCORE	0.18***	0.09***	0.12***	0.14***	0.24***	0.29***	0.18***	0.08***	0.15***	0.22***	0.22***	0.16***
	(0.014)	(0.017)	(0.012)	(0.016)	(0.017)	(0.024)	(0.016)	(0.008)	(0.009)	(0.013)	(0.013)	(0.015)
SELF-STUDY	0.17	-0.12	0.28	0.21**	0.21	-0.02	0.20	-0.02	0.09	0.21**	0.09	0.07
	(0.095)	(0.078)	(0.147)	(0.076)	(0.182)	(0.137)	(0.111)	(0.065)	(0.079)	(0.066)	(0.050)	(0.055)
SELF-ESTEEM	0.07	0.07	0.05	0.09*	0.04	0.04	0.12*	0.03	0.12*	0.16***	0.12*	0.14**
	(0.044)	(0.051)	(0.074)	(0.045)	(0.091)	(0.066)	(0.051)	(0.038)	(0.051)	(0.047)	(0.051)	(0.045)
Constant	-1.28***	-2.00***	-1.94***	-1.26***	-0.88*	-0.69	-1.24***	-1.96***	-1.67***	-1.50***	-1.11***	-0.08
	(0.206)	(0.162)	(0.210)	(0.249)	(0.403)	(0.481)	(0.261)	(0.121)	(0.161)	(0.211)	(0.173)	(0.162)
Observations	992	992	992	992	992	992	693	4,260	4,260	4,260	4,260	4,260
R-squared	0.242						0.272					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9MAT_Z (math score in grade 9)

Table I.11. Heterogeneous effects of two years of math tutoring in middle school on math achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of Math PT	0.29***	0.08*	0.14*	0.29***	0.46***	0.50***	0.01	0.08	1.16	3.37***	4.22***	2.83***
	(0.049)	(0.039)	(0.061)	(0.055)	(0.074)	(0.089)	(0.307)	(0.746)	(0.931)	(0.912)	(0.866)	(0.790)
URBAN	-0.19**	-0.00	-0.02	-0.14	-0.31**	-0.24*	-0.24**	0.02	-0.14	-0.40***	-0.32***	-0.17*
	(0.067)	(0.050)	(0.077)	(0.133)	(0.113)	(0.119)	(0.081)	(0.059)	(0.079)	(0.055)	(0.061)	(0.069)
GENDER (1=female)	0.00	0.05	-0.00	-0.01	0.05	-0.07	-0.02	0.05	0.07	0.12*	0.02	-0.05
	(0.044)	(0.058)	(0.062)	(0.063)	(0.072)	(0.080)	(0.052)	(0.059)	(0.070)	(0.049)	(0.043)	(0.044)
SES	0.15***	0.05	0.06	0.16**	0.20***	0.22***	0.21***	0.08	0.08	-0.12	-0.24*	-0.14
	(0.031)	(0.034)	(0.046)	(0.052)	(0.054)	(0.063)	(0.051)	(0.092)	(0.114)	(0.110)	(0.098)	(0.086)
SCHOOL TYPE	0.15**	0.07	0.11*	0.11	0.20	0.15	0.18**	0.10	0.12	0.04	-0.03	0.02
	(0.055)	(0.048)	(0.048)	(0.097)	(0.104)	(0.111)	(0.066)	(0.055)	(0.069)	(0.058)	(0.050)	(0.060)
STU-TEA RATIO	0.00	0.00	0.00	0.01	-0.00	-0.00	0.01	0.01	-0.00	-0.01	-0.01	-0.01
	(0.005)	(0.004)	(0.006)	(0.005)	(0.010)	(0.010)	(0.006)	(0.005)	(0.007)	(0.005)	(0.007)	(0.007)
SCHOOL CHOICE	-0.05	0.06	-0.01	-0.00	-0.07	-0.09	-0.10	0.06	-0.03	-0.08	0.06	0.15**
	(0.067)	(0.061)	(0.086)	(0.127)	(0.123)	(0.114)	(0.080)	(0.040)	(0.059)	(0.072)	(0.048)	(0.055)
PRESCORE	0.16***	0.07***	0.11***	0.17***	0.20***	0.21***	0.18***	0.08***	0.12***	0.14***	0.13***	0.09***
	(0.013)	(0.020)	(0.019)	(0.024)	(0.019)	(0.020)	(0.017)	(0.021)	(0.023)	(0.029)	(0.029)	(0.018)
SELF-STUDY	0.08	-0.09	0.00	0.22	0.14	0.00	0.09	-0.02	0.12	0.30***	0.20**	0.14**
	(0.080)	(0.082)	(0.180)	(0.128)	(0.079)	(0.118)	(0.094)	(0.056)	(0.076)	(0.051)	(0.064)	(0.049)
SELF-ESTEEM	0.13**	0.05	0.13*	0.17**	0.18*	0.10	0.15**	0.02	0.06	-0.03	-0.11	-0.01
	(0.040)	(0.047)	(0.062)	(0.057)	(0.075)	(0.072)	(0.051)	(0.059)	(0.067)	(0.061)	(0.058)	(0.050)
Constant	-1.22***	-1.90***	-1.59***	-1.48***	-0.83*	-0.21	-1.00***	-2.00***	-2.20***	-3.03***	-3.02***	-1.36*
	(0.193)	(0.162)	(0.251)	(0.351)	(0.378)	(0.248)	(0.283)	(0.426)	(0.549)	(0.547)	(0.446)	(0.532)
Observations	1,423	1,423	1,423	1,423	1,423	1,423	1,031	4,260	4,260	4,260	4,260	4,260
R-squared	0.244						0.245					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9MAT_Z (math score in grade 9)

Table I.12. Heterogeneous effects of three years of math tutoring in middle school on math achievement in grade 9

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of Math PT	0.46***	0.14**	0.29***	0.48***	0.74***	0.61***	0.88***	0.02	0.31	0.90**	1.13***	0.76***
	(0.048)	(0.052)	(0.061)	(0.058)	(0.088)	(0.111)	(0.136)	(0.218)	(0.280)	(0.280)	(0.226)	(0.204)
URBAN	-0.14**	-0.05	-0.15**	-0.21***	-0.14*	-0.03	-0.17***	0.02	-0.08	-0.24***	-0.11**	-0.03
	(0.044)	(0.041)	(0.052)	(0.052)	(0.055)	(0.044)	(0.051)	(0.042)	(0.049)	(0.063)	(0.042)	(0.039)
GENDER (1=female)	0.01	0.07	0.07	0.00	-0.06	-0.12***	0.01	0.04	0.05	0.04	-0.07*	-0.11***
	(0.031)	(0.046)	(0.038)	(0.035)	(0.031)	(0.031)	(0.036)	(0.032)	(0.042)	(0.040)	(0.033)	(0.023)
SES	0.17***	0.13***	0.15***	0.21***	0.18***	0.10***	0.17***	0.09**	0.20***	0.21***	0.17***	0.13***
	(0.021)	(0.037)	(0.035)	(0.026)	(0.021)	(0.019)	(0.026)	(0.030)	(0.038)	(0.038)	(0.030)	(0.030)
SCHOOL TYPE	0.15***	0.11	0.10	0.16*	0.12*	0.10*	0.14**	0.10**	0.17***	0.18***	0.14**	0.14*
	(0.039)	(0.088)	(0.071)	(0.072)	(0.048)	(0.039)	(0.045)	(0.040)	(0.036)	(0.032)	(0.049)	(0.064)
STU-TEA RATIO	0.01	0.00	0.01	0.01	0.00	0.01	0.00	0.01*	0.00	0.00	0.01	0.00
	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.006)	(0.005)	(0.004)	(0.006)	(0.004)	(0.005)	(0.004)
SCHOOL CHOICE	-0.06	-0.04	-0.07	-0.07	-0.07	0.08	-0.03	0.06	-0.04	-0.11	0.03	0.12
	(0.048)	(0.048)	(0.051)	(0.071)	(0.073)	(0.052)	(0.056)	(0.046)	(0.056)	(0.060)	(0.052)	(0.071)
PRESCORE	0.18***	0.11***	0.16***	0.22***	0.18***	0.14***	0.16***	0.08***	0.14***	0.20***	0.20***	0.14***
	(0.010)	(0.012)	(0.013)	(0.011)	(0.013)	(0.011)	(0.011)	(0.012)	(0.014)	(0.014)	(0.015)	(0.012)
SELF-STUDY	0.04	-0.08	0.07	0.14*	0.04	0.03	0.03	-0.02	0.08	0.18**	0.05	0.04
	(0.044)	(0.082)	(0.129)	(0.066)	(0.035)	(0.046)	(0.049)	(0.067)	(0.086)	(0.058)	(0.044)	(0.040)
SELF-ESTEEM	0.11***	0.00	0.12*	0.13**	0.15***	0.14***	0.09**	0.03	0.11*	0.13***	0.08*	0.12***
	(0.028)	(0.049)	(0.056)	(0.047)	(0.040)	(0.039)	(0.032)	(0.033)	(0.046)	(0.038)	(0.037)	(0.033)
Constant	-1.34***	-1.93***	-1.89***	-1.58***	-0.78***	-0.19	-1.58***	-1.97***	-1.77***	-1.81***	-1.49***	-0.33
	(0.146)	(0.126)	(0.191)	(0.152)	(0.203)	(0.217)	(0.188)	(0.163)	(0.235)	(0.307)	(0.221)	(0.239)
Observations	3,198	3,198	3,198	3,198	3,198	3,198	2,531	4,260	4,260	4,260	4,260	4,260
R-squared	0.254						0.215					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9MAT_Z (math score in grade 9)

Table J.1. Heterogeneous effects of private tutoring in grade 7 on academic achievement for 3 years using the OLS estimation

	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
PT in G7	0.22***	0.10**	0.18***	0.25***	0.27***	0.27***	0.09**	0.02	0.02	0.08*	0.15***	0.14***	0.05	0.02	0.01	0.06	0.09	0.11
	(0.022)	(0.035)	(0.035)	(0.028)	(0.026)	(0.032)	(0.026)	(0.035)	(0.027)	(0.034)	(0.035)	(0.038)	(0.033)	(0.033)	(0.045)	(0.049)	(0.059)	(0.069)
URBANICITY	0.07**	0.08	0.08	0.04	0.04	0.07*	0.01	0.06	0.04	0.04	-0.02	-0.01	-0.05	-0.03	-0.04	-0.10	-0.03	-0.05
	(0.025)	(0.043)	(0.046)	(0.025)	(0.029)	(0.030)	(0.028)	(0.046)	(0.040)	(0.046)	(0.046)	(0.051)	(0.034)	(0.059)	(0.054)	(0.054)	(0.043)	(0.044)
GENDER (1=female)	0.25***	0.34***	0.32***	0.27***	0.19***	0.13***	0.29***	0.39***	0.38***	0.33***	0.21***	0.13***	0.28***	0.26***	0.38***	0.33***	0.20***	0.11***
	(0.017)	(0.026)	(0.020)	(0.022)	(0.017)	(0.023)	(0.019)	(0.029)	(0.030)	(0.027)	(0.019)	(0.021)	(0.023)	(0.027)	(0.034)	(0.021)	(0.034)	(0.028)
SES	0.19***	0.18***	0.20***	0.20***	0.18***	0.14***	0.16***	0.11***	0.18***	0.20***	0.20***	0.14***	0.15***	0.08**	0.14***	0.18***	0.16***	0.15***
	(0.011)	(0.019)	(0.019)	(0.014)	(0.013)	(0.019)	(0.013)	(0.026)	(0.028)	(0.015)	(0.011)	(0.015)	(0.016)	(0.026)	(0.027)	(0.020)	(0.019)	(0.021)
SCHOOL TYPE (1=private)	0.06**	0.08*	0.04	0.08***	0.07***	0.04	0.06*	0.08	0.07	0.04	0.02	0.01	0.09**	0.08	0.07	0.11**	0.04	0.07
	(0.021)	(0.031)	(0.039)	(0.021)	(0.020)	(0.039)	(0.024)	(0.052)	(0.044)	(0.031)	(0.038)	(0.053)	(0.029)	(0.047)	(0.057)	(0.041)	(0.026)	(0.048)
STU-TEA RATIO	0.01***	0.01***	0.01***	0.01***	0.01***	0.01**	0.01***	0.01**	0.01**	0.01**	0.01***	0.01*	0.01*	0.01*	0.01	0.01	0.01	0.00
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
SCHOOL CHOICE	-0.07**	-0.05	-0.09*	-0.10**	-0.10**	-0.01	-0.09**	-0.05	-0.07	-0.07	-0.12*	-0.11*	-0.02	-0.06	-0.00	-0.05	0.01	-0.03
	(0.026)	(0.041)	(0.043)	(0.030)	(0.032)	(0.044)	(0.029)	(0.056)	(0.052)	(0.062)	(0.054)	(0.047)	(0.036)	(0.056)	(0.048)	(0.053)	(0.039)	(0.044)
PRESCORE (G6)	0.20***	0.18***	0.21***	0.22***	0.20***	0.16***	0.17***	0.11***	0.17***	0.20***	0.19***	0.16***	0.16***	0.09***	0.15***	0.19***	0.18***	0.14***
	(0.005)	(0.007)	(0.008)	(0.007)	(0.007)	(0.009)	(0.006)	(0.011)	(0.009)	(0.009)	(0.010)	(0.010)	(0.007)	(0.010)	(0.010)	(0.011)	(0.011)	(0.012)
STUDY HOUR (1= >10hrs/week)	0.10***	0.15***	0.11**	0.11***	0.08***	0.06	0.09**	0.11	0.15**	0.08**	0.06*	0.09***	0.07	-0.04	0.10	0.14*	0.09	0.10*
	(0.025)	(0.036)	(0.037)	(0.021)	(0.019)	(0.029)	(0.028)	(0.063)	(0.046)	(0.028)	(0.027)	(0.026)	(0.035)	(0.080)	(0.054)	(0.058)	(0.046)	(0.044)
SELF ESTEEM	0.19***	0.18***	0.21***	0.21***	0.18***	0.19***	0.18***	0.14***	0.17***	0.18***	0.19***	0.17***	0.12***	0.05*	0.10***	0.12***	0.13***	0.11**
	(0.015)	(0.026)	(0.030)	(0.018)	(0.015)	(0.018)	(0.017)	(0.024)	(0.031)	(0.025)	(0.023)	(0.031)	(0.021)	(0.024)	(0.024)	(0.027)	(0.031)	(0.040)
PT in G8							0.24***	0.18***	0.22***	0.23***	0.25***	0.28***	0.18***	0.08*	0.17***	0.18***	0.20***	0.22***
							(0.027)	(0.034)	(0.038)	(0.030)	(0.039)	(0.042)	(0.035)	(0.035)	(0.045)	(0.052)	(0.056)	(0.053)
PT in G9													0.23***	0.21***	0.20***	0.25***	0.28***	0.22***
													(0.033)	(0.025)	(0.030)	(0.048)	(0.056)	(0.053)
Constant	1.92***	2.77***	2.45***	1.99***	1.38***	0.80***	1.77***	2.39***	2.34***	2.01***	1.28***	0.63***	1.78***	2.16***	2.37***	1.95***	1.35***	0.49***
	(0.078)	(0.127)	(0.118)	(0.086)	(0.100)	(0.137)	(0.088)	(0.138)	(0.138)	(0.200)	(0.135)	(0.135)	(0.106)	(0.128)	(0.126)	(0.169)	(0.165)	(0.141)
Observations	5,895	5,895	5,895	5,895	5,895	5,895	5,380	5,380	5,380	5,380	5,380	5,380	3,990	3,990	3,990	3,990	3,990	3,990
R-squared	0.444						0.364						0.315					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G7VEM_Z (average score in grade 7) for (1)-(6); G8VEM_Z (average score in grade 8) for (7)-(12); G9VEM_Z (average score in grade 9) for (13)-(18)

Table J.2. Heterogeneous effects of private tutoring in grade 7 on overall achievement for 3 years using the 2SLAD estimation

	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
PT in G7 (predicted)	0.53***	0.32*	0.77***	0.75***	0.82***	0.93***	0.33***	0.10	0.30	0.61***	0.73***	0.82***	0.22*	0.19	0.10	0.23	0.51**	0.52**
	(0.066)	(0.150)	(0.171)	(0.140)	(0.109)	(0.129)	(0.076)	(0.132)	(0.158)	(0.183)	(0.114)	(0.138)	(0.094)	(0.148)	(0.058)	(0.149)	(0.179)	(0.189)
URBANICITY	0.04	0.06	0.04	-0.02	0.00	0.05*	-0.01	0.05	-0.02	-0.04	-0.05	-0.06	-0.06	-0.04	-0.04	-0.09**	-0.05	-0.07
	(0.026)	(0.062)	(0.037)	(0.032)	(0.027)	(0.027)	(0.029)	(0.070)	(0.049)	(0.048)	(0.032)	(0.037)	(0.035)	(0.046)	(0.056)	(0.035)	(0.038)	(0.049)
GENDER (1=female)	0.26***	0.35***	0.32***	0.27***	0.20***	0.13***	0.29***	0.39***	0.38***	0.33***	0.23***	0.14***	0.28***	0.27***	0.36***	0.32***	0.22***	0.11**
	(0.018)	(0.033)	(0.033)	(0.026)	(0.025)	(0.029)	(0.020)	(0.026)	(0.025)	(0.025)	(0.022)	(0.020)	(0.024)	(0.030)	(0.029)	(0.027)	(0.026)	(0.039)
SES	0.16***	0.18***	0.16***	0.16***	0.14***	0.08***	0.16***	0.11***	0.19***	0.19***	0.17***	0.10***	0.14***	0.07**	0.14***	0.17***	0.14***	0.12***
	(0.013)	(0.028)	(0.022)	(0.014)	(0.013)	(0.018)	(0.014)	(0.029)	(0.027)	(0.018)	(0.016)	(0.024)	(0.017)	(0.026)	(0.029)	(0.024)	(0.024)	(0.021)
SCHOOL TYPE (1=private)	0.04	0.06*	0.03	0.02	0.05	0.03	0.05	0.08**	0.06	0.03	0.01	-0.02	0.07*	0.07*	0.06	0.12**	0.06	0.07
	(0.022)	(0.024)	(0.022)	(0.023)	(0.024)	(0.027)	(0.025)	(0.024)	(0.043)	(0.024)	(0.026)	(0.046)	(0.030)	(0.035)	(0.060)	(0.039)	(0.042)	(0.047)
STU-TEA RATIO	0.01***	0.01**	0.01**	0.01***	0.01***	0.01***	0.01***	0.00	0.01	0.01**	0.01***	0.01*	0.01*	0.00	0.01*	0.00	0.01	0.00
	(0.002)	(0.004)	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)	(0.004)
SCHOOL CHOICE	-0.07**	-0.05	-0.07	-0.12**	-0.10**	0.03	-0.10***	-0.08	-0.12*	-0.13**	-0.11***	-0.11**	-0.02	-0.04	-0.01	-0.05	0.01	-0.01
	(0.028)	(0.064)	(0.043)	(0.040)	(0.034)	(0.034)	(0.031)	(0.058)	(0.050)	(0.044)	(0.029)	(0.035)	(0.037)	(0.037)	(0.044)	(0.056)	(0.036)	(0.053)
PRESCORE (G6)	0.19***	0.17***	0.19***	0.21***	0.19***	0.15***	0.16***	0.10***	0.16***	0.19***	0.18***	0.16***	0.16***	0.09***	0.14***	0.19***	0.17***	0.14***
	(0.006)	(0.012)	(0.012)	(0.011)	(0.008)	(0.009)	(0.006)	(0.009)	(0.008)	(0.008)	(0.007)	(0.008)	(0.007)	(0.010)	(0.012)	(0.008)	(0.008)	(0.010)
STUDY HOUR (1=>10hrs/week)	0.09***	0.15***	0.11***	0.09***	0.04	0.02	0.08**	0.11***	0.12*	0.05	0.05	0.06*	0.05	-0.06	0.08	0.13**	0.08*	0.09
	(0.026)	(0.044)	(0.028)	(0.026)	(0.032)	(0.036)	(0.029)	(0.032)	(0.052)	(0.050)	(0.041)	(0.028)	(0.036)	(0.088)	(0.074)	(0.049)	(0.038)	(0.064)
SELF ESTEEM	0.19***	0.18***	0.19***	0.21***	0.15***	0.14***	0.18***	0.15***	0.19***	0.17***	0.16***	0.14***	0.12***	0.05	0.13**	0.15***	0.14***	0.11***
	(0.016)	(0.031)	(0.032)	(0.024)	(0.022)	(0.024)	(0.018)	(0.024)	(0.037)	(0.029)	(0.023)	(0.024)	(0.022)	(0.042)	(0.045)	(0.035)	(0.024)	(0.028)
PT_G8							0.15***	0.16**	0.11	0.00	0.02	0.01	0.12**	0.02	0.13**	0.12*	0.03	0.07
							(0.040)	(0.058)	(0.079)	(0.073)	(0.071)	(0.079)	(0.045)	(0.052)	(0.046)	(0.053)	(0.047)	(0.061)
PT_G9													0.20***	0.16***	0.17***	0.22***	0.21***	0.18**
													(0.038)	(0.043)	(0.045)	(0.056)	(0.041)	(0.064)
Constant	2.06***	2.83***	2.71***	2.21***	1.68***	1.29***	-1.83***	2.31***	2.26***	2.00***	-1.53***	0.91***	1.85***	2.19***	2.28***	1.97***	1.52***	0.71***
	(0.090)	(0.180)	(0.157)	(0.150)	(0.118)	(0.127)	(0.096)	(0.130)	(0.134)	(0.111)	(0.065)	(0.096)	(0.115)	(0.103)	(0.087)	(0.177)	(0.111)	(0.153)
Observations	5,473	5,882	5,882	5,882	5,882	5,882	5,022	5,377	5,377	5,377	5,377	5,377	3,716	3,990	3,990	3,990	3,990	3,990
R-squared	0.419						0.351						0.307					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G7VEM_Z (average score in grade 7) for (1)-(6); G8VEM_Z (average score in grade 8) for (7)-(12); G9VEM_Z (average score in grade 9) for (13)-(18)

Table J.3. Heterogeneous effects of private tutoring in grade 8 on overall achievement for 2 years using the OLS estimation

	Year 0 (Grade 8)						Year 1 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
PT in G8	0.12***	0.07***	0.11***	0.10***	0.11***	0.17***	0.09**	0.03	0.07*	0.10***	0.07*	0.16***
	(0.020)	(0.018)	(0.024)	(0.022)	(0.024)	(0.025)	(0.028)	(0.036)	(0.030)	(0.023)	(0.029)	(0.031)
URBANICITY	-0.04	-0.06	-0.05	-0.02	-0.04	-0.07*	-0.09**	-0.07	-0.11***	-0.06*	-0.05	-0.07*
	(0.021)	(0.051)	(0.024)	(0.028)	(0.031)	(0.026)	(0.028)	(0.058)	(0.033)	(0.028)	(0.028)	(0.027)
GENDER (1=female)	0.10***	0.21***	0.16***	0.08***	0.03*	0.03*	0.09***	0.15***	0.14***	0.08***	0.04*	-0.01
	(0.014)	(0.023)	(0.020)	(0.017)	(0.015)	(0.015)	(0.019)	(0.039)	(0.029)	(0.020)	(0.018)	(0.015)
SES	0.04***	0.01	0.04**	0.05***	0.05***	0.04***	0.05***	0.04	0.06**	0.04**	0.05*	0.04*
	(0.010)	(0.022)	(0.016)	(0.012)	(0.011)	(0.009)	(0.013)	(0.029)	(0.023)	(0.013)	(0.019)	(0.018)
SCHOOL TYPE (1=private)	0.03	0.06	0.02	0.00	0.02	0.03	0.06*	0.08	0.06*	0.03	0.06**	0.05
	(0.018)	(0.036)	(0.019)	(0.020)	(0.022)	(0.023)	(0.023)	(0.049)	(0.029)	(0.034)	(0.020)	(0.035)
STU-TEA RATIO	0.00	0.00	0.00	0.00	0.00	0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.005)	(0.003)	(0.002)	(0.002)	(0.003)
SCHOOL CHOICE	-0.05*	-0.06	-0.04	-0.01	-0.05	-0.09***	0.01	-0.04	-0.01	0.05	0.05	0.02
	(0.022)	(0.057)	(0.030)	(0.031)	(0.030)	(0.027)	(0.029)	(0.040)	(0.035)	(0.026)	(0.034)	(0.034)
PRESCORE (G7)	0.73***	0.67***	0.78***	0.80***	0.77***	0.66***	0.68***	0.47***	0.72***	0.80***	0.75***	0.62***
	(0.010)	(0.031)	(0.021)	(0.012)	(0.014)	(0.019)	(0.013)	(0.044)	(0.014)	(0.012)	(0.019)	(0.022)
STUDY HOUR (1= >10hrs/week)	0.03	0.04	0.05*	0.02	0.02	0.02	0.01	-0.07	0.03	0.06	0.06*	0.05
	(0.021)	(0.058)	(0.022)	(0.026)	(0.033)	(0.031)	(0.029)	(0.063)	(0.055)	(0.039)	(0.023)	(0.031)
SELF ESTEEM	0.07***	0.09***	0.06***	0.05***	0.05**	0.06***	0.03	-0.01	0.01	0.01	0.03	0.04**
	(0.013)	(0.026)	(0.016)	(0.012)	(0.017)	(0.016)	(0.017)	(0.033)	(0.021)	(0.019)	(0.021)	(0.016)
PT in G7	-0.03	-0.05	-0.04*	-0.02	-0.01	0.00	-0.06*	-0.04	-0.05	-0.00	-0.07**	-0.10
	(0.020)	(0.037)	(0.019)	(0.027)	(0.036)	(0.028)	(0.027)	(0.047)	(0.031)	(0.027)	(0.024)	(0.052)
PT in G9							0.16***	0.18***	0.13**	0.14***	0.18***	0.15***
							(0.027)	(0.046)	(0.042)	(0.028)	(0.043)	(0.037)
		-	-					-				
Constant	-0.18**	0.89***	0.55***	-0.15*	0.27***	0.59***	-0.25**	1.07***	-0.59***	-0.22**	0.12	0.59***
	(0.062)	(0.127)	(0.080)	(0.073)	(0.082)	(0.102)	(0.082)	(0.159)	(0.125)	(0.071)	(0.081)	(0.113)
Observations	5,501	5,501	5,501	5,501	5,501	5,501	4,077	4,077	4,077	4,077	4,077	4,077
R-squared	0.633						0.540					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8VEM_Z (average score in grade 8) for (1)-(6); G9VEM_Z (average score in grade 9) for (7)-(12)

Table J.4. Heterogeneous effects of private tutoring in grade 8 on overall achievement for 2 years using the 2SLAD estimation

	Year 0 (Grade 8)						Year 1 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
PT in G8 (predicted)	0.27***	0.26	0.32**	0.29***	0.24*	0.14	0.13	0.05	0.07	0.11	0.18	0.21
	(0.066)	(0.143)	(0.099)	(0.069)	(0.101)	(0.079)	(0.097)	(0.176)	(0.146)	(0.134)	(0.143)	(0.207)
URBANICITY	-0.05*	-0.06	-0.06*	-0.03	-0.06*	-0.04	-0.09**	-0.07*	-0.10*	-0.07*	-0.05	-0.06
	(0.022)	(0.036)	(0.025)	(0.022)	(0.024)	(0.033)	(0.029)	(0.034)	(0.042)	(0.027)	(0.040)	(0.035)
GENDER (1=female)	0.11***	0.23***	0.17***	0.08***	0.04*	0.02	0.09***	0.15***	0.15***	0.07***	0.04*	-0.00
	(0.015)	(0.028)	(0.018)	(0.017)	(0.018)	(0.021)	(0.020)	(0.036)	(0.030)	(0.016)	(0.017)	(0.028)
SES	0.04***	0.02	0.05**	0.05***	0.04*	0.04***	0.06***	0.06	0.08***	0.05***	0.05**	0.04*
	(0.011)	(0.025)	(0.016)	(0.011)	(0.016)	(0.012)	(0.014)	(0.035)	(0.020)	(0.016)	(0.016)	(0.019)
SCHOOL TYPE (1=private)	0.03	0.03	0.03	0.02	0.01	0.02	0.07**	0.10	0.07	0.06	0.06*	0.04
	(0.019)	(0.041)	(0.026)	(0.021)	(0.017)	(0.023)	(0.025)	(0.061)	(0.043)	(0.044)	(0.024)	(0.039)
STU-TEA RATIO	0.00	0.00	0.00	0.00	0.00	0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
SCHOOL CHOICE	-0.05*	-0.06	-0.03	-0.01	-0.07**	-0.06	0.01	-0.06	-0.02	0.05	0.05	0.04
	(0.023)	(0.039)	(0.026)	(0.027)	(0.025)	(0.033)	(0.031)	(0.046)	(0.046)	(0.041)	(0.041)	(0.031)
PRESCORE (G7)	0.72***	0.66***	0.77***	0.79***	0.76***	0.66***	0.68***	0.48***	0.72***	0.80***	0.74***	0.61***
	(0.011)	(0.025)	(0.018)	(0.011)	(0.013)	(0.018)	(0.014)	(0.034)	(0.024)	(0.014)	(0.013)	(0.024)
STUDY HOUR (1= >10hrs/week)	0.01	0.03	0.04	0.01	0.02	0.01	-0.01	-0.10	-0.01	0.04	0.06	0.06
	(0.023)	(0.050)	(0.027)	(0.022)	(0.026)	(0.027)	(0.030)	(0.061)	(0.037)	(0.029)	(0.033)	(0.048)
SELF ESTEEM	0.06***	0.07**	0.05***	0.04***	0.05**	0.06***	0.03	-0.00	0.01	0.01	0.03	0.04
	(0.013)	(0.025)	(0.011)	(0.011)	(0.018)	(0.014)	(0.018)	(0.037)	(0.026)	(0.017)	(0.021)	(0.031)
PT in G7	-0.08**	-0.11*	-0.12***	-0.11***	-0.04	0.02	-0.08*	-0.07	-0.06	-0.02	-0.09	-0.12
	(0.031)	(0.055)	(0.032)	(0.029)	(0.042)	(0.035)	(0.039)	(0.067)	(0.054)	(0.062)	(0.057)	(0.086)
PT in G9							0.15***	0.17*	0.12	0.12	0.14*	0.15
							(0.040)	(0.075)	(0.074)	(0.066)	(0.068)	(0.092)
Constant	-0.25***	-1.02***	-0.66***	-0.24*	0.22	0.54***	-0.24**	-0.99***	-0.59***	-0.20*	0.08	0.50***
	(0.073)	(0.164)	(0.119)	(0.095)	(0.111)	(0.138)	(0.092)	(0.133)	(0.102)	(0.083)	(0.086)	(0.116)
Observations	4,953	5,000	5,000	5,000	5,000	5,000	3,657	3,696	3,696	3,696	3,696	3,696
R-squared	0.623						0.530					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8VEM_Z (average score in grade 8) for (1)-(6); G9VEM_Z (average score in grade 9) for (7)-(12)

Table J.5. Heterogeneous effects of private tutoring in grade 9 on overall achievement in grade 9 using the OLS estimation

	Year 0 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Avg	q10	q25	q50	q75	q90
PT in G9	0.16***	0.13***	0.11***	0.16***	0.17***	0.13***
	(0.023)	(0.031)	(0.027)	(0.026)	(0.023)	(0.034)
URBANICITY	-0.07**	-0.13**	-0.06	-0.06*	-0.02	-0.03
	(0.025)	(0.047)	(0.034)	(0.025)	(0.023)	(0.025)
GENDER (1=female)	0.06**	0.08**	0.08**	0.03	0.02	-0.01
	(0.018)	(0.031)	(0.025)	(0.015)	(0.019)	(0.018)
SES	0.05***	0.07*	0.04*	0.03*	0.05***	0.06***
	(0.012)	(0.029)	(0.016)	(0.010)	(0.007)	(0.013)
SCHOOL TYPE (1=private)	0.06**	0.11***	0.05	0.04	0.05*	0.08**
	(0.021)	(0.027)	(0.031)	(0.019)	(0.024)	(0.028)
STU-TEA RATIO	-0.00	0.00	0.00	-0.00	0.00	-0.00
	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
SCHOOL CHOICE	0.03	-0.05	0.04	0.03	0.09***	0.07*
	(0.027)	(0.049)	(0.037)	(0.020)	(0.028)	(0.027)
PRESCORE (G8)	0.70***	0.56***	0.78***	0.81***	0.73***	0.62***
	(0.012)	(0.028)	(0.014)	(0.010)	(0.011)	(0.014)
STUDY HOUR (1= >10hrs/week)	0.00	-0.04	0.03	0.02	0.02	0.04
	(0.027)	(0.069)	(0.039)	(0.029)	(0.038)	(0.023)
SELF ESTEEM	0.05***	0.02	0.04*	0.04***	0.06***	0.07***
	(0.015)	(0.026)	(0.019)	(0.012)	(0.018)	(0.018)
PT in G8	0.05*	0.05	0.03	0.03	0.06**	0.09*
	(0.024)	(0.028)	(0.030)	(0.030)	(0.020)	(0.043)
Constant	-0.23**	-0.90***	-0.60***	-0.14*	-0.01	0.50***
	(0.074)	(0.124)	(0.092)	(0.063)	(0.074)	(0.092)
Observations	4,378	4,378	4,378	4,378	4,378	4,378
R-squared	0.585					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VEM_Z (average score in grade 9)

Table J.6. Heterogeneous effects of private tutoring in grade 9 on overall achievement in grade 9 using the 2SLAD estimation

	Year 0 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Avg	q10	q25	q50	q75	q90
PT in G9 (predicted)	0.19*	-0.04	-0.07	-0.01	0.17	0.34
	(0.090)	(0.170)	(0.153)	(0.172)	(0.179)	(0.176)
URBANICITY	-0.07**	-0.14**	-0.08**	-0.04	-0.00	-0.02
	(0.028)	(0.048)	(0.029)	(0.023)	(0.024)	(0.019)
GENDER (1=female)	0.06**	0.06	0.08***	0.05**	0.02	-0.02
	(0.019)	(0.034)	(0.022)	(0.019)	(0.015)	(0.021)
SES	0.06***	0.09***	0.06***	0.05**	0.04**	0.04**
	(0.014)	(0.020)	(0.016)	(0.016)	(0.014)	(0.017)
SCHOOL TYPE (1=private)	0.07**	0.10**	0.08***	0.06**	0.07**	0.10***
	(0.023)	(0.032)	(0.022)	(0.021)	(0.025)	(0.028)
STU-TEA RATIO	0.00	0.00	0.00	-0.00	-0.00	-0.00
	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
SCHOOL CHOICE	0.02	-0.09*	-0.00	0.02	0.09***	0.07*
	(0.029)	(0.040)	(0.026)	(0.018)	(0.026)	(0.032)
PRESCORE (G8)	0.69***	0.61***	0.80***	0.82***	0.75***	0.61***
	(0.013)	(0.034)	(0.014)	(0.011)	(0.015)	(0.020)
STUDY HOUR (1= >10hrs/week)	0.00	-0.04	0.00	-0.00	-0.01	0.03
	(0.029)	(0.059)	(0.046)	(0.024)	(0.031)	(0.031)
SELF ESTEEM	0.05**	0.03	0.06***	0.05**	0.07***	0.07**
	(0.017)	(0.024)	(0.019)	(0.017)	(0.016)	(0.025)
PT in G8	0.01	0.04	0.07	0.07	0.04	-0.03
	(0.046)	(0.073)	(0.065)	(0.071)	(0.085)	(0.089)
Constant	-0.25**	-0.65***	-0.45***	-0.08	0.03	0.37***
	(0.086)	(0.138)	(0.082)	(0.070)	(0.080)	(0.102)
Observations	3,761	4,839	4,839	4,839	4,839	4,839
R-squared	0.579					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VEM_Z (average score in grade 9)

Table K.1. Heterogeneous effects of verbal tutoring in grade 7 on verbal achievement for 3 years using the OLS estimation

	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
VERBAL PT in G7	-0.01	-0.06	-0.03	-0.02	0.01	-0.00	-0.05	-0.02	-0.04	-0.06	-0.07*	-0.05	-0.02	-0.01	-0.03	0.03	-0.00	-0.06*
	(0.022)	(0.045)	(0.032)	(0.021)	(0.020)	(0.024)	(0.025)	(0.039)	(0.044)	(0.034)	(0.032)	(0.039)	(0.031)	(0.050)	(0.063)	(0.034)	(0.036)	(0.029)
URBANICITY	0.05	0.17	0.03	0.03	0.05	0.03	0.02	0.10	0.04	-0.01	-0.01	0.00	-0.04	0.03	-0.02	-0.09	-0.05	-0.04
	(0.031)	(0.099)	(0.032)	(0.038)	(0.035)	(0.043)	(0.034)	(0.072)	(0.047)	(0.034)	(0.037)	(0.018)	(0.041)	(0.075)	(0.092)	(0.066)	(0.040)	(0.033)
GENDER (1=female)	0.45***	0.70***	0.54***	0.44***	0.31***	0.23***	0.47***	0.65***	0.64***	0.49***	0.36***	0.29***	0.47***	0.44***	0.71***	0.56***	0.34***	0.21***
	(0.021)	(0.045)	(0.026)	(0.027)	(0.024)	(0.016)	(0.023)	(0.041)	(0.034)	(0.026)	(0.023)	(0.025)	(0.028)	(0.042)	(0.059)	(0.047)	(0.030)	(0.028)
SES	0.14***	0.16***	0.15***	0.15***	0.12***	0.08***	0.10***	0.10***	0.10**	0.14***	0.11***	0.07**	0.11***	0.05	0.12**	0.15***	0.11***	0.08***
	(0.014)	(0.032)	(0.020)	(0.021)	(0.017)	(0.019)	(0.015)	(0.026)	(0.029)	(0.022)	(0.019)	(0.021)	(0.018)	(0.029)	(0.045)	(0.026)	(0.018)	(0.020)
SCHOOL TYPE (1=private)	0.04	0.04	0.05	0.02	0.03	0.03	0.05	0.09	0.11**	0.03	0.02	-0.03	0.08*	0.05	0.10	0.12**	0.07*	0.03
	(0.026)	(0.062)	(0.042)	(0.038)	(0.027)	(0.033)	(0.029)	(0.051)	(0.039)	(0.027)	(0.033)	(0.033)	(0.035)	(0.058)	(0.073)	(0.038)	(0.033)	(0.038)
STU-TEA RATIO	0.02***	0.02***	0.02***	0.02***	0.01***	0.01	0.02***	0.02**	0.02***	0.02***	0.01***	0.01*	0.01**	0.00	0.01*	0.01**	0.01**	0.00
	(0.003)	(0.007)	(0.006)	(0.005)	(0.003)	(0.003)	(0.003)	(0.007)	(0.005)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.006)	(0.003)	(0.003)	(0.002)
SCHOOL CHOICE	-0.05	0.08	-0.06	-0.07	-0.02	-0.03	-0.08*	-0.02	-0.09	-0.08*	-0.08	-0.08**	-0.03	-0.05	0.00	-0.07	-0.01	-0.01
	(0.033)	(0.113)	(0.050)	(0.043)	(0.040)	(0.047)	(0.036)	(0.076)	(0.052)	(0.041)	(0.044)	(0.031)	(0.043)	(0.065)	(0.076)	(0.056)	(0.043)	(0.043)
PRESCORE (G6)	0.20***	0.21***	0.24***	0.22***	0.18***	0.13***	0.17***	0.15***	0.20***	0.20***	0.18***	0.14***	0.15***	0.07***	0.19***	0.19***	0.15***	0.13***
	(0.006)	(0.013)	(0.013)	(0.010)	(0.007)	(0.006)	(0.007)	(0.020)	(0.013)	(0.008)	(0.008)	(0.011)	(0.008)	(0.010)	(0.014)	(0.009)	(0.011)	(0.009)
STUDY HOUR	0.06*	0.18**	0.07	0.05	-0.01	-0.02	0.05	0.08	0.08	0.02	0.03	-0.03	0.08	0.07	0.02	0.09	0.08**	0.05
(1= >10hrs/week)	(0.032)	(0.067)	(0.064)	(0.028)	(0.028)	(0.046)	(0.035)	(0.061)	(0.054)	(0.031)	(0.038)	(0.041)	(0.043)	(0.043)	(0.083)	(0.054)	(0.030)	(0.031)
SELF ESTEEM	0.19***	0.18***	0.21***	0.18***	0.17***	0.17***	0.17***	0.20***	0.16***	0.16***	0.17***	0.16***	0.10***	0.06	0.11*	0.13***	0.10***	0.05
	(0.019)	(0.054)	(0.042)	(0.027)	(0.021)	(0.032)	(0.021)	(0.046)	(0.034)	(0.025)	(0.023)	(0.019)	(0.025)	(0.042)	(0.047)	(0.034)	(0.023)	(0.033)
VERBAL PT in G8							0.09***	0.04	0.12*	0.11**	0.06	0.01	0.06	0.06	0.01	0.03	0.04	0.12**
							(0.025)	(0.054)	(0.050)	(0.041)	(0.040)	(0.037)	(0.033)	(0.054)	(0.065)	(0.040)	(0.033)	(0.038)
VERBAL PT in G9													0.01	0.05	0.07	0.01	-0.04	-0.09*
													(0.032)	(0.049)	(0.069)	(0.049)	(0.040)	(0.038)
Constant	-2.12***	-4.00***	-3.13***	-2.08***	-1.15***	-0.21	-1.96***	-3.46***	-3.06***	-2.09***	-1.10***	-0.21	-1.77***	-2.44***	-3.07***	-1.92***	-0.84***	-0.01
	(0.096)	(0.286)	(0.166)	(0.104)	(0.100)	(0.138)	(0.105)	(0.277)	(0.158)	(0.134)	(0.131)	(0.125)	(0.126)	(0.198)	(0.244)	(0.156)	(0.125)	(0.128)
Observations	5,855	5,855	5,855	5,855	5,855	5,855	5,357	5,357	5,357	5,357	5,357	5,357	4,073	4,073	4,073	4,073	4,073	4,073
R-squared	0.316						0.257						0.198					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G7VER_Z (verbal score in grade 7) for (1)-(6); G8VER_Z (verbal score in grade 8) for (7)-(12); G9VER_Z (verbal score in grade 9) for (13)-(18)

Table K.2. Heterogeneous effects of verbal tutoring in grade 7 on verbal achievement for 3 years using the 2SLAD estimation

	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
VARIABLES	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90	Avg	q10	q25	q50	q75	q90
VERBAL PT in G7 (predicted)	0.01	0.04	-0.01	-0.03	0.04	0.01	-0.08	-0.03	-0.06	-0.13*	-0.05	0.04	-0.12	-0.02	-0.09	-0.09	0.02	-0.11
	(0.056)	(0.101)	(0.077)	(0.088)	(0.092)	(0.090)	(0.071)	(0.128)	(0.072)	(0.063)	(0.106)	(0.120)	(0.087)	(0.174)	(0.154)	(0.113)	(0.091)	(0.080)
URBANICITY	0.05	0.14	0.02	0.03	0.04	0.01	0.01	0.04	0.01	-0.02	-0.02	-0.01	-0.04	0.04	-0.03	-0.09	-0.03	-0.03
	(0.032)	(0.090)	(0.046)	(0.038)	(0.032)	(0.033)	(0.035)	(0.067)	(0.065)	(0.034)	(0.039)	(0.032)	(0.042)	(0.090)	(0.114)	(0.053)	(0.038)	(0.043)
GENDER (1=female)	0.45***	0.65***	0.52***	0.44***	0.31***	0.23***	0.47***	0.64***	0.63***	0.48***	0.34***	0.28***	0.47***	0.42***	0.70***	0.54***	0.33***	0.21***
	(0.022)	(0.048)	(0.024)	(0.023)	(0.020)	(0.029)	(0.024)	(0.052)	(0.034)	(0.031)	(0.030)	(0.034)	(0.029)	(0.052)	(0.053)	(0.037)	(0.034)	(0.033)
SES	0.13***	0.17***	0.15***	0.15***	0.11***	0.07***	0.11***	0.14***	0.11***	0.16***	0.10***	0.07***	0.12***	0.07*	0.15***	0.16***	0.11***	0.08***
	(0.015)	(0.040)	(0.030)	(0.020)	(0.015)	(0.019)	(0.016)	(0.028)	(0.028)	(0.019)	(0.020)	(0.014)	(0.019)	(0.032)	(0.030)	(0.026)	(0.021)	(0.016)
SCHOOL TYPE (1=private)	0.02	0.03	0.02	0.01	0.00	0.01	0.04	0.09	0.12***	0.02	0.02	-0.03	0.08*	0.05	0.13*	0.15***	0.07*	0.03
	(0.027)	(0.063)	(0.051)	(0.038)	(0.027)	(0.025)	(0.030)	(0.059)	(0.035)	(0.029)	(0.029)	(0.026)	(0.036)	(0.049)	(0.060)	(0.044)	(0.036)	(0.030)
STU/TEA RATIO	0.01***	0.02***	0.02***	0.02***	0.01***	0.01	0.02***	0.01**	0.02***	0.02***	0.01***	0.01**	0.01**	0.00	0.01	0.01	0.01**	0.01
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.006)	(0.004)	(0.003)	(0.004)
SCHOOL CHOICE	-0.05	0.03	-0.06	-0.08	-0.02	-0.05	-0.09*	-0.09	-0.14**	-0.10*	-0.08	-0.10**	-0.03	-0.03	-0.03	-0.07	0.02	0.03
	(0.034)	(0.090)	(0.051)	(0.049)	(0.034)	(0.032)	(0.037)	(0.069)	(0.054)	(0.040)	(0.047)	(0.037)	(0.045)	(0.069)	(0.099)	(0.052)	(0.057)	(0.049)
PRESCORE (G6)	0.20***	0.20***	0.24***	0.23***	0.18***	0.14***	0.17***	0.13***	0.19***	0.21***	0.18***	0.14***	0.15***	0.08***	0.18***	0.19***	0.15***	0.13***
	(0.007)	(0.012)	(0.007)	(0.008)	(0.006)	(0.008)	(0.007)	(0.021)	(0.017)	(0.009)	(0.011)	(0.008)	(0.009)	(0.011)	(0.016)	(0.012)	(0.011)	(0.010)
STUDY HOUR	0.07*	0.14*	0.09*	0.06	0.01	0.01	0.04	0.05	0.05	0.02	0.01	-0.01	0.07	0.07	0.02	0.09	0.08*	0.09**
(1= >10hrs/week)	(0.032)	(0.069)	(0.047)	(0.037)	(0.032)	(0.035)	(0.036)	(0.065)	(0.051)	(0.052)	(0.039)	(0.042)	(0.044)	(0.065)	(0.087)	(0.063)	(0.033)	(0.027)
SELF ESTEEM	0.19***	0.20***	0.20***	0.19***	0.16***	0.14***	0.17***	0.22***	0.17***	0.15***	0.16***	0.13***	0.11***	0.07	0.16***	0.16***	0.11***	0.05*
	(0.020)	(0.035)	(0.024)	(0.027)	(0.022)	(0.030)	(0.021)	(0.033)	(0.034)	(0.030)	(0.020)	(0.030)	(0.026)	(0.041)	(0.046)	(0.038)	(0.025)	(0.024)
VERBAL PT in G8							0.09**	0.06	0.14**	0.12***	0.05	-0.03	0.07	0.08	0.02	0.06	0.02	0.11*
							(0.035)	(0.092)	(0.051)	(0.032)	(0.044)	(0.062)	(0.043)	(0.065)	(0.064)	(0.039)	(0.033)	(0.044)
VERBAL PT in G9													0.03	0.05	0.06	0.04	-0.03	-0.06
													(0.035)	(0.052)	(0.063)	(0.041)	(0.037)	(0.041)
Constant	- 2.07***	- 3.77***	- 3.01***	- 2.11***	- 1.19***	-0.18*	- 1.89***	- 3.09***	- 2.91***	- 2.09***	- 1.07***	-0.19	- 1.72***	- 2.45***	- 2.81***	- 1.81***	- 0.91***	-0.12
	(0.102)	(0.197)	(0.127)	(0.094)	(0.100)	(0.085)	(0.110)	(0.203)	(0.155)	(0.124)	(0.159)	(0.121)	(0.133)	(0.220)	(0.257)	(0.148)	(0.153)	(0.140)
Observations	5,435	5,825	5,825	5,825	5,825	5,825	5,004	5,346	5,346	5,346	5,346	5,346	3,790	4,058	4,058	4,058	4,058	4,058
R-squared	0.307						0.250						0.192					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G7VER_Z (verbal score in grade 7) for (1)-(6); G8VER_Z (verbal score in grade 8) for (7)-(12); G9VER_Z (verbal score in grade 9) for (13)-(18)

Table K.3. Heterogeneous effects of verbal tutoring in grade 8 on verbal achievement for 2 years using the OLS estimation

	Year 0 (Grade 8)						Year 1 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
VERBAL PT in G8	0.04*	0.00	0.02	0.02	0.04	0.04	0.02	-0.02	-0.05	0.01	0.07*	0.02
	(0.021)	(0.055)	(0.041)	(0.027)	(0.027)	(0.033)	(0.028)	(0.088)	(0.049)	(0.035)	(0.029)	(0.044)
URBANICITY	-0.04	0.01	-0.04	-0.06	-0.03	-0.04	-0.09*	-0.06	-0.03	-0.10*	-0.07	-0.05
	(0.028)	(0.069)	(0.043)	(0.042)	(0.041)	(0.039)	(0.035)	(0.060)	(0.044)	(0.048)	(0.048)	(0.038)
GENDER (1=female)	0.29***	0.42***	0.36***	0.29***	0.22***	0.18***	0.30***	0.36***	0.39***	0.31***	0.21***	0.09***
	(0.020)	(0.058)	(0.052)	(0.037)	(0.028)	(0.027)	(0.025)	(0.070)	(0.051)	(0.038)	(0.027)	(0.026)
SES	-0.04**	-0.04	-0.05	-0.03	-0.02	-0.02	-0.02	-0.02	-0.01	-0.03	-0.00	0.00
	(0.013)	(0.032)	(0.028)	(0.020)	(0.020)	(0.020)	(0.016)	(0.041)	(0.025)	(0.020)	(0.013)	(0.012)
SCHOOL TYPE (1=private)	0.02	0.02	0.06	-0.01	-0.00	-0.00	0.06*	0.05	0.13***	0.07	0.03	-0.00
	(0.024)	(0.052)	(0.033)	(0.024)	(0.028)	(0.043)	(0.030)	(0.041)	(0.038)	(0.036)	(0.031)	(0.043)
STU-TEA RATIO	0.01**	0.01	0.01*	0.01**	0.00	-0.00	0.00	-0.00	0.00	0.00	0.00	-0.00
	(0.002)	(0.006)	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)	(0.006)	(0.006)	(0.003)	(0.002)	(0.002)
SCHOOL CHOICE	-0.03	-0.00	-0.01	-0.02	-0.03	-0.05	0.01	-0.03	0.06	-0.00	0.09	0.07*
	(0.030)	(0.076)	(0.041)	(0.039)	(0.041)	(0.048)	(0.037)	(0.050)	(0.049)	(0.044)	(0.046)	(0.030)
PRESCORE (G7)	0.73***	0.76***	0.83***	0.79***	0.68***	0.59***	0.68***	0.57***	0.82***	0.80***	0.64***	0.51***
	(0.013)	(0.027)	(0.019)	(0.015)	(0.016)	(0.024)	(0.016)	(0.044)	(0.017)	(0.019)	(0.019)	(0.021)
STUDY HOUR (1= >10hrs/week)	-0.02	0.00	-0.01	-0.02	-0.02	-0.04	0.02	0.07	0.00	0.02	0.04	0.05
	(0.029)	(0.056)	(0.047)	(0.030)	(0.023)	(0.038)	(0.037)	(0.078)	(0.043)	(0.046)	(0.025)	(0.025)
SELF ESTEEM	0.05**	0.08	0.05	0.04*	0.05**	0.04	-0.01	-0.08	-0.05*	-0.03	0.01	0.01
	(0.017)	(0.039)	(0.028)	(0.018)	(0.015)	(0.024)	(0.021)	(0.059)	(0.025)	(0.033)	(0.022)	(0.028)
VERBAL PT in G7	-0.06**	-0.05	-0.08*	-0.07**	-0.06*	-0.06*	-0.05	-0.08	0.02	-0.01	-0.07*	-0.03
	(0.021)	(0.052)	(0.032)	(0.022)	(0.027)	(0.023)	(0.027)	(0.048)	(0.042)	(0.035)	(0.030)	(0.042)
VERBAL PT in G9							0.00	0.06	0.00	-0.03	-0.02	-0.03
							(0.027)	(0.045)	(0.054)	(0.029)	(0.022)	(0.034)
Constant	-0.49***	-1.69***	-1.07***	-0.45***	0.21*	0.72***	-0.43***	-1.44***	-1.11***	-0.37**	0.11	0.75***
	(0.082)	(0.242)	(0.152)	(0.097)	(0.102)	(0.129)	(0.102)	(0.218)	(0.170)	(0.136)	(0.103)	(0.097)
Observations	5,478	5,478	5,478	5,478	5,478	5,478	4,164	4,164	4,164	4,164	4,164	4,164
R-squared	0.469						0.392					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8VER_Z (verbal score in grade 8) for (1)-(6); G9VER_Z (verbal score in grade 9) for (7)-(12)

Table K.4. Heterogeneous effects of verbal tutoring in grade 8 on verbal achievement for 2 years using the 2SLAD estimation

VARIABLES	(1) Average	(2) q10	(3) q25	(4) q50	(5) q75	(6) q90	(7) Average	(8) q10	(9) q25	(10) q50	(11) q75	(12) q90
VERBAL PT in G8 (predicted)	-0.00	-0.15	0.05	-0.03	0.00	-0.03	-0.05	-0.05	0.04	0.14	0.13	-0.02
	(0.053)	(0.130)	(0.073)	(0.057)	(0.058)	(0.094)	(0.077)	(0.140)	(0.104)	(0.076)	(0.085)	(0.081)
URBANICITY	-0.04	0.01	-0.05	-0.07	-0.02	-0.03	-0.10*	-0.08	-0.06	-0.11***	-0.08*	-0.07
	(0.029)	(0.057)	(0.046)	(0.042)	(0.025)	(0.035)	(0.037)	(0.055)	(0.038)	(0.030)	(0.043)	(0.047)
GENDER (1=female)	0.30***	0.43***	0.38***	0.29***	0.22***	0.18***	0.29***	0.36***	0.41***	0.31***	0.22***	0.07*
	(0.021)	(0.043)	(0.038)	(0.030)	(0.030)	(0.038)	(0.026)	(0.065)	(0.041)	(0.040)	(0.035)	(0.031)
SES	-0.04**	-0.02	-0.06**	-0.03*	-0.02	-0.02	-0.01	-0.01	-0.02	-0.02	-0.00	0.01
	(0.014)	(0.027)	(0.019)	(0.016)	(0.017)	(0.020)	(0.018)	(0.041)	(0.026)	(0.023)	(0.016)	(0.020)
SCHOOL TYPE (1=private)	0.02	0.03	0.06	-0.03	-0.02	-0.00	0.07*	0.04	0.16***	0.08*	0.04	-0.00
	(0.025)	(0.065)	(0.035)	(0.039)	(0.028)	(0.039)	(0.032)	(0.067)	(0.039)	(0.036)	(0.029)	(0.043)
STU-TEA RATIO	0.01**	0.01	0.01**	0.01**	0.01	0.00	0.00	-0.00	0.00	0.00	-0.00	-0.00
	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)	(0.003)	(0.004)
SCHOOL CHOICE	-0.04	-0.01	-0.03	-0.03	-0.01	-0.04	-0.01	-0.07	0.01	-0.02	0.06	0.05
	(0.031)	(0.050)	(0.048)	(0.045)	(0.026)	(0.035)	(0.040)	(0.054)	(0.039)	(0.033)	(0.048)	(0.053)
PRESCORE (G7)	0.72***	0.76***	0.83***	0.78***	0.68***	0.58***	0.67***	0.55***	0.80***	0.79***	0.64***	0.51***
	(0.014)	(0.032)	(0.022)	(0.016)	(0.021)	(0.020)	(0.017)	(0.056)	(0.022)	(0.024)	(0.033)	(0.023)
STUDY HOUR (1= >10hrs/week)	-0.03	0.02	-0.02	-0.03	-0.03	-0.04	-0.00	0.04	-0.00	0.01	0.05	0.07*
	(0.030)	(0.073)	(0.039)	(0.029)	(0.029)	(0.026)	(0.039)	(0.070)	(0.045)	(0.044)	(0.026)	(0.027)
SELF-ESTEEM	0.04*	0.07	0.02	0.03	0.05*	0.03	-0.01	-0.06	-0.06	-0.03	0.00	-0.01
	(0.018)	(0.040)	(0.023)	(0.027)	(0.023)	(0.025)	(0.023)	(0.053)	(0.047)	(0.030)	(0.023)	(0.030)
VERBAL PT in G7	-0.04	0.01	-0.08	-0.04	-0.04	-0.02	-0.01	-0.08	0.01	-0.03	-0.07*	-0.01
	(0.029)	(0.071)	(0.046)	(0.031)	(0.032)	(0.052)	(0.037)	(0.073)	(0.043)	(0.052)	(0.036)	(0.039)
VERBAL PT in G9							0.01	0.06	-0.04	-0.07*	-0.04	-0.01
							(0.037)	(0.058)	(0.052)	(0.037)	(0.037)	(0.043)
Constant	-0.49***	-1.64***	-1.08***	-0.45**	0.12	0.65***	-0.38***	-1.42***	-1.10***	-0.36**	0.22	0.87***
	(0.089)	(0.158)	(0.133)	(0.160)	(0.101)	(0.138)	(0.110)	(0.175)	(0.157)	(0.123)	(0.144)	(0.159)
Observations	4,935	4,991	4,991	4,991	4,991	4,991	3,728	3,738	3,738	3,738	3,738	3,738
R-squared	0.462						0.381					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8VER_Z (verbal score in grade 8) for (1)-(6); G9VER_Z (verbal score in grade 9) for (7)-(12)

Table K.5. Heterogeneous effects of verbal tutoring in grade 9 on verbal achievement in grade 9 using the OLS estimation

	Year 0 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
VERBAL PT in G9	-0.00	0.02	-0.01	-0.01	-0.04	-0.02
	(0.027)	(0.037)	(0.039)	(0.035)	(0.034)	(0.039)
URBANICITY	-0.08*	-0.10	-0.05	-0.05	-0.08*	-0.03
	(0.034)	(0.061)	(0.046)	(0.035)	(0.034)	(0.043)
GENDER (1=female)	0.26***	0.30***	0.35***	0.28***	0.20***	0.12***
	(0.024)	(0.047)	(0.037)	(0.032)	(0.025)	(0.032)
SES	-0.01	0.02	-0.00	-0.02	-0.01	-0.01
	(0.016)	(0.033)	(0.021)	(0.014)	(0.017)	(0.017)
SCHOOL TYPE (1=private)	0.05	0.00	0.10**	0.06	0.01	-0.01
	(0.029)	(0.060)	(0.036)	(0.031)	(0.033)	(0.040)
STU-TEA RATIO	0.00	-0.00	-0.00	0.00	-0.00	-0.00
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
SCHOOL CHOICE	0.02	-0.01	0.04	0.06	0.03	0.09
	(0.036)	(0.043)	(0.049)	(0.050)	(0.037)	(0.050)
PRESCORE (G8)	0.71***	0.66***	0.84***	0.81***	0.66***	0.49***
	(0.015)	(0.039)	(0.016)	(0.014)	(0.020)	(0.024)
STUDY HOUR (1= >10hrs/week)	0.00	0.03	-0.05	-0.01	0.03	0.07*
	(0.036)	(0.072)	(0.056)	(0.039)	(0.037)	(0.033)
SELF ESTEEM	0.01	0.00	0.00	0.00	-0.00	0.05
	(0.021)	(0.052)	(0.024)	(0.027)	(0.018)	(0.030)
VERBAL PT in G7	-0.02	-0.01	0.03	0.00	-0.04	-0.07*
	(0.026)	(0.049)	(0.040)	(0.031)	(0.033)	(0.033)
VERBAL PT in G8	0.00	-0.03	-0.02	-0.02	0.04	0.07*
	(0.028)	(0.043)	(0.042)	(0.042)	(0.038)	(0.031)
Constant	-0.38***	-1.27***	-0.98***	-0.50***	0.28*	0.66***
	(0.100)	(0.152)	(0.148)	(0.143)	(0.116)	(0.106)
Observations	4,133	4,133	4,133	4,133	4,133	4,133
R-squared	0.425					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VER_Z (verbal score in grade 9)

Table K.6. Heterogeneous effects of verbal tutoring in grade 9 on verbal achievement in grade 9 using the 2SLAD estimation

	Year 0 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
VERBAL PT in G9 (predicted)	-0.04	0.05	-0.15	0.00	0.09	-0.07
	(0.093)	(0.150)	(0.080)	(0.140)	(0.129)	(0.096)
URBANICITY	-0.09*	-0.09	-0.07	-0.06*	-0.06	-0.03
	(0.037)	(0.060)	(0.043)	(0.032)	(0.032)	(0.034)
GENDER (1=female)	0.27***	0.30***	0.35***	0.29***	0.23***	0.14***
	(0.027)	(0.054)	(0.034)	(0.027)	(0.028)	(0.033)
SES	-0.01	0.02	0.00	-0.01	-0.02	0.00
	(0.017)	(0.027)	(0.024)	(0.018)	(0.012)	(0.025)
SCHOOL TYPE (1=private)	0.07*	0.07	0.11*	0.06*	0.04	0.02
	(0.031)	(0.076)	(0.049)	(0.028)	(0.024)	(0.029)
STU-TEA RATIO	0.00	-0.00	0.00	0.00	0.00	0.00
	(0.003)	(0.007)	(0.004)	(0.003)	(0.003)	(0.004)
SCHOOL CHOICE	0.00	-0.08	-0.00	0.02	0.05	0.08*
	(0.039)	(0.062)	(0.044)	(0.045)	(0.042)	(0.038)
PRESCORE (G8)	0.69***	0.68***	0.82***	0.78***	0.65***	0.47***
	(0.017)	(0.030)	(0.017)	(0.015)	(0.018)	(0.028)
STUDY HOUR (1= >10hrs/week)	0.01	-0.05	-0.05	-0.02	0.02	0.03
	(0.039)	(0.082)	(0.041)	(0.042)	(0.046)	(0.047)
SELF ESTEEM	0.01	0.00	0.00	0.01	0.03	0.05
	(0.023)	(0.046)	(0.034)	(0.026)	(0.022)	(0.026)
VERBAL PT in G7	-0.01	-0.03	0.03	0.01	-0.05	-0.09**
	(0.031)	(0.055)	(0.050)	(0.032)	(0.026)	(0.034)
VERBAL PT in G8	-0.01	-0.08	-0.02	-0.06	-0.02	0.06
	(0.043)	(0.073)	(0.044)	(0.058)	(0.053)	(0.040)
Constant	-0.40***	-1.15***	-0.89***	-0.42***	0.12	0.62***
	(0.112)	(0.183)	(0.089)	(0.100)	(0.076)	(0.105)
Observations	3,556	4,404	4,404	4,404	4,404	4,404
R-squared	0.414					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9VER_Z (verbal score in grade 9)

Table L.1. Heterogeneous effects of English tutoring in grade 7 on English achievement for 3 years using the OLS estimation

	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
ENGLISH PT in G7	0.25***	0.13***	0.21***	0.27***	0.33***	0.33***	0.12***	0.02	0.08**	0.12**	0.21***	0.21***	0.07*	0.01	0.06	0.06	0.18***	0.11
	(0.024)	(0.037)	(0.023)	(0.036)	(0.030)	(0.037)	(0.029)	(0.030)	(0.028)	(0.041)	(0.044)	(0.038)	(0.033)	(0.039)	(0.039)	(0.055)	(0.042)	(0.063)
URBANICITY	0.10***	0.12*	0.08*	0.05	0.10**	0.10*	0.05	0.11*	0.07	0.05	0.03	0.01	0.00	0.03	0.02	0.04	-0.03	-0.06
	(0.029)	(0.055)	(0.037)	(0.040)	(0.037)	(0.047)	(0.032)	(0.052)	(0.041)	(0.053)	(0.029)	(0.029)	(0.036)	(0.054)	(0.052)	(0.045)	(0.049)	(0.045)
GENDER (1=female)	0.28***	0.34***	0.33***	0.29***	0.23***	0.17***	0.36***	0.40***	0.45***	0.37***	0.28***	0.20***	0.34***	0.21***	0.45***	0.41***	0.25***	0.14***
	(0.020)	(0.031)	(0.028)	(0.025)	(0.024)	(0.031)	(0.022)	(0.037)	(0.033)	(0.033)	(0.033)	(0.029)	(0.025)	(0.037)	(0.032)	(0.037)	(0.034)	(0.030)
SES	0.28***	0.20***	0.27***	0.32***	0.28***	0.25***	0.25***	0.17***	0.28***	0.32***	0.24***	0.20***	0.21***	0.12***	0.22***	0.22***	0.23***	0.16***
	(0.013)	(0.026)	(0.020)	(0.018)	(0.017)	(0.020)	(0.015)	(0.024)	(0.031)	(0.019)	(0.023)	(0.020)	(0.017)	(0.022)	(0.034)	(0.032)	(0.026)	(0.012)
SCHOOL TYPE (1=private)	0.08**	0.04	0.02	0.10**	0.10**	0.08	0.06*	0.01	0.07	0.04	0.02	0.05	0.09**	0.05	0.08	0.10*	0.06	0.08
	(0.025)	(0.040)	(0.036)	(0.032)	(0.037)	(0.041)	(0.028)	(0.041)	(0.047)	(0.036)	(0.037)	(0.035)	(0.031)	(0.038)	(0.044)	(0.045)	(0.050)	(0.050)
STU-TEA RATIO	0.01***	0.01*	0.01**	0.01***	0.01***	0.01**	0.01***	0.00	0.01*	0.01*	0.01**	0.01*	0.01	0.01	0.01*	0.00	0.00	0.01*
	(0.002)	(0.004)	(0.003)	(0.003)	(0.004)	(0.005)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
SCHOOL CHOICE	-0.11***	-0.05	-0.13**	-0.15**	-0.14**	-0.06	-0.08*	0.03	-0.04	-0.10*	-0.09*	-0.07	-0.05	-0.01	-0.02	-0.01	-0.10	-0.09
	(0.031)	(0.060)	(0.040)	(0.048)	(0.047)	(0.048)	(0.034)	(0.043)	(0.049)	(0.043)	(0.037)	(0.045)	(0.038)	(0.054)	(0.051)	(0.053)	(0.057)	(0.052)
PRESCORE (G6)	0.18***	0.15***	0.19***	0.20***	0.20***	0.15***	0.15***	0.08***	0.14***	0.18***	0.17***	0.13***	0.16***	0.07***	0.15***	0.20***	0.16***	0.11***
	(0.006)	(0.013)	(0.008)	(0.008)	(0.010)	(0.008)	(0.007)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.008)	(0.008)	(0.009)	(0.014)	(0.010)	(0.010)
STUDY HOUR	0.13***	0.17***	0.14***	0.10*	0.09**	0.07	0.11**	0.13*	0.20**	0.12*	0.08	0.03	0.03	-0.05	0.08	0.06	-0.02	-0.02
(1= >10hrs/week)	(0.030)	(0.041)	(0.031)	(0.043)	(0.031)	(0.042)	(0.033)	(0.054)	(0.072)	(0.045)	(0.044)	(0.039)	(0.037)	(0.063)	(0.076)	(0.036)	(0.045)	(0.035)
SELF-ESTEEM	0.23***	0.11**	0.26***	0.28***	0.25***	0.21***	0.23***	0.19***	0.25***	0.24***	0.23***	0.16***	0.21***	0.12**	0.21***	0.24***	0.19***	0.16***
	(0.018)	(0.036)	(0.033)	(0.030)	(0.023)	(0.029)	(0.020)	(0.026)	(0.028)	(0.034)	(0.031)	(0.027)	(0.022)	(0.040)	(0.049)	(0.039)	(0.032)	(0.029)
ENGLISH PT in G8							0.25***	0.15**	0.21***	0.26***	0.32***	0.22***	0.18***	0.11***	0.19***	0.21**	0.20**	0.12
							(0.029)	(0.046)	(0.030)	(0.042)	(0.063)	(0.055)	(0.036)	(0.033)	(0.048)	(0.068)	(0.060)	(0.068)
ENGLISH PT in G9													0.23***	0.10**	0.15**	0.31***	0.29***	0.23**
													(0.035)	(0.036)	(0.045)	(0.053)	(0.059)	(0.070)
Constant	-1.82***	2.71***	2.33***	1.84***	1.32***	0.61***	1.77***	2.37***	2.40***	1.94***	1.32***	-0.33*	1.81***	2.11***	2.59***	2.25***	1.12***	-0.04
	(0.092)	(0.206)	(0.100)	(0.136)	(0.138)	(0.145)	(0.102)	(0.118)	(0.152)	(0.116)	(0.151)	(0.144)	(0.114)	(0.166)	(0.132)	(0.139)	(0.150)	(0.129)
Observations	5,910	5,910	5,910	5,910	5,910	5,910	5,380	5,380	5,380	5,380	5,380	5,380	4,546	4,546	4,546	4,546	4,546	4,546
R-squared	0.403						0.338						0.314					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G7ENG_Z (English score in grade 7) for (1)-(6); G8ENG_Z (English score in grade 8) for (7)-(12); G9ENG_Z (English score in grade 9) for (13)-(18)

Table L.2. Heterogeneous effects of English tutoring in grade 7 on English achievement for 3 years using the 2SLAD estimation

	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
VARIABLES	IV	q10	q25	q50	q75	q90	IV	q10	q25	q50	q75	q90	IV	q10	q25	q50	q75	q90
ENGLISH PT in G7 (predicted)	0.72***	0.32*	0.74***	1.07***	1.20***	1.03***	0.61***	0.23	0.74**	1.02***	0.86***	0.78***	0.64***	0.42*	0.71***	0.68***	0.75***	0.50***
	(0.071)	(0.145)	(0.173)	(0.126)	(0.140)	(0.115)	(0.086)	(0.239)	(0.259)	(0.154)	(0.133)	(0.183)	(0.098)	(0.191)	(0.149)	(0.108)	(0.122)	(0.066)
URBANICITY	0.05	0.06	-0.00	-0.01	0.01	0.02	0.01	0.07	0.01	-0.02	-0.00	0.00	-0.03	0.03	0.00	-0.01	-0.08*	-0.07
	(0.032)	(0.052)	(0.048)	(0.035)	(0.040)	(0.033)	(0.034)	(0.073)	(0.050)	(0.048)	(0.035)	(0.048)	(0.039)	(0.044)	(0.054)	(0.037)	(0.033)	(0.039)
GENDER (1=female)	0.30***	0.33***	0.34***	0.33***	0.26***	0.18***	0.37***	0.40***	0.46***	0.38***	0.31***	0.20***	0.35***	0.22***	0.45***	0.42***	0.27***	0.13***
	(0.022)	(0.028)	(0.024)	(0.023)	(0.025)	(0.039)	(0.024)	(0.041)	(0.032)	(0.032)	(0.034)	(0.033)	(0.027)	(0.032)	(0.026)	(0.041)	(0.036)	(0.028)
SES	0.25***	0.19***	0.24***	0.25***	0.21***	0.17***	0.23***	0.17***	0.28***	0.28***	0.20***	0.16***	0.19***	0.11***	0.20***	0.21***	0.20***	0.14***
	(0.016)	(0.028)	(0.018)	(0.020)	(0.019)	(0.023)	(0.017)	(0.023)	(0.031)	(0.019)	(0.013)	(0.025)	(0.019)	(0.023)	(0.031)	(0.027)	(0.025)	(0.015)
SCHOOL TYPE (1=private)	0.06*	0.02	-0.01	0.08*	0.08	0.03	0.04	0.03	0.03	0.03	0.02	0.03	0.06	0.02	0.06	0.08	0.05	0.06
	(0.027)	(0.043)	(0.029)	(0.035)	(0.052)	(0.036)	(0.029)	(0.039)	(0.040)	(0.035)	(0.034)	(0.038)	(0.033)	(0.042)	(0.055)	(0.044)	(0.034)	(0.046)
STU-TEA RATIO	0.01***	0.01*	0.00	0.01**	0.01***	0.01**	0.01**	0.00	0.00	0.01**	0.01***	0.01*	0.01*	0.01	0.01	0.00	0.01	0.01*
	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.003)
SCHOOL CHOICE	-0.12***	-0.05	-0.13*	-0.17***	-0.14**	-0.09*	-0.10**	-0.01	-0.10	-0.12*	-0.10*	-0.04	-0.05	-0.01	-0.04	-0.04	-0.11*	-0.07
	(0.033)	(0.064)	(0.063)	(0.042)	(0.044)	(0.039)	(0.036)	(0.053)	(0.058)	(0.056)	(0.046)	(0.047)	(0.041)	(0.048)	(0.063)	(0.044)	(0.042)	(0.039)
PRESCORE (G6)	0.17***	0.14***	0.16***	0.18***	0.17***	0.14***	0.14***	0.07***	0.12***	0.17***	0.17***	0.12***	0.15***	0.07***	0.13***	0.19***	0.16***	0.11***
	(0.007)	(0.011)	(0.008)	(0.010)	(0.013)	(0.011)	(0.007)	(0.010)	(0.011)	(0.010)	(0.012)	(0.011)	(0.008)	(0.007)	(0.008)	(0.010)	(0.014)	(0.013)
STUDY HOUR	0.10**	0.15**	0.14**	0.09**	0.05	0.03	0.09*	0.11	0.16**	0.08	0.04	-0.01	-0.01	-0.06	0.02	0.04	-0.04	-0.04
(1= >10hrs/week)	(0.032)	(0.052)	(0.051)	(0.031)	(0.037)	(0.029)	(0.035)	(0.065)	(0.052)	(0.041)	(0.030)	(0.025)	(0.040)	(0.061)	(0.053)	(0.042)	(0.047)	(0.024)
SELF ESTEEM	0.21***	0.11**	0.23***	0.24***	0.22***	0.17***	0.22***	0.19***	0.22***	0.22***	0.20***	0.14***	0.20***	0.11***	0.21***	0.22***	0.18***	0.15***
	(0.020)	(0.035)	(0.027)	(0.025)	(0.030)	(0.024)	(0.021)	(0.037)	(0.033)	(0.034)	(0.022)	(0.017)	(0.024)	(0.025)	(0.025)	(0.033)	(0.038)	(0.024)
ENGLISH PT in G8							0.05	0.06	-0.06	-0.12	0.04	0.03	-0.02	-0.03	-0.07	-0.06	-0.03	-0.03
							(0.045)	(0.096)	(0.104)	(0.081)	(0.065)	(0.092)	(0.050)	(0.066)	(0.054)	(0.068)	(0.064)	(0.051)
ENGLISH PT in G9													0.13**	0.04	0.05	0.20**	0.19***	0.20***
													(0.041)	(0.052)	(0.048)	(0.061)	(0.058)	(0.033)
Constant	2.02***	2.69***	2.45***	2.25***	1.80***	0.94***	1.90***	2.33***	2.40***	2.20***	1.61***	0.67***	1.99***	2.22***	2.63***	2.32***	1.33***	-0.20
	(0.105)	(0.155)	(0.198)	(0.124)	(0.183)	(0.143)	(0.112)	(0.159)	(0.200)	(0.162)	(0.114)	(0.193)	(0.126)	(0.163)	(0.140)	(0.171)	(0.186)	(0.143)
Observations	5,487	5,880	5,880	5,880	5,880	5,880	5,023	5,364	5,364	5,364	5,364	5,364	4,248	4,532	4,532	4,532	4,532	4,532
R-squared	0.362						0.301						0.269					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G7ENG_Z (English score in grade 7) for (1)-(6); G8ENG_Z (English score in grade 8) for (7)-(12); G9ENG_Z (English score in grade 9) for (13)-(18)

Table L.3. Heterogeneous effects of English tutoring in grade 8 on English achievement for 2 years using the OLS esitmaiton

	Year 0 (Grade 8)						Year 1 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
ENGLISH PT in G8	0.14***	0.08	0.13***	0.16***	0.14***	0.16***	0.09**	0.04	0.10**	0.06	0.10***	0.08*
	(0.024)	(0.057)	(0.025)	(0.027)	(0.031)	(0.045)	(0.030)	(0.033)	(0.032)	(0.033)	(0.027)	(0.033)
URBANICITY	0.00	0.04	0.02	-0.01	0.02	-0.02	-0.04	-0.02	-0.06	-0.04	-0.03	-0.05
	(0.026)	(0.047)	(0.028)	(0.025)	(0.025)	(0.031)	(0.030)	(0.058)	(0.053)	(0.033)	(0.047)	(0.051)
GENDER (1=female)	0.17***	0.26***	0.21***	0.15***	0.11***	0.07**	0.15***	0.19***	0.25***	0.13***	0.08**	0.05
	(0.018)	(0.035)	(0.017)	(0.017)	(0.018)	(0.022)	(0.021)	(0.049)	(0.037)	(0.026)	(0.026)	(0.033)
SES	0.11***	0.11**	0.13***	0.12***	0.13***	0.10***	0.10***	0.09*	0.13***	0.09***	0.08***	0.06**
	(0.012)	(0.032)	(0.017)	(0.014)	(0.015)	(0.016)	(0.015)	(0.042)	(0.037)	(0.019)	(0.016)	(0.018)
SCHOOL TYPE (1=private)	0.03	-0.02	0.03	-0.01	0.03	0.03	0.06*	0.09	0.08	0.07	0.05	0.04
	(0.022)	(0.051)	(0.028)	(0.032)	(0.023)	(0.041)	(0.026)	(0.052)	(0.057)	(0.039)	(0.036)	(0.049)
STU-TEA RATIO	-0.00	-0.00	-0.00	-0.00	0.00	-0.00	-0.00	-0.00	-0.01	-0.00*	-0.00	-0.01
	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
SCHOOL CHOICE	-0.03	0.01	-0.02	-0.02	-0.02	-0.05	-0.01	0.02	0.00	-0.01	-0.02	-0.04
	(0.027)	(0.050)	(0.033)	(0.029)	(0.019)	(0.035)	(0.032)	(0.066)	(0.062)	(0.040)	(0.038)	(0.045)
PRESCORE (G7)	0.74***	0.62***	0.80***	0.83***	0.76***	0.62***	0.70***	0.43***	0.78***	0.82***	0.75***	0.59***
	(0.012)	(0.030)	(0.015)	(0.012)	(0.017)	(0.023)	(0.014)	(0.030)	(0.025)	(0.012)	(0.014)	(0.026)
STUDY HOUR (1= >10hrs/week)	0.05	0.07	0.09*	0.04	0.03	-0.01	-0.02	-0.10	0.02	0.00	0.00	-0.01
	(0.027)	(0.064)	(0.037)	(0.032)	(0.027)	(0.033)	(0.031)	(0.059)	(0.047)	(0.032)	(0.036)	(0.034)
SELF ESTEEM	0.09***	0.09**	0.09***	0.09***	0.08***	0.07***	0.11***	0.09*	0.10***	0.11***	0.08***	0.10***
	(0.016)	(0.029)	(0.024)	(0.018)	(0.021)	(0.019)	(0.018)	(0.041)	(0.029)	(0.018)	(0.016)	(0.026)
ENGLISH PT in G7	0.00	-0.04	0.00	0.01	0.01	0.07	-0.03	-0.01	-0.08	-0.03	0.00	0.00
	(0.023)	(0.034)	(0.027)	(0.026)	(0.024)	(0.038)	(0.028)	(0.042)	(0.044)	(0.034)	(0.030)	(0.050)
ENGLISH PT in G9							0.17***	0.13**	0.15***	0.21***	0.15**	0.16***
							(0.029)	(0.041)	(0.038)	(0.034)	(0.046)	(0.044)
Constant	-0.30***	-1.18***	-0.74***	-0.28***	0.15	0.69***	-0.29**	-1.35***	-0.80***	-0.20*	0.23*	0.79***
	(0.077)	(0.131)	(0.091)	(0.072)	(0.093)	(0.125)	(0.091)	(0.195)	(0.169)	(0.100)	(0.097)	(0.140)
Observations	5,502	5,502	5,502	5,502	5,502	5,502	4,643	4,643	4,643	4,643	4,643	4,643
R-squared	0.561						0.504					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8ENG_Z (English score in grade 8) for (1)-(6); G9ENG_Z (English score in grade 9) for (7)-(12)

Table L.4. Heterogeneous effects of English tutoring in grade 8 on English achievement for 2 years using the 2SLAD estimation

	Year 0 (Grade 8)						Year 1 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
ENGLISH PT in G8 (predicted)	0.31***	0.19	0.45***	0.40***	0.26*	0.30***	0.18	-0.11	0.27	0.29**	0.12	0.12
	(0.073)	(0.108)	(0.105)	(0.090)	(0.104)	(0.068)	(0.102)	(0.206)	(0.139)	(0.101)	(0.092)	(0.157)
URBANICITY	-0.01	0.03	-0.01	-0.03	0.01	-0.00	-0.04	0.01	-0.03	-0.03	-0.05	-0.04
	(0.027)	(0.062)	(0.035)	(0.026)	(0.026)	(0.027)	(0.032)	(0.079)	(0.055)	(0.032)	(0.039)	(0.066)
GENDER (1=female)	0.17***	0.25***	0.22***	0.17***	0.11***	0.09**	0.16***	0.21***	0.27***	0.14***	0.07**	0.04
	(0.019)	(0.037)	(0.024)	(0.017)	(0.024)	(0.028)	(0.022)	(0.043)	(0.030)	(0.021)	(0.023)	(0.040)
SES	0.12***	0.12**	0.12***	0.11***	0.13***	0.09***	0.10***	0.10***	0.14***	0.09***	0.08***	0.06**
	(0.014)	(0.041)	(0.018)	(0.014)	(0.017)	(0.012)	(0.016)	(0.031)	(0.021)	(0.014)	(0.016)	(0.021)
SCHOOL TYPE (1=private)	0.04	0.00	0.06**	0.02	0.01	0.07*	0.07**	0.12*	0.09*	0.07*	0.05*	0.04
	(0.023)	(0.050)	(0.022)	(0.023)	(0.024)	(0.036)	(0.027)	(0.056)	(0.038)	(0.030)	(0.024)	(0.028)
STU-TEA RATIO	-0.00	-0.00	0.00	-0.00	0.00	-0.00	-0.00	-0.00	-0.01	-0.00	-0.00	-0.01
	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.005)	(0.004)	(0.002)	(0.004)	(0.004)
SCHOOL CHOICE	-0.04	0.00	-0.02	-0.02	-0.03	-0.03	-0.00	0.03	0.01	0.00	-0.02	-0.02
	(0.029)	(0.050)	(0.032)	(0.029)	(0.033)	(0.035)	(0.034)	(0.067)	(0.041)	(0.038)	(0.038)	(0.074)
PRESCORE (G7)	0.73***	0.63***	0.79***	0.82***	0.75***	0.60***	0.70***	0.46***	0.78***	0.82***	0.75***	0.58***
	(0.014)	(0.032)	(0.015)	(0.015)	(0.016)	(0.025)	(0.016)	(0.026)	(0.022)	(0.017)	(0.018)	(0.042)
STUDY HOUR (1= >10hrs/week)	0.03	0.07	0.05	0.01	0.03	0.00	-0.05	-0.12	-0.01	-0.01	0.00	-0.02
	(0.028)	(0.082)	(0.046)	(0.027)	(0.026)	(0.023)	(0.033)	(0.079)	(0.052)	(0.031)	(0.043)	(0.037)
SELF ESTEEM	0.09***	0.08**	0.08**	0.08***	0.07***	0.06**	0.10***	0.09***	0.09**	0.09***	0.07***	0.08**
	(0.017)	(0.030)	(0.027)	(0.015)	(0.021)	(0.020)	(0.019)	(0.022)	(0.030)	(0.018)	(0.017)	(0.026)
ENGLISH PT in G7	-0.06	-0.10*	-0.12*	-0.08*	-0.04	0.00	-0.07	0.02	-0.13**	-0.10*	-0.01	0.01
	(0.035)	(0.047)	(0.047)	(0.041)	(0.052)	(0.040)	(0.040)	(0.071)	(0.050)	(0.040)	(0.040)	(0.048)
ENGLISH PT in G9							0.14**	0.18	0.09	0.12*	0.14**	0.13*
							(0.045)	(0.094)	(0.074)	(0.052)	(0.045)	(0.059)
Constant	-0.37***	-1.20***	-0.95***	-0.39***	0.14	0.58***	-0.33**	-1.35***	-0.88***	-0.31**	0.21**	0.79***
	(0.090)	(0.137)	(0.094)	(0.106)	(0.096)	(0.091)	(0.102)	(0.207)	(0.117)	(0.112)	(0.065)	(0.186)
Observations	4,955	5,003	5,003	5,003	5,003	5,003	4,188	4,230	4,230	4,230	4,230	4,230
R-squared	0.555						0.499					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8ENG_Z (English score in grade 8) for (1)-(6); G9ENG_Z (English score in grade 9) for (7)-(12)

Table L.5. Heterogeneous effects of English tutoring in grade 9 on English achievement in grade 9 using the OLS estimation

	Year 0 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
ENGLISH PT in G9	0.16***	0.12**	0.14***	0.16***	0.23***	0.17**
	(0.028)	(0.037)	(0.028)	(0.034)	(0.029)	(0.056)
URBANICITY	-0.02	-0.03	-0.03	-0.04	-0.04*	0.01
	(0.029)	(0.056)	(0.045)	(0.026)	(0.020)	(0.040)
GENDER (1=female)	0.12***	0.17***	0.14***	0.10***	0.08***	0.02
	(0.021)	(0.033)	(0.027)	(0.021)	(0.020)	(0.027)
SES	0.11***	0.09***	0.11***	0.08***	0.09***	0.09***
	(0.014)	(0.022)	(0.020)	(0.013)	(0.017)	(0.019)
SCHOOL TYPE (1=private)	0.04	-0.01	0.03	0.03	0.06*	0.04
	(0.025)	(0.041)	(0.042)	(0.031)	(0.031)	(0.027)
STU-TEA RATIO	-0.00	-0.00	-0.00	-0.00	-0.01**	-0.00
	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)
SCHOOL CHOICE	0.01	0.06	0.02	-0.03	-0.03	0.04
	(0.031)	(0.062)	(0.059)	(0.026)	(0.032)	(0.049)
PRESCORE (G8)	0.73***	0.53***	0.85***	0.84***	0.76***	0.56***
	(0.014)	(0.020)	(0.017)	(0.013)	(0.017)	(0.030)
STUDY HOUR (1= >10hrs/week)	-0.03	-0.06	-0.00	0.02	-0.02	-0.06
	(0.030)	(0.053)	(0.064)	(0.031)	(0.042)	(0.035)
SELF ESTEEM	0.13***	0.09**	0.12***	0.11***	0.10***	0.10***
	(0.018)	(0.029)	(0.024)	(0.014)	(0.017)	(0.023)
ENGLISH PT in G7	0.01	0.05	-0.01	0.02	0.03	0.06
	(0.027)	(0.042)	(0.035)	(0.033)	(0.022)	(0.042)
ENGLISH PT in G8	0.06*	0.04	0.05	0.04	0.02	0.06
	(0.029)	(0.034)	(0.036)	(0.033)	(0.033)	(0.041)
Constant	-0.27**	-1.38***	-0.69***	-0.15**	0.28***	0.64***
	(0.088)	(0.145)	(0.129)	(0.051)	(0.085)	(0.121)
Observations	4,609	4,609	4,609	4,609	4,609	4,609
R-squared	0.536					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9ENG_Z (English score in grade 9)

Table L.6. Heterogeneous effects of English tutoring in grade 9 on English achievement in grade 9 using the 2SLAD estimation

	Year 0 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
ENGLISH PT in G9 (predicted)	-0.15	-0.14	-0.34	0.33	2.02	0.37
	(0.272)	(1.478)	(1.406)	(2.044)	(1.919)	(1.349)
URBANICITY	-0.00	-0.04	-0.01	-0.04	-0.05	0.04
	(0.032)	(0.058)	(0.049)	(0.048)	(0.042)	(0.046)
GENDER (1=female)	0.12***	0.17***	0.14**	0.10	0.14*	0.02
	(0.024)	(0.044)	(0.053)	(0.076)	(0.061)	(0.050)
SES	0.12***	0.08	0.13	0.07	0.01	0.06
	(0.018)	(0.069)	(0.065)	(0.079)	(0.071)	(0.054)
SCHOOL TYPE (1=private)	0.05	0.01	0.03	0.05*	0.10**	0.08*
	(0.027)	(0.062)	(0.046)	(0.024)	(0.032)	(0.035)
STU-TEA RATIO	-0.00	0.00	0.00	-0.00	-0.02	-0.00
	(0.003)	(0.010)	(0.010)	(0.016)	(0.015)	(0.011)
SCHOOL CHOICE	0.02	0.00	0.01	-0.03	-0.05	0.05
	(0.035)	(0.076)	(0.053)	(0.056)	(0.049)	(0.060)
PRESCORE (G8)	0.74***	0.55***	0.87***	0.84***	0.69***	0.57***
	(0.018)	(0.075)	(0.057)	(0.079)	(0.076)	(0.062)
STUDY HOUR (1= >10hrs/week)	-0.04	-0.06	-0.02	0.01	-0.07*	-0.04
	(0.033)	(0.053)	(0.046)	(0.030)	(0.033)	(0.031)
SELF ESTEEM	0.13***	0.09	0.15***	0.11	0.05	0.11*
	(0.020)	(0.052)	(0.045)	(0.061)	(0.053)	(0.047)
ENGLISH PT in G7	0.07	0.16	0.11	-0.01	-0.27	-0.01
	(0.050)	(0.214)	(0.221)	(0.309)	(0.287)	(0.208)
ENGLISH PT in G8	0.14	0.09	0.16	-0.03	-0.62	-0.03
	(0.100)	(0.516)	(0.485)	(0.718)	(0.682)	(0.484)
Constant	-0.22	-1.24**	-0.58	-0.22	-0.25	0.52
	(0.119)	(0.421)	(0.396)	(0.534)	(0.493)	(0.335)
Observations	4,002	4,423	4,423	4,423	4,423	4,423
R-squared	0.524					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9ENG_Z (English score in grade 9)

Table M.1. Heterogeneous effects of math tutoring in grade 7 on math achievement for 3 years using the OLS estimation

	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
MATH PT in G7	0.26***	0.17***	0.23***	0.26***	0.31***	0.22***	0.09**	0.04	0.04	0.10**	0.15***	0.12*	0.04	-0.01	-0.01	0.03	0.12**	0.05
	(0.024)	(0.045)	(0.034)	(0.027)	(0.028)	(0.042)	(0.030)	(0.036)	(0.037)	(0.033)	(0.042)	(0.049)	(0.033)	(0.039)	(0.042)	(0.051)	(0.042)	(0.061)
URBANICITY	0.05	0.02	0.03	0.05	0.05	0.10***	-0.02	0.00	0.02	-0.01	-0.05	-0.07	-0.14***	-0.04	-0.10	-0.21**	-0.16***	-0.04
	(0.031)	(0.030)	(0.031)	(0.043)	(0.038)	(0.029)	(0.034)	(0.035)	(0.044)	(0.048)	(0.044)	(0.057)	(0.037)	(0.037)	(0.078)	(0.069)	(0.040)	(0.052)
GENDER (1=female)	0.02	0.07	0.06*	0.01	-0.05**	-0.02	0.04	0.10***	0.13***	0.08*	-0.02	-0.08	0.01	0.08*	0.05	0.02	-0.04	-0.12***
	(0.021)	(0.043)	(0.031)	(0.018)	(0.018)	(0.022)	(0.023)	(0.026)	(0.036)	(0.035)	(0.048)	(0.047)	(0.026)	(0.038)	(0.039)	(0.030)	(0.026)	(0.033)
SES	0.16***	0.16***	0.19***	0.20***	0.15***	0.10***	0.16***	0.07***	0.13***	0.21***	0.20***	0.15***	0.16***	0.09***	0.14***	0.19***	0.17***	0.11***
	(0.014)	(0.027)	(0.020)	(0.020)	(0.017)	(0.018)	(0.016)	(0.019)	(0.015)	(0.021)	(0.020)	(0.023)	(0.017)	(0.025)	(0.028)	(0.025)	(0.025)	(0.020)
SCHOOL TYPE (1=private)	0.05	0.04	0.04*	0.06*	0.06	0.01	0.07*	0.07	0.10*	0.06	0.03	0.03	0.15***	0.12***	0.13***	0.15***	0.13***	0.10***
	(0.026)	(0.048)	(0.021)	(0.031)	(0.036)	(0.040)	(0.029)	(0.049)	(0.039)	(0.036)	(0.044)	(0.039)	(0.032)	(0.027)	(0.039)	(0.034)	(0.038)	(0.027)
STU-TEA RATIO	0.01***	0.01*	0.01***	0.01***	0.02***	0.02***	0.01***	0.00	0.01*	0.01	0.02***	0.02**	0.01*	0.01	0.00	0.01**	0.01	0.01
	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.004)
SCHOOL CHOICE	-0.06*	-0.12**	-0.05	-0.09*	-0.08	0.03	-0.11**	-0.08**	-0.06	-0.10	-0.15**	-0.14**	-0.04	-0.01	-0.04	-0.08	-0.05	0.09
	(0.032)	(0.044)	(0.031)	(0.039)	(0.044)	(0.042)	(0.036)	(0.030)	(0.046)	(0.057)	(0.055)	(0.051)	(0.039)	(0.030)	(0.074)	(0.068)	(0.048)	(0.049)
PRESCORE (G6)	0.22***	0.17***	0.23***	0.26***	0.23***	0.17***	0.18***	0.10***	0.17***	0.21***	0.21***	0.17***	0.17***	0.09***	0.14***	0.20***	0.20***	0.14***
	(0.006)	(0.015)	(0.009)	(0.009)	(0.007)	(0.009)	(0.007)	(0.010)	(0.010)	(0.012)	(0.007)	(0.015)	(0.008)	(0.009)	(0.007)	(0.009)	(0.010)	(0.008)
STUDY HOUR	0.11***	0.19**	0.17**	0.11*	0.07*	0.01	0.11***	0.16*	0.18**	0.12*	0.11*	0.04	0.06	-0.04	0.07	0.17***	0.05	0.03
(1= >10hrs/week)	(0.031)	(0.067)	(0.064)	(0.045)	(0.031)	(0.036)	(0.035)	(0.066)	(0.055)	(0.051)	(0.049)	(0.063)	(0.038)	(0.049)	(0.050)	(0.020)	(0.035)	(0.044)
SELF ESTEEM	0.17***	0.16***	0.18***	0.18***	0.15***	0.15***	0.15***	0.08**	0.12***	0.17***	0.17***	0.18***	0.10***	0.01	0.09*	0.12***	0.14***	0.15***
	(0.019)	(0.028)	(0.031)	(0.024)	(0.018)	(0.018)	(0.021)	(0.030)	(0.031)	(0.034)	(0.024)	(0.024)	(0.023)	(0.042)	(0.043)	(0.036)	(0.040)	(0.037)
MATH PT in G8							0.28***	0.17***	0.25***	0.32***	0.33***	0.34***	0.20***	0.11**	0.13*	0.23***	0.27***	0.20**
							(0.031)	(0.033)	(0.040)	(0.048)	(0.049)	(0.067)	(0.037)	(0.040)	(0.052)	(0.044)	(0.066)	(0.063)
MATH PT in G9													0.30***	0.10**	0.27***	0.34***	0.39***	0.36***
													(0.036)	(0.036)	(0.048)	(0.061)	(0.058)	(0.068)
Constant	-1.72***	-2.35***	-2.39***	-1.87***	-1.20***	-0.55***	-1.44***	-1.93***	-2.13***	-1.66***	-1.07***	-0.20	-1.41***	-2.03***	-1.84***	-1.66***	-1.05***	-0.21
	(0.096)	(0.155)	(0.125)	(0.156)	(0.128)	(0.139)	(0.106)	(0.099)	(0.117)	(0.117)	(0.131)	(0.145)	(0.117)	(0.103)	(0.186)	(0.133)	(0.107)	(0.144)
Observations	5,859	5,859	5,859	5,859	5,859	5,859	5,391	5,391	5,391	5,391	5,391	5,391	4,641	4,641	4,641	4,641	4,641	4,641
R-squared	0.348						0.286						0.259					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G7MAT_Z (math score in grade 7) for (1)-(6); G8MAT_Z (math score in grade 8) for (7)-(12); G9MAT_Z (math score in grade 9) for (13)-(18)

Table M.2. Heterogeneous effects of math tutoring in grade 7 on math achievement for 3 years using the 2SLAD estimation

	Year 0 (Grade 7)						Year 1 (Grade 8)						Year 2 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
VARIABLES	IV	q10	q25	q50	q75	q90	IV	q10	q25	q50	q75	q90	IV	q10	q25	q50	q75	q90
MATH PT in G7 (predicted)	0.53***	0.46	0.75***	0.80***	0.76***	0.52***	0.36***	0.16	0.27	0.84***	0.97**	1.12***	0.34**	0.38	0.26	0.46	0.61**	0.61
	(0.081)	(0.312)	(0.176)	(0.131)	(0.162)	(0.106)	(0.085)	(0.220)	(0.224)	(0.237)	(0.304)	(0.230)	(0.132)	(0.260)	(0.260)	(0.295)	(0.213)	(0.347)
URBANICITY	0.03	-0.03	-0.01	-0.04	0.03	0.06	-0.06	-0.02	-0.05	-0.07	-0.11***	-0.10**	-0.17***	-0.06	-0.14	-0.23***	-0.17***	-0.06
	(0.032)	(0.044)	(0.057)	(0.052)	(0.047)	(0.043)	(0.035)	(0.046)	(0.045)	(0.049)	(0.031)	(0.034)	(0.039)	(0.045)	(0.081)	(0.051)	(0.042)	(0.045)
GENDER (1=female)	0.02	0.09*	0.07	0.02	-0.02	-0.04	0.05*	0.11***	0.13***	0.08*	-0.00	-0.06*	0.01	0.08	0.05	0.03	-0.04	-0.12***
	(0.022)	(0.044)	(0.041)	(0.038)	(0.035)	(0.024)	(0.024)	(0.026)	(0.030)	(0.032)	(0.034)	(0.031)	(0.027)	(0.044)	(0.041)	(0.038)	(0.033)	(0.030)
SES	0.14***	0.16***	0.16***	0.15***	0.12***	0.07***	0.16***	0.07**	0.13***	0.19***	0.18***	0.10***	0.15***	0.07*	0.14***	0.19***	0.16***	0.10**
	(0.016)	(0.039)	(0.028)	(0.019)	(0.022)	(0.014)	(0.017)	(0.026)	(0.017)	(0.025)	(0.023)	(0.025)	(0.019)	(0.030)	(0.031)	(0.033)	(0.027)	(0.031)
SCHOOL TYPE (1=private)	0.04	0.03	0.02	0.05*	0.02	-0.01	0.06	0.08*	0.08*	0.02	-0.02	-0.00	0.13***	0.10**	0.14**	0.15**	0.14***	0.10*
	(0.028)	(0.055)	(0.038)	(0.022)	(0.048)	(0.041)	(0.030)	(0.034)	(0.031)	(0.035)	(0.051)	(0.049)	(0.033)	(0.036)	(0.044)	(0.049)	(0.028)	(0.047)
STU-TEA RATIO	0.01***	0.00	0.01*	0.01**	0.01***	0.02***	0.01**	0.00	0.01	0.00	0.01**	0.01***	0.01	0.00	0.00	0.01	0.00	0.00
	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)
SCHOOL CHOICE	-0.07*	-0.14***	-0.03	-0.11*	-0.05	0.03	-0.12***	-0.08	-0.09**	-0.13*	-0.15***	-0.11*	-0.05	-0.01	-0.05	-0.06	-0.05	0.11**
	(0.034)	(0.041)	(0.057)	(0.052)	(0.043)	(0.042)	(0.037)	(0.050)	(0.031)	(0.053)	(0.044)	(0.048)	(0.041)	(0.051)	(0.075)	(0.044)	(0.041)	(0.040)
PRESCORE (G6)	0.21***	0.17***	0.22***	0.25***	0.22***	0.17***	0.18***	0.09***	0.16***	0.21***	0.20***	0.18***	0.17***	0.09***	0.13***	0.19***	0.20***	0.15***
	(0.007)	(0.011)	(0.007)	(0.006)	(0.006)	(0.008)	(0.007)	(0.011)	(0.010)	(0.014)	(0.012)	(0.011)	(0.008)	(0.011)	(0.012)	(0.017)	(0.013)	(0.010)
STUDY HOUR	0.09**	0.17**	0.12*	0.11***	0.05	0.02	0.11**	0.15*	0.18**	0.11	0.08	0.05	0.06	-0.05	0.03	0.15***	0.05	0.03
(1= >10hrs/week)	(0.033)	(0.064)	(0.054)	(0.027)	(0.042)	(0.045)	(0.036)	(0.066)	(0.057)	(0.070)	(0.057)	(0.048)	(0.039)	(0.062)	(0.091)	(0.045)	(0.030)	(0.038)
SELF ESTEEM	0.16***	0.17***	0.18***	0.15***	0.13***	0.11***	0.15***	0.08**	0.12***	0.17***	0.14***	0.11***	0.10***	0.01	0.09*	0.16***	0.12***	0.13***
	(0.020)	(0.036)	(0.034)	(0.027)	(0.027)	(0.023)	(0.022)	(0.026)	(0.032)	(0.035)	(0.029)	(0.033)	(0.024)	(0.033)	(0.044)	(0.046)	(0.029)	(0.026)
MATH PT in G8							0.16***	0.13	0.15	-0.02	-0.02	-0.09	0.09	-0.03	0.01	0.08	0.10	0.05
							(0.046)	(0.089)	(0.096)	(0.107)	(0.113)	(0.102)	(0.058)	(0.090)	(0.097)	(0.096)	(0.094)	(0.138)
MATH PT in G9													0.25***	0.03	0.21***	0.22***	0.29***	0.27**
													(0.044)	(0.055)	(0.045)	(0.062)	(0.066)	(0.091)
Constant	-1.83***	-2.39***	-2.63***	-2.04***	-1.42***	-0.69***	-1.52***	-1.95***	-2.05***	-1.72***	-1.23***	-0.67***	-1.50***	-2.06***	-1.83***	-1.74***	-1.18***	-0.39*
	(0.108)	(0.185)	(0.159)	(0.187)	(0.160)	(0.095)	(0.114)	(0.135)	(0.133)	(0.166)	(0.137)	(0.193)	(0.128)	(0.187)	(0.222)	(0.182)	(0.170)	(0.154)
Observations	5,445	5,830	5,830	5,830	5,830	5,830	5,035	5,372	5,372	5,372	5,372	5,372	4,336	4,622	4,622	4,622	4,622	4,622
R-squared	0.330						0.275						0.244					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G7MAT_Z (math score in grade 7) for (1)-(6); G8MAT_Z (math score in grade 8) for (7)-(12); G9MAT_Z (math score in grade 9) for (13)-(18)

Table M.3. Heterogeneous effects of math tutoring in grade 8 on math achievement for 2 years using the OLS estimation

	Year 0 (Grade 8)						Year 1 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
MATH PT in G8	0.17***	0.16***	0.13***	0.17***	0.20***	0.19***	0.11***	0.04	0.11**	0.10**	0.13***	0.15*
	(0.026)	(0.044)	(0.036)	(0.039)	(0.048)	(0.057)	(0.032)	(0.043)	(0.036)	(0.040)	(0.037)	(0.070)
URBANICITY	-0.08**	-0.04	-0.04	-0.07*	-0.12***	-0.10*	-0.18***	-0.12*	-0.18***	-0.18***	-0.14***	-0.08
	(0.029)	(0.044)	(0.039)	(0.036)	(0.034)	(0.039)	(0.032)	(0.051)	(0.053)	(0.046)	(0.034)	(0.044)
GENDER (1=female)	-0.15***	-0.08	-0.13***	-0.15***	-0.21***	-0.19***	-0.18***	-0.06	-0.14***	-0.22***	-0.21***	-0.23***
	(0.020)	(0.044)	(0.034)	(0.025)	(0.029)	(0.029)	(0.023)	(0.041)	(0.026)	(0.023)	(0.019)	(0.036)
SES	0.04**	0.01	0.03	0.07**	0.05**	0.03	0.05***	0.04*	0.03	0.07**	0.04	0.05**
	(0.014)	(0.022)	(0.020)	(0.022)	(0.016)	(0.015)	(0.015)	(0.020)	(0.024)	(0.022)	(0.020)	(0.018)
SCHOOL TYPE (1=private)	0.04	0.02	0.02	0.04*	0.04	0.04	0.12***	0.09*	0.10*	0.11*	0.14***	0.09**
	(0.025)	(0.039)	(0.036)	(0.021)	(0.028)	(0.037)	(0.028)	(0.041)	(0.043)	(0.042)	(0.032)	(0.033)
STU-TEA RATIO	0.00	-0.00	-0.00	0.00	0.00	0.00	-0.00	-0.00	0.00	-0.00	-0.00	-0.00
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.005)	(0.005)
SCHOOL CHOICE	-0.08*	-0.02	-0.04	-0.05	-0.11***	-0.07*	-0.01	-0.03	0.01	-0.01	0.02	0.07
	(0.030)	(0.043)	(0.043)	(0.030)	(0.033)	(0.031)	(0.034)	(0.057)	(0.049)	(0.056)	(0.041)	(0.053)
PRESCORE (G7)	0.73***	0.54***	0.74***	0.80***	0.81***	0.69***	0.67***	0.44***	0.67***	0.80***	0.76***	0.59***
	(0.014)	(0.035)	(0.027)	(0.013)	(0.018)	(0.019)	(0.015)	(0.029)	(0.027)	(0.019)	(0.018)	(0.026)
STUDY HOUR (1= >10hrs/week)	0.05	0.11*	0.08*	0.04	-0.02	0.06	-0.00	-0.07	-0.02	-0.00	0.05	0.03
	(0.029)	(0.047)	(0.037)	(0.037)	(0.033)	(0.035)	(0.033)	(0.057)	(0.056)	(0.046)	(0.035)	(0.030)
SELF ESTEEM	0.06**	0.00	0.03	0.06**	0.07***	0.06*	0.02	-0.03	0.01	0.01	0.03	0.06*
	(0.017)	(0.032)	(0.030)	(0.020)	(0.021)	(0.025)	(0.020)	(0.031)	(0.022)	(0.027)	(0.023)	(0.028)
MATH PT in G7	0.00	-0.05	-0.01	0.01	0.01	0.01	-0.03	-0.03	-0.04	-0.02	-0.02	-0.03
	(0.025)	(0.040)	(0.040)	(0.044)	(0.047)	(0.042)	(0.029)	(0.037)	(0.029)	(0.036)	(0.031)	(0.051)
MATH PT in G9							0.25***	0.13***	0.22***	0.28***	0.33***	0.29***
							(0.032)	(0.029)	(0.047)	(0.029)	(0.037)	(0.047)
Constant	0.23**	-0.86***	-0.27**	0.18*	0.84***	1.09***	0.14	-0.87***	-0.48**	0.22	0.61***	1.02***
	(0.085)	(0.139)	(0.099)	(0.074)	(0.120)	(0.129)	(0.097)	(0.149)	(0.157)	(0.138)	(0.136)	(0.162)
Observations	5,513	5,513	5,513	5,513	5,513	5,513	4,739	4,739	4,739	4,739	4,739	4,739
R-squared	0.471						0.419					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8MAT_Z (math score in grade 8) for (1)-(6); G9MAT_Z (math score in grade 9) for (7)-(12)

Table M.4. Heterogeneous effects of math tutoring in grade 8 on math achievement for 2 years using the 2SLAD estimation

	Year 0 (Grade 8)						Year 1 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
MATH PT in G8 (predicted)	0.45***	0.39**	0.52***	0.48***	0.40***	0.15	0.43***	0.28	0.47***	0.48***	0.40**	0.37
	(0.083)	(0.120)	(0.141)	(0.090)	(0.106)	(0.157)	(0.111)	(0.189)	(0.132)	(0.131)	(0.151)	(0.189)
URBANICITY	-0.09**	-0.01	-0.04	-0.10*	-0.10**	-0.12***	-0.17***	-0.12**	-0.20***	-0.18***	-0.14***	-0.09*
	(0.030)	(0.043)	(0.044)	(0.043)	(0.039)	(0.034)	(0.034)	(0.040)	(0.033)	(0.031)	(0.033)	(0.037)
GENDER (1=female)	-0.14***	-0.03	-0.12***	-0.14***	-0.20***	-0.19***	-0.18***	-0.05	-0.14***	-0.22***	-0.21***	-0.23***
	(0.021)	(0.029)	(0.030)	(0.032)	(0.027)	(0.022)	(0.024)	(0.031)	(0.030)	(0.031)	(0.027)	(0.029)
SES	0.03*	0.01	0.03	0.07**	0.03	0.03	0.05**	0.04	0.05	0.07***	0.04*	0.04*
	(0.015)	(0.032)	(0.031)	(0.024)	(0.020)	(0.031)	(0.017)	(0.030)	(0.030)	(0.019)	(0.015)	(0.021)
SCHOOL TYPE (1=private)	0.04	0.02	0.02	0.05	0.01	0.04	0.13***	0.10*	0.13**	0.13**	0.14***	0.12**
	(0.026)	(0.051)	(0.037)	(0.034)	(0.028)	(0.043)	(0.030)	(0.050)	(0.042)	(0.042)	(0.023)	(0.037)
STU-TEA RATIO	-0.00	-0.00	-0.00	0.00	0.00	0.00	-0.00	0.00	0.00	-0.00	-0.00	-0.01
	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)
SCHOOL CHOICE	-0.07*	0.02	-0.01	-0.07	-0.07	-0.08	0.01	-0.00	0.01	0.03	0.03	0.08*
	(0.033)	(0.045)	(0.029)	(0.043)	(0.047)	(0.049)	(0.037)	(0.039)	(0.047)	(0.042)	(0.030)	(0.038)
PRESCORE (G7)	0.71***	0.53***	0.72***	0.79***	0.80***	0.69***	0.67***	0.44***	0.66***	0.79***	0.76***	0.57***
	(0.015)	(0.033)	(0.016)	(0.019)	(0.014)	(0.027)	(0.017)	(0.042)	(0.029)	(0.020)	(0.016)	(0.022)
STUDY HOUR (1= >10hrs/week)	0.03	0.10	0.07	0.02	-0.03	0.07	-0.03	-0.08	-0.06	-0.03	0.04	0.04
	(0.031)	(0.056)	(0.052)	(0.037)	(0.037)	(0.047)	(0.035)	(0.066)	(0.056)	(0.058)	(0.046)	(0.038)
SELF ESTEEM	0.05*	0.01	0.01	0.04	0.06*	0.05*	0.01	-0.03	0.01	0.01	0.02	0.06*
	(0.019)	(0.035)	(0.030)	(0.020)	(0.026)	(0.025)	(0.021)	(0.033)	(0.036)	(0.030)	(0.025)	(0.026)
MATH PT in G7	-0.09*	-0.13*	-0.15*	-0.09	-0.05	0.02	-0.13**	-0.12	-0.15**	-0.13*	-0.13**	-0.10
	(0.040)	(0.064)	(0.069)	(0.047)	(0.061)	(0.073)	(0.044)	(0.073)	(0.058)	(0.053)	(0.049)	(0.073)
MATH PT in G9							0.14**	0.01	0.08	0.15*	0.23***	0.19*
							(0.048)	(0.072)	(0.067)	(0.063)	(0.056)	(0.093)
Constant	0.09	-1.11***	-0.53***	0.04	0.66***	1.16***	0.04	-0.98***	-0.56***	0.04	0.53***	1.02***
	(0.099)	(0.107)	(0.099)	(0.070)	(0.132)	(0.143)	(0.108)	(0.142)	(0.132)	(0.156)	(0.088)	(0.131)
Observations	4,964	5,011	5,011	5,011	5,011	5,011	4,275	4,316	4,316	4,316	4,316	4,316
R-squared	0.455						0.405					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variables: G8MAT_Z (math score in grade 8) for (1)-(6); G9MAT_Z (math score in grade 9) for (7)-(12)

Table M.5. Heterogeneous effects of math tutoring in grade 9 on math achievement in grade 9 using the OLS estimation

	Year 0 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
MATH PT in G9	0.24***	0.16***	0.22***	0.23***	0.32***	0.30***
	(0.031)	(0.035)	(0.033)	(0.047)	(0.059)	(0.055)
URBANICITY	-0.15***	-0.19*	-0.18***	-0.15***	-0.10**	-0.08
	(0.032)	(0.076)	(0.043)	(0.031)	(0.032)	(0.043)
GENDER (1=female)	-0.21***	-0.07*	-0.18***	-0.27***	-0.25***	-0.25***
	(0.022)	(0.035)	(0.029)	(0.028)	(0.029)	(0.039)
SES	0.07***	0.08***	0.06***	0.04*	0.04**	0.05
	(0.015)	(0.020)	(0.015)	(0.020)	(0.015)	(0.027)
SCHOOL TYPE (1=private)	0.11***	0.10**	0.09*	0.09*	0.13***	0.12**
	(0.027)	(0.036)	(0.041)	(0.042)	(0.030)	(0.042)
STU-TEA RATIO	-0.00	-0.00	-0.00	0.00	0.00	-0.00
	(0.003)	(0.005)	(0.003)	(0.004)	(0.004)	(0.006)
SCHOOL CHOICE	0.01	-0.08	-0.01	0.01	0.05	0.06
	(0.034)	(0.074)	(0.031)	(0.030)	(0.040)	(0.043)
PRESCORE (G8)	0.68***	0.51***	0.70***	0.82***	0.75***	0.58***
	(0.015)	(0.023)	(0.020)	(0.019)	(0.018)	(0.019)
STUDY HOUR (1= >10hrs/week)	-0.00	-0.14*	0.02	0.02	0.03	0.03
	(0.033)	(0.071)	(0.065)	(0.055)	(0.045)	(0.048)
SELF ESTEEM	0.04*	-0.00	0.04	0.05*	0.06*	0.05
	(0.019)	(0.036)	(0.023)	(0.025)	(0.027)	(0.038)
MATH PT in G7	0.01	-0.00	-0.02	0.04	0.03	-0.05
	(0.029)	(0.052)	(0.039)	(0.043)	(0.038)	(0.049)
MATH PT in G8	0.08**	0.04	0.06*	0.09**	0.11**	0.12
	(0.031)	(0.025)	(0.028)	(0.032)	(0.041)	(0.072)
Constant	0.11	-0.74***	-0.32**	0.13	0.42***	1.06***
	(0.095)	(0.155)	(0.103)	(0.107)	(0.102)	(0.154)
Observations	4,697	4,697	4,697	4,697	4,697	4,697
R-squared	0.443					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9MAT_Z (math score in grade 9)

Table M.6. Heterogeneous effects of math tutoring in grade 9 on math achievement in grade 9 using the 2SLAD estimation

	Year 0 (Grade 9)					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90
MATH PT in G9 (predicted)	-0.09	-0.17	-0.34	1.83	1.23	0.40
	(0.287)	(1.302)	(1.575)	(1.228)	(1.336)	(1.293)
URBANICITY	-0.15***	-0.16**	-0.14***	-0.11**	-0.10**	-0.05
	(0.035)	(0.059)	(0.033)	(0.037)	(0.031)	(0.033)
GENDER (1=female)	-0.22***	-0.08	-0.19***	-0.20***	-0.22***	-0.26***
	(0.026)	(0.063)	(0.056)	(0.048)	(0.040)	(0.066)
SES	0.09***	0.08	0.09	0.00	0.02	0.04
	(0.020)	(0.061)	(0.060)	(0.055)	(0.053)	(0.063)
SCHOOL TYPE (1=private)	0.13***	0.09*	0.13***	0.09*	0.14***	0.14**
	(0.030)	(0.042)	(0.036)	(0.045)	(0.032)	(0.041)
STU-TEA RATIO	0.00	0.00	0.00	-0.01	-0.00	-0.00
	(0.004)	(0.009)	(0.010)	(0.009)	(0.010)	(0.007)
SCHOOL CHOICE	0.01	-0.05	0.02	0.05	0.05	0.08
	(0.037)	(0.047)	(0.033)	(0.044)	(0.052)	(0.056)
PRESCORE (G8)	0.70***	0.51***	0.74***	0.78***	0.73***	0.57***
	(0.019)	(0.056)	(0.063)	(0.050)	(0.055)	(0.059)
STUDY HOUR (1= >10hrs/week)	-0.00	-0.08	0.02	0.02	0.02	0.03
	(0.036)	(0.071)	(0.052)	(0.048)	(0.036)	(0.049)
SELF ESTEEM	0.05*	-0.00	0.04	-0.02	0.01	0.04
	(0.023)	(0.055)	(0.061)	(0.057)	(0.060)	(0.056)
MATH PT in G7	0.05	0.06	0.06	-0.22	-0.12	-0.02
	(0.053)	(0.194)	(0.250)	(0.170)	(0.194)	(0.218)
MATH PT in G8	0.19	0.13	0.22	-0.48	-0.23	0.01
	(0.103)	(0.455)	(0.536)	(0.433)	(0.466)	(0.417)
Constant	0.22	-0.75	-0.21	-0.38	0.17	0.95
	(0.136)	(0.420)	(0.484)	(0.370)	(0.396)	(0.561)
Observations	4,073	4,491	4,491	4,491	4,491	4,491
R-squared	0.427					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: G9MAT_Z (math score in grade 9)

Table N.1. Long-term heterogeneous effects of one year private tutoring in middle school on the CSAT

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	IV	q10	q25	q50	q75	q90
1 year of PT in middle school	0.03	-0.08	-0.11	-0.03	0.07	0.22	0.34	0.07	0.02	0.00	0.12	0.16
	(0.180)	(0.407)	(0.169)	(0.177)	(0.270)	(0.307)	(0.482)	(0.131)	(0.078)	(0.087)	(0.085)	(0.128)
URBAN	-0.63*	-0.68	-0.50	-0.70**	-0.78*	-0.31	-0.91**	-0.07	-0.11	-0.19	-0.09	0.06
	(0.272)	(0.555)	(0.355)	(0.262)	(0.374)	(0.367)	(0.308)	(0.145)	(0.105)	(0.109)	(0.119)	(0.115)
GENDER (1=female)	-0.05	0.02	-0.15	-0.03	-0.01	0.30	-0.24	0.19*	0.11	-0.04	-0.03	-0.13
	(0.178)	(0.492)	(0.270)	(0.181)	(0.277)	(0.311)	(0.207)	(0.091)	(0.062)	(0.056)	(0.071)	(0.112)
SES	0.02	-0.37	-0.13	0.31	-0.01	-0.07	-0.17	0.17**	0.24**	0.32***	0.33***	0.30***
	(0.153)	(0.418)	(0.288)	(0.251)	(0.151)	(0.248)	(0.191)	(0.066)	(0.072)	(0.051)	(0.042)	(0.066)
SCHOOL TYPE	-0.16	-0.08	-0.45	0.07	0.10	-0.36	-0.13	0.08	0.06	0.01	0.04	0.10
	(0.257)	(0.517)	(0.357)	(0.316)	(0.294)	(0.304)	(0.287)	(0.120)	(0.073)	(0.103)	(0.123)	(0.141)
STU-TEA RATIO	0.03	0.02	0.04	0.02	0.03	0.01	0.03	0.02	0.02**	0.00	0.00	0.00
	(0.018)	(0.038)	(0.029)	(0.021)	(0.026)	(0.043)	(0.020)	(0.012)	(0.007)	(0.008)	(0.009)	(0.008)
SCHOOL CHOICE	-0.34	-0.80	-0.50	-0.40	-0.37	-0.05	-0.53	-0.07	-0.08	-0.10	-0.10	-0.07
	(0.280)	(0.520)	(0.382)	(0.264)	(0.369)	(0.433)	(0.315)	(0.168)	(0.101)	(0.097)	(0.102)	(0.138)
PRESCORE	0.27***	0.22	0.34***	0.30***	0.30**	0.34***	0.32***	0.27***	0.27***	0.28***	0.29***	0.24***
	(0.054)	(0.152)	(0.081)	(0.067)	(0.107)	(0.096)	(0.061)	(0.042)	(0.029)	(0.031)	(0.021)	(0.028)
SELF-STUDY	-0.24	-0.82	0.08	-0.14	-0.43	-1.00*	-0.26	0.20	0.01	0.03	0.27*	0.09
	(0.332)	(0.662)	(0.303)	(0.243)	(0.363)	(0.487)	(0.381)	(0.113)	(0.097)	(0.158)	(0.124)	(0.100)
SELF-ESTEEM	0.23	0.62	0.15	0.20	0.29	0.21	0.07	0.26***	0.24***	0.28***	0.19**	0.25**
	(0.155)	(0.360)	(0.178)	(0.175)	(0.214)	(0.307)	(0.177)	(0.078)	(0.070)	(0.073)	(0.066)	(0.078)
PT in grade 10	0.10	0.22	0.27	0.10	0.01	-0.15	0.16	0.67***	0.36***	0.36***	0.24*	0.01
	(0.186)	(0.377)	(0.223)	(0.175)	(0.322)	(0.364)	(0.221)	(0.126)	(0.084)	(0.076)	(0.109)	(0.148)
PT in grade 11	0.35	0.31	0.16	0.30	0.36	0.15	0.23	0.45***	0.34***	0.21**	0.28***	0.20*
	(0.206)	(0.389)	(0.273)	(0.286)	(0.360)	(0.427)	(0.242)	(0.129)	(0.066)	(0.081)	(0.075)	(0.079)
PT in grade 12	0.54*	0.84*	0.42	0.68**	0.72*	0.66	0.60*	0.28	0.29***	0.34***	0.31***	0.43***
	(0.253)	(0.414)	(0.252)	(0.240)	(0.281)	(0.422)	(0.298)	(0.148)	(0.076)	(0.101)	(0.075)	(0.115)
Constant	3.46***	2.68*	2.53*	3.69***	4.06***	3.94***	3.68***	0.79	2.01***	3.37***	3.92***	5.25***
	(0.801)	(1.317)	(1.096)	(0.724)	(1.142)	(1.078)	(0.951)	(0.408)	(0.332)	(0.309)	(0.382)	(0.365)
Observations	246	246	246	246	246	246	181	2,128	2,128	2,128	2,128	2,128
R-squared	0.275						0.294					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table N.2. Long-term heterogeneous effects of two years private tutoring in middle school on the CSAT

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	IV	q10	q25	q50	q75	q90
2 years of PT in middle school	0.13	0.36	0.09	0.10	0.15	-0.05	0.36	0.12	0.04	0.01	0.21	0.27
	(0.166)	(0.440)	(0.184)	(0.215)	(0.331)	(0.276)	(0.410)	(0.178)	(0.147)	(0.124)	(0.177)	(0.321)
URBAN	-0.07	0.15	-0.10	-0.29	-0.23	0.21	-0.12	-0.07	-0.11	-0.19*	-0.08	0.07
	(0.206)	(0.525)	(0.214)	(0.215)	(0.267)	(0.300)	(0.232)	(0.176)	(0.083)	(0.095)	(0.124)	(0.166)
GENDER (1=female)	0.13	0.36	0.25	0.04	0.12	-0.01	0.09	0.19	0.11	-0.04	-0.02	-0.13
	(0.138)	(0.306)	(0.236)	(0.188)	(0.174)	(0.272)	(0.162)	(0.115)	(0.083)	(0.070)	(0.081)	(0.093)
SES	0.05	-0.09	0.09	0.16	0.11	-0.05	0.06	0.16	0.23***	0.31***	0.32***	0.28***
	(0.104)	(0.348)	(0.173)	(0.158)	(0.130)	(0.147)	(0.117)	(0.088)	(0.066)	(0.061)	(0.047)	(0.076)
SCHOOL TYPE	0.31	-0.09	0.10	0.17	0.45	0.77	0.17	0.07	0.06	0.01	0.02	0.08
	(0.175)	(0.440)	(0.237)	(0.253)	(0.319)	(0.426)	(0.197)	(0.125)	(0.082)	(0.093)	(0.065)	(0.093)
STU-TEA RATIO	-0.00	0.00	0.00	-0.00	-0.01	0.00	-0.00	0.02	0.02**	0.00	0.00	0.00
	(0.014)	(0.034)	(0.014)	(0.014)	(0.021)	(0.018)	(0.016)	(0.014)	(0.007)	(0.007)	(0.010)	(0.016)
SCHOOL CHOICE	-0.14	-0.00	-0.16	-0.35	-0.41	-0.07	-0.21	-0.07	-0.08	-0.10	-0.10	-0.07
	(0.213)	(0.683)	(0.280)	(0.253)	(0.304)	(0.295)	(0.238)	(0.199)	(0.068)	(0.063)	(0.099)	(0.108)
PRESCORE	0.24***	0.26**	0.26***	0.27***	0.24***	0.23**	0.28***	0.27***	0.27***	0.28***	0.29***	0.24***
	(0.039)	(0.090)	(0.040)	(0.050)	(0.067)	(0.077)	(0.046)	(0.042)	(0.024)	(0.018)	(0.021)	(0.026)
SELF-STUDY	0.17	0.52*	0.15	-0.10	0.20	-0.15	0.11	0.20*	0.01	0.03	0.27***	0.08
	(0.231)	(0.262)	(0.236)	(0.253)	(0.386)	(0.425)	(0.259)	(0.092)	(0.063)	(0.110)	(0.079)	(0.117)
SELF-ESTEEM	0.24	0.30	0.19	0.22	0.28	0.23	0.11	0.26**	0.24***	0.28***	0.20**	0.25***
	(0.130)	(0.247)	(0.213)	(0.203)	(0.174)	(0.171)	(0.152)	(0.090)	(0.061)	(0.075)	(0.066)	(0.062)
PT in grade 10	0.03	0.21	0.23	0.11	-0.08	-0.21	0.09	0.67***	0.36***	0.36**	0.23*	-0.00
	(0.155)	(0.297)	(0.181)	(0.205)	(0.298)	(0.327)	(0.191)	(0.179)	(0.092)	(0.111)	(0.110)	(0.151)
PT in grade 11	0.21	0.56	0.17	0.06	0.32	-0.29	-0.01	0.45***	0.34***	0.21*	0.27*	0.18
	(0.158)	(0.333)	(0.142)	(0.201)	(0.285)	(0.325)	(0.189)	(0.121)	(0.064)	(0.086)	(0.124)	(0.140)
PT in grade 12	0.36*	-0.14	0.28	0.44	0.43	0.68*	0.45*	0.28*	0.29**	0.34***	0.31***	0.43**
	(0.175)	(0.416)	(0.275)	(0.257)	(0.250)	(0.289)	(0.199)	(0.131)	(0.097)	(0.094)	(0.084)	(0.134)
Constant	3.40***	0.64	2.29***	3.85***	4.84***	5.53***	3.36***	0.77	2.01***	3.37***	3.89***	5.21***
	(0.598)	(2.029)	(0.592)	(0.610)	(0.945)	(0.783)	(0.712)	(0.638)	(0.254)	(0.221)	(0.354)	(0.602)
Observations	421	421	421	421	421	421	325	2,128	2,128	2,128	2,128	2,128
R-squared	0.181						0.180					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table N.3. Long-term heterogeneous effects of three years private tutoring in middle school on the CSAT achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of PT in middle school	0.04	0.27	0.02	-0.01	0.09	-0.12	0.48	0.28	0.09	0.01	0.50	0.64
	(0.134)	(0.431)	(0.200)	(0.144)	(0.283)	(0.343)	(0.456)	(0.641)	(0.380)	(0.464)	(0.314)	(0.490)
URBAN	-0.03	-0.01	-0.00	-0.02	-0.02	-0.03	-0.15	-0.07	-0.11	-0.19	-0.08	0.07
	(0.092)	(0.176)	(0.092)	(0.126)	(0.098)	(0.115)	(0.103)	(0.165)	(0.088)	(0.125)	(0.105)	(0.146)
GENDER (1=female)	0.05	0.19	0.12	0.01	0.01	-0.28**	0.03	0.20	0.11	-0.04	-0.02	-0.12
	(0.064)	(0.132)	(0.094)	(0.060)	(0.082)	(0.104)	(0.072)	(0.139)	(0.057)	(0.072)	(0.093)	(0.100)
SES	0.31***	0.20***	0.25***	0.36***	0.39***	0.38***	0.25***	0.16	0.23***	0.31***	0.31***	0.28***
	(0.043)	(0.052)	(0.053)	(0.056)	(0.067)	(0.071)	(0.051)	(0.085)	(0.043)	(0.060)	(0.045)	(0.062)
SCHOOL TYPE	0.05	0.09	0.12	0.00	0.04	0.10	-0.04	0.07	0.06	0.01	0.03	0.09
	(0.081)	(0.152)	(0.111)	(0.096)	(0.103)	(0.130)	(0.091)	(0.114)	(0.084)	(0.085)	(0.100)	(0.131)
STU-TEA RATIO	0.00	0.01	0.02	-0.01	-0.01	0.00	0.01	0.02	0.02*	0.00	0.00	-0.00
	(0.008)	(0.015)	(0.014)	(0.009)	(0.014)	(0.014)	(0.009)	(0.012)	(0.009)	(0.007)	(0.012)	(0.013)
SCHOOL CHOICE	-0.04	0.11	0.04	-0.01	-0.07	-0.15	-0.12	-0.07	-0.08	-0.10	-0.09	-0.07
	(0.100)	(0.217)	(0.126)	(0.103)	(0.096)	(0.135)	(0.110)	(0.216)	(0.102)	(0.144)	(0.104)	(0.116)
PRESCORE	0.26***	0.21***	0.24***	0.28***	0.29***	0.23***	0.26***	0.27***	0.27***	0.28***	0.29***	0.24***
	(0.020)	(0.032)	(0.020)	(0.022)	(0.028)	(0.045)	(0.022)	(0.026)	(0.018)	(0.018)	(0.020)	(0.023)
SELF-STUDY	0.15	0.28**	0.14	0.13	0.21	-0.04	0.15	0.19	0.01	0.03	0.26***	0.07
	(0.087)	(0.096)	(0.091)	(0.150)	(0.111)	(0.090)	(0.095)	(0.129)	(0.061)	(0.104)	(0.078)	(0.123)
SELF-ESTEEM	0.31***	0.35***	0.32***	0.36***	0.27**	0.40***	0.28***	0.26***	0.23***	0.28***	0.18**	0.24***
	(0.057)	(0.084)	(0.084)	(0.088)	(0.095)	(0.087)	(0.065)	(0.068)	(0.042)	(0.050)	(0.064)	(0.060)
PT in grade 10	0.35***	0.70*	0.33**	0.33*	0.31**	0.19	0.32**	0.64**	0.35*	0.36**	0.17	-0.07
	(0.097)	(0.328)	(0.100)	(0.139)	(0.118)	(0.174)	(0.122)	(0.212)	(0.147)	(0.114)	(0.115)	(0.099)
PT in grade 11	0.33***	0.58***	0.39***	0.29*	0.29*	0.17	0.32**	0.44***	0.34***	0.21*	0.26**	0.18*
	(0.087)	(0.097)	(0.097)	(0.139)	(0.113)	(0.172)	(0.101)	(0.125)	(0.067)	(0.084)	(0.081)	(0.076)
PT in grade 12	0.29***	0.28*	0.27**	0.30***	0.28*	0.43***	0.34***	0.29*	0.29***	0.34***	0.32***	0.45***
	(0.072)	(0.120)	(0.092)	(0.084)	(0.113)	(0.126)	(0.079)	(0.137)	(0.065)	(0.064)	(0.080)	(0.113)
Constant	3.24***	0.68	2.06***	3.32***	4.10***	5.94***	2.95***	0.69	1.98***	3.36***	3.73***	5.00***
	(0.316)	(0.875)	(0.474)	(0.311)	(0.374)	(0.626)	(0.455)	(0.766)	(0.415)	(0.374)	(0.335)	(0.448)
Observations	1,452	1,452	1,452	1,452	1,452	1,452	1,190	2,128	2,128	2,128	2,128	2,128
R-squared	0.318						0.310					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table N.4. Long-term heterogeneous effects of one year verbal tutoring in middle school on the CSAT verbal achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of Verbal PT in middle school	-0.17	-0.06	-0.14	-0.29	-0.24	-0.42**	0.52*	-0.28*	-0.19	-0.19	-0.22	-0.17
	(0.106)	(0.179)	(0.178)	(0.148)	(0.180)	(0.160)	(0.256)	(0.136)	(0.174)	(0.158)	(0.173)	(0.255)
URBAN	-0.22	-0.19	-0.17	-0.32	-0.27	-0.26	-0.28	-0.08	-0.07	-0.09	0.11	-0.09
	(0.158)	(0.232)	(0.307)	(0.190)	(0.217)	(0.184)	(0.180)	(0.165)	(0.141)	(0.106)	(0.109)	(0.155)
GENDER (1=female)	0.20	0.33*	0.08	0.23	0.20	0.01	0.21	0.47***	0.24***	0.23**	0.11	-0.06
	(0.107)	(0.162)	(0.177)	(0.170)	(0.175)	(0.190)	(0.121)	(0.109)	(0.069)	(0.073)	(0.100)	(0.082)
SES	0.29***	0.25*	0.28	0.36***	0.26*	0.29***	0.27***	0.25**	0.18**	0.21***	0.24***	0.24***
	(0.068)	(0.128)	(0.152)	(0.072)	(0.115)	(0.074)	(0.079)	(0.078)	(0.057)	(0.044)	(0.057)	(0.066)
SCHOOL TYPE	0.01	-0.14	-0.03	-0.12	0.08	0.17	-0.17	-0.09	0.08	0.02	-0.01	0.02
	(0.133)	(0.192)	(0.266)	(0.195)	(0.282)	(0.259)	(0.154)	(0.175)	(0.114)	(0.090)	(0.105)	(0.104)
STU-TEA RATIO	0.02	0.04**	0.03	0.02	0.02	0.01	0.01	0.02	0.02*	0.01	0.00	0.01
	(0.012)	(0.012)	(0.025)	(0.016)	(0.023)	(0.011)	(0.014)	(0.014)	(0.009)	(0.010)	(0.012)	(0.016)
SCHOOL CHOICE	0.00	-0.07	0.06	-0.03	0.06	-0.05	-0.08	0.04	-0.00	0.00	0.07	-0.07
	(0.174)	(0.271)	(0.386)	(0.188)	(0.269)	(0.190)	(0.198)	(0.151)	(0.121)	(0.073)	(0.112)	(0.151)
PRESCORE	0.31***	0.36***	0.30***	0.31***	0.33***	0.29***	0.31***	0.32***	0.29***	0.31***	0.30***	0.36***
	(0.032)	(0.075)	(0.058)	(0.045)	(0.051)	(0.056)	(0.037)	(0.041)	(0.034)	(0.032)	(0.024)	(0.028)
SELF-STUDY	-0.06	-0.27	0.05	0.15	0.07	-0.19	-0.03	-0.21	0.10	0.16	0.02	0.06
	(0.158)	(0.263)	(0.241)	(0.158)	(0.159)	(0.176)	(0.176)	(0.135)	(0.148)	(0.109)	(0.114)	(0.132)
SELF-ESTEEM	0.33***	0.43	0.35*	0.33***	0.31**	0.24	0.28**	0.37***	0.27***	0.29***	0.28**	0.15
	(0.094)	(0.317)	(0.163)	(0.093)	(0.103)	(0.127)	(0.108)	(0.082)	(0.080)	(0.069)	(0.086)	(0.095)
Verbal PT in grade 10	-0.10	-0.00	-0.12	-0.08	-0.00	-0.07	-0.18	0.16	0.08	0.04	0.05	-0.06
	(0.115)	(0.148)	(0.177)	(0.142)	(0.150)	(0.136)	(0.136)	(0.112)	(0.090)	(0.103)	(0.121)	(0.123)
Verbal PT in grade 11	0.13	0.04	0.00	0.16	0.26	0.41**	0.05	0.02	0.05	0.08	0.10	0.06
	(0.143)	(0.267)	(0.299)	(0.168)	(0.266)	(0.149)	(0.163)	(0.141)	(0.100)	(0.101)	(0.098)	(0.123)
Verbal PT in grade 12	0.57**	0.27	0.82	0.56	0.37	0.59**	0.53**	0.35*	0.18	0.39*	0.36*	0.20
	(0.180)	(0.247)	(0.437)	(0.302)	(0.351)	(0.200)	(0.200)	(0.148)	(0.139)	(0.158)	(0.145)	(0.211)
Constant	3.34***	0.80	2.34*	3.50***	4.25***	5.88***	3.35***	1.01	2.30***	3.27***	4.55***	5.60***
	(0.492)	(0.685)	(1.167)	(0.761)	(0.782)	(0.757)	(0.568)	(0.533)	(0.396)	(0.257)	(0.353)	(0.496)
Observations	791	791	791	791	791	791	635	2,178	2,178	2,178	2,178	2,178
R-squared	0.254						0.204					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table N.5. Long-term heterogeneous effects of two years verbal tutoring in middle school on the CSAT verbal achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of Verbal PT in middle school	-0.21*	-0.25	-0.13	-0.30**	-0.39**	-0.21	-0.28	-0.29	-0.20	-0.21	-0.23	-0.18
	(0.103)	(0.195)	(0.123)	(0.114)	(0.143)	(0.158)	(0.222)	(0.206)	(0.169)	(0.108)	(0.217)	(0.169)
URBAN	-0.14	-0.24	-0.01	-0.43*	-0.18	-0.18	-0.14	-0.09	-0.07	-0.09	0.10	-0.09
	(0.144)	(0.354)	(0.278)	(0.206)	(0.202)	(0.212)	(0.160)	(0.174)	(0.158)	(0.091)	(0.155)	(0.127)
GENDER (1=female)	0.40***	0.44*	0.39*	0.38**	0.51**	0.25	0.39***	0.45***	0.23**	0.22***	0.10	-0.07
	(0.100)	(0.185)	(0.158)	(0.129)	(0.170)	(0.166)	(0.115)	(0.125)	(0.081)	(0.065)	(0.103)	(0.102)
SES	0.26***	0.38**	0.16	0.23*	0.18**	0.30**	0.24**	0.25**	0.19***	0.21***	0.24***	0.24**
	(0.067)	(0.118)	(0.131)	(0.095)	(0.063)	(0.096)	(0.075)	(0.089)	(0.056)	(0.053)	(0.046)	(0.078)
SCHOOL TYPE	0.03	-0.21	0.05	-0.12	0.14	0.14	0.01	-0.08	0.08	0.02	-0.01	0.02
	(0.128)	(0.269)	(0.272)	(0.169)	(0.188)	(0.270)	(0.144)	(0.174)	(0.084)	(0.058)	(0.114)	(0.082)
STU-TEA RATIO	0.01	0.01	0.03*	0.01	0.00	-0.02	0.01	0.02	0.02	0.01	0.00	0.01
	(0.011)	(0.019)	(0.012)	(0.017)	(0.010)	(0.018)	(0.013)	(0.014)	(0.012)	(0.012)	(0.010)	(0.015)
SCHOOL CHOICE	-0.14	-0.16	-0.02	-0.31	-0.12	-0.34	-0.14	0.04	-0.00	0.00	0.07	-0.07
	(0.154)	(0.315)	(0.274)	(0.211)	(0.169)	(0.237)	(0.171)	(0.215)	(0.173)	(0.097)	(0.148)	(0.136)
PRESCORE	0.31***	0.27***	0.32***	0.30***	0.32***	0.35***	0.31***	0.32***	0.29***	0.31***	0.30***	0.36***
	(0.029)	(0.050)	(0.039)	(0.041)	(0.048)	(0.049)	(0.033)	(0.045)	(0.022)	(0.023)	(0.026)	(0.043)
SELF-STUDY	-0.06	-0.19	0.11	0.06	-0.05	-0.31	-0.02	-0.20	0.11	0.17*	0.03	0.07
	(0.141)	(0.269)	(0.291)	(0.121)	(0.175)	(0.299)	(0.156)	(0.158)	(0.139)	(0.082)	(0.119)	(0.176)
SELF-ESTEEM	0.31***	0.39*	0.47***	0.34***	0.26*	0.09	0.25*	0.37**	0.27***	0.29***	0.27**	0.15
	(0.089)	(0.189)	(0.128)	(0.088)	(0.130)	(0.134)	(0.101)	(0.114)	(0.067)	(0.064)	(0.086)	(0.102)
Verbal PT in grade 10	-0.01	-0.10	-0.11	0.14	0.01	-0.07	0.07	0.15	0.08	0.04	0.04	-0.06
	(0.106)	(0.210)	(0.143)	(0.135)	(0.130)	(0.132)	(0.126)	(0.118)	(0.088)	(0.093)	(0.111)	(0.116)
Verbal PT in grade 11	-0.02	0.04	-0.12	-0.01	0.20	-0.02	-0.11	0.02	0.05	0.08	0.10	0.06
	(0.129)	(0.244)	(0.219)	(0.197)	(0.152)	(0.192)	(0.145)	(0.126)	(0.110)	(0.064)	(0.103)	(0.087)
Verbal PT in grade 12	0.40*	0.56***	0.39	0.23	0.36*	0.34	0.52**	0.33*	0.17	0.37**	0.34**	0.18
	(0.167)	(0.162)	(0.259)	(0.237)	(0.178)	(0.232)	(0.181)	(0.152)	(0.141)	(0.139)	(0.129)	(0.203)
Constant	3.38***	1.74*	1.72*	3.82***	4.32***	6.29***	3.38***	1.01*	2.30***	3.28***	4.55***	5.60***
	(0.449)	(0.884)	(0.732)	(0.569)	(0.598)	(0.821)	(0.514)	(0.467)	(0.392)	(0.307)	(0.469)	(0.425)
Observations	925	925	925	925	925	925	722	2,178	2,178	2,178	2,178	2,178
R-squared	0.222						0.214					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table N.6. Long-term heterogeneous effects of three years verbal tutoring in middle school on the CSAT verbal achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of Verbal PT in middle school	-0.26**	-0.13	-0.11	-0.26	-0.35*	-0.39**	-0.47*	-0.41*	-0.28	-0.29	-0.32	-0.25
	(0.098)	(0.219)	(0.102)	(0.138)	(0.142)	(0.148)	(0.192)	(0.202)	(0.205)	(0.152)	(0.198)	(0.246)
URBAN	-0.13	-0.10	-0.16	-0.14	-0.09	-0.18	-0.14	-0.10	-0.08	-0.10	0.10	-0.10
	(0.127)	(0.194)	(0.179)	(0.114)	(0.148)	(0.227)	(0.140)	(0.201)	(0.153)	(0.121)	(0.167)	(0.193)
GENDER (1=female)	0.18*	0.19	0.26	0.21	0.04	-0.05	0.13	0.44***	0.22**	0.21**	0.09	-0.08
	(0.088)	(0.196)	(0.136)	(0.123)	(0.190)	(0.176)	(0.099)	(0.097)	(0.073)	(0.064)	(0.086)	(0.113)
SES	0.19**	0.14	0.19*	0.10	0.25*	0.24**	0.19**	0.26**	0.19***	0.21***	0.25***	0.25**
	(0.060)	(0.118)	(0.075)	(0.090)	(0.102)	(0.081)	(0.066)	(0.084)	(0.054)	(0.042)	(0.041)	(0.085)
SCHOOL TYPE	-0.02	0.29	0.29*	-0.02	-0.18	-0.22	-0.15	-0.07	0.09	0.03	0.00	0.03
	(0.114)	(0.205)	(0.115)	(0.129)	(0.227)	(0.145)	(0.126)	(0.175)	(0.100)	(0.084)	(0.139)	(0.123)
STU-TEA RATIO	0.02*	0.02	0.03*	0.02	0.01	0.02**	0.02*	0.02	0.02	0.02	0.00	0.01
	(0.011)	(0.015)	(0.014)	(0.012)	(0.013)	(0.009)	(0.012)	(0.013)	(0.013)	(0.010)	(0.011)	(0.017)
SCHOOL CHOICE	-0.08	-0.17	-0.24	-0.05	0.12	0.07	-0.04	0.03	-0.01	-0.00	0.06	-0.08
	(0.139)	(0.229)	(0.204)	(0.166)	(0.192)	(0.166)	(0.151)	(0.177)	(0.117)	(0.130)	(0.150)	(0.178)
PRESCORE	0.29***	0.29***	0.26***	0.27***	0.33***	0.35***	0.30***	0.32***	0.29***	0.31***	0.30***	0.36***
	(0.027)	(0.032)	(0.038)	(0.037)	(0.034)	(0.039)	(0.030)	(0.038)	(0.028)	(0.025)	(0.025)	(0.028)
SELF-STUDY	-0.02	-0.17	0.15	0.03	0.01	-0.07	0.05	-0.21	0.10	0.16	0.02	0.06
	(0.127)	(0.252)	(0.141)	(0.174)	(0.151)	(0.232)	(0.137)	(0.121)	(0.142)	(0.117)	(0.149)	(0.139)
SELF-ESTEEM	0.43***	0.52***	0.45***	0.50***	0.34***	0.23	0.38***	0.39**	0.28**	0.30***	0.29***	0.16
	(0.080)	(0.151)	(0.103)	(0.070)	(0.095)	(0.146)	(0.089)	(0.118)	(0.087)	(0.052)	(0.075)	(0.093)
Verbal PT in grade 10	0.10	0.16	0.13	0.08	0.11	0.06	0.15	0.20	0.11	0.07	0.08	-0.04
	(0.095)	(0.182)	(0.104)	(0.172)	(0.150)	(0.135)	(0.113)	(0.146)	(0.095)	(0.090)	(0.104)	(0.128)
Verbal PT in grade 11	0.04	0.12	-0.07	0.06	0.15	0.17	0.02	0.02	0.05	0.08	0.10	0.06
	(0.113)	(0.202)	(0.141)	(0.170)	(0.188)	(0.164)	(0.124)	(0.136)	(0.104)	(0.093)	(0.122)	(0.113)
Verbal PT in grade 12	0.32*	0.11	-0.04	0.43*	0.39	0.30	0.36*	0.33	0.17	0.37***	0.34***	0.18
	(0.141)	(0.308)	(0.272)	(0.202)	(0.269)	(0.265)	(0.150)	(0.184)	(0.095)	(0.093)	(0.091)	(0.147)
Constant	3.52***	1.76**	2.49***	3.70***	4.56***	5.23***	3.55***	1.03*	2.32***	3.29***	4.56***	5.61***
	(0.416)	(0.635)	(0.661)	(0.441)	(0.689)	(0.609)	(0.467)	(0.453)	(0.409)	(0.414)	(0.393)	(0.468)
Observations	1,114	1,114	1,114	1,114	1,114	1,114	909	2,178	2,178	2,178	2,178	2,178
R-squared	0.212						0.210					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table N.7. Long-term heterogeneous effects of one year English tutoring in middle school on the CSAT English achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of English PT in middle school	-0.18	-0.19	-0.15	-0.09	-0.31	-0.36	-0.02	0.36*	0.26*	0.33***	0.30**	0.61*
	(0.180)	(0.460)	(0.323)	(0.254)	(0.310)	(0.419)	(0.521)	(0.161)	(0.130)	(0.084)	(0.113)	(0.261)
URBAN	-0.44	-0.77	-0.33	-0.28	-0.23	-0.41	-0.62*	0.04	-0.23*	-0.26**	-0.13	0.02
	(0.273)	(0.567)	(0.436)	(0.263)	(0.438)	(0.484)	(0.305)	(0.230)	(0.107)	(0.083)	(0.120)	(0.172)
GENDER (1=female)	0.38*	0.28	0.40	0.31	0.53*	0.59	0.17	0.40***	0.24***	0.18**	0.06	0.01
	(0.178)	(0.419)	(0.233)	(0.165)	(0.229)	(0.312)	(0.203)	(0.110)	(0.056)	(0.066)	(0.106)	(0.111)
SES	0.15	0.09	0.22	0.36*	0.35	0.07	0.03	0.26*	0.31***	0.43***	0.44***	0.36***
	(0.139)	(0.335)	(0.167)	(0.164)	(0.215)	(0.269)	(0.167)	(0.109)	(0.066)	(0.067)	(0.052)	(0.081)
SCHOOL TYPE	0.38	0.14	0.48	0.51	0.15	0.59	0.21	-0.00	0.20*	0.09	0.02	0.26
	(0.234)	(0.797)	(0.299)	(0.384)	(0.384)	(0.540)	(0.262)	(0.195)	(0.092)	(0.116)	(0.136)	(0.181)
STU-TEA RATIO	0.02	0.03	0.02	0.00	0.02	0.06	0.02	0.02	0.02	0.01	0.00	-0.00
	(0.018)	(0.045)	(0.031)	(0.021)	(0.016)	(0.034)	(0.021)	(0.019)	(0.010)	(0.008)	(0.010)	(0.017)
SCHOOL CHOICE	-0.29	-0.73	-0.32	-0.35	-0.01	-0.04	-0.29	-0.00	-0.21*	-0.21*	-0.14	-0.26
	(0.284)	(0.496)	(0.384)	(0.378)	(0.470)	(0.570)	(0.317)	(0.241)	(0.100)	(0.097)	(0.130)	(0.150)
PRESCORE	0.25***	0.18	0.28***	0.23**	0.25**	0.34**	0.30***	0.31***	0.32***	0.31***	0.28***	0.21***
	(0.052)	(0.106)	(0.084)	(0.070)	(0.094)	(0.129)	(0.060)	(0.052)	(0.016)	(0.024)	(0.034)	(0.042)
SELF-STUDY	-0.13	-0.87	-0.28	0.00	0.13	-0.45	0.02	0.25	0.05	0.04	0.14	0.18
	(0.323)	(0.930)	(0.471)	(0.702)	(0.410)	(0.363)	(0.378)	(0.176)	(0.127)	(0.096)	(0.148)	(0.134)
SELF-ESTEEM	0.47**	0.32	0.50	0.52**	0.45*	0.41	0.32	0.39***	0.29***	0.32***	0.30***	0.29**
	(0.156)	(0.414)	(0.262)	(0.188)	(0.179)	(0.273)	(0.179)	(0.082)	(0.067)	(0.087)	(0.086)	(0.112)
English PT in grade 10	0.04	0.32	0.33	0.01	-0.08	-0.09	0.09	0.50**	0.26**	0.11	-0.06	-0.06
	(0.188)	(0.461)	(0.206)	(0.190)	(0.249)	(0.265)	(0.221)	(0.156)	(0.085)	(0.119)	(0.138)	(0.157)
English PT in grade 11	0.44*	0.89	0.28	0.46	0.38	0.62	0.42	0.51***	0.19*	0.09	0.19	0.15
	(0.216)	(0.455)	(0.383)	(0.407)	(0.361)	(0.354)	(0.266)	(0.147)	(0.083)	(0.098)	(0.112)	(0.161)
English PT in grade 12	0.35	0.75	0.05	0.14	0.74*	0.34	0.15	0.20	0.29**	0.24**	0.13	-0.05
	(0.289)	(0.578)	(0.450)	(0.502)	(0.363)	(0.504)	(0.338)	(0.143)	(0.095)	(0.085)	(0.071)	(0.112)
Constant	3.16***	2.13	1.92	3.73***	3.44*	2.99	3.14**	-0.33	1.75***	2.92***	4.30***	5.67***
	(0.819)	(1.439)	(1.117)	(1.006)	(1.423)	(1.844)	(0.959)	(0.717)	(0.249)	(0.240)	(0.318)	(0.655)
Observations	343	343	343	343	343	343	260	2,172	2,172	2,172	2,172	2,172
R-squared	0.203						0.203					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table N.8. Long-term heterogeneous effects of two years English tutoring in middle school on the CSAT English achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of English PT in middle school	-0.13	-0.45	-0.30	-0.16	-0.37	-0.19	0.54	0.45	0.32	0.42**	0.38*	0.77*
	(0.163)	(0.403)	(0.266)	(0.167)	(0.285)	(0.283)	(0.408)	(0.272)	(0.258)	(0.136)	(0.185)	(0.362)
URBAN	0.03	0.63	-0.15	-0.15	-0.14	-0.22	-0.19	0.07	-0.21*	-0.23*	-0.11	0.07
	(0.189)	(0.389)	(0.327)	(0.175)	(0.215)	(0.388)	(0.220)	(0.203)	(0.087)	(0.099)	(0.171)	(0.217)
GENDER (1=female)	0.14	0.39	0.21	0.10	0.04	-0.28	0.18	0.40**	0.24**	0.18*	0.06	0.02
	(0.132)	(0.231)	(0.117)	(0.149)	(0.100)	(0.292)	(0.154)	(0.125)	(0.092)	(0.070)	(0.059)	(0.091)
SES	0.30**	0.38	0.54***	0.32***	0.36**	0.21	0.23*	0.23**	0.29***	0.40***	0.42***	0.31**
	(0.096)	(0.231)	(0.112)	(0.091)	(0.111)	(0.142)	(0.112)	(0.081)	(0.070)	(0.052)	(0.062)	(0.112)
SCHOOL TYPE	0.16	-0.24	0.20	0.21	-0.03	0.39	0.03	-0.02	0.19*	0.07	0.01	0.23
	(0.173)	(0.337)	(0.264)	(0.242)	(0.281)	(0.391)	(0.200)	(0.142)	(0.091)	(0.098)	(0.163)	(0.162)
STU-TEA RATIO	-0.00	-0.00	0.00	-0.00	-0.00	0.02	-0.01	0.02	0.02	0.01	0.01	0.00
	(0.015)	(0.031)	(0.024)	(0.014)	(0.020)	(0.028)	(0.017)	(0.020)	(0.014)	(0.011)	(0.010)	(0.011)
SCHOOL CHOICE	-0.34	0.35	-0.51	-0.48**	-0.73**	-0.54*	-0.49*	0.00	-0.21*	-0.20*	-0.13	-0.25
	(0.201)	(0.439)	(0.350)	(0.179)	(0.272)	(0.247)	(0.233)	(0.188)	(0.103)	(0.096)	(0.177)	(0.189)
PRESCORE	0.27***	0.35***	0.32***	0.30***	0.33***	0.20**	0.28***	0.30***	0.31***	0.30***	0.28***	0.20***
	(0.039)	(0.068)	(0.035)	(0.056)	(0.056)	(0.077)	(0.047)	(0.045)	(0.025)	(0.023)	(0.028)	(0.026)
SELF-STUDY	0.19	-0.00	0.13	0.25	0.13	0.24	0.05	0.25	0.05	0.04	0.14	0.17
	(0.220)	(0.405)	(0.372)	(0.284)	(0.258)	(0.349)	(0.261)	(0.157)	(0.096)	(0.063)	(0.128)	(0.152)
SELF-ESTEEM	0.30*	0.55*	0.35	0.18	0.24	0.35*	0.22	0.40**	0.29***	0.32***	0.30***	0.30**
	(0.119)	(0.240)	(0.188)	(0.164)	(0.131)	(0.155)	(0.143)	(0.134)	(0.051)	(0.072)	(0.079)	(0.112)
English PT in grade 10	0.05	-0.02	0.03	0.14	0.01	0.16	0.01	0.47**	0.24*	0.09	-0.09	-0.11
	(0.142)	(0.304)	(0.159)	(0.186)	(0.161)	(0.272)	(0.174)	(0.181)	(0.108)	(0.070)	(0.101)	(0.160)
English PT in grade 11	0.42**	0.61	0.43**	0.39	0.39	0.31	0.34	0.51**	0.19	0.09	0.20	0.15
	(0.154)	(0.354)	(0.161)	(0.273)	(0.258)	(0.347)	(0.184)	(0.167)	(0.106)	(0.104)	(0.123)	(0.120)
English PT in grade 12	0.15	0.64	0.24	0.07	0.13	-0.07	0.12	0.20	0.29**	0.24*	0.13	-0.05
	(0.183)	(0.341)	(0.172)	(0.203)	(0.284)	(0.333)	(0.213)	(0.172)	(0.099)	(0.096)	(0.129)	(0.126)
Constant	3.69***	-0.10	2.79**	3.85***	5.43***	6.91***	3.58***	-0.36	1.73***	2.89***	4.28***	5.62***
	(0.587)	(1.178)	(0.895)	(0.537)	(0.797)	(1.020)	(0.713)	(0.766)	(0.502)	(0.409)	(0.443)	(0.584)
Observations	595	595	595	595	595	595	462	2,172	2,172	2,172	2,172	2,172
R-squared	0.204						0.173					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table N.9. Long-term heterogeneous effects of three years English tutoring in middle school on the CSAT English achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of English PT in middle school	0.09	-0.00	0.11	0.19	0.02	0.03	-0.47*	-0.41*	-0.28	-0.29	-0.32	-0.25
	(0.132)	(0.379)	(0.219)	(0.151)	(0.169)	(0.164)	(0.192)	(0.202)	(0.205)	(0.152)	(0.198)	(0.246)
URBAN	0.02	0.05	-0.12	-0.08	0.09	0.19	-0.14	-0.10	-0.08	-0.10	0.10	-0.10
	(0.103)	(0.253)	(0.121)	(0.132)	(0.139)	(0.174)	(0.140)	(0.201)	(0.153)	(0.121)	(0.167)	(0.193)
GENDER (1=female)	0.21**	0.32***	0.30***	0.25***	0.06	0.08	0.13	0.44***	0.22**	0.21**	0.09	-0.08
	(0.071)	(0.081)	(0.072)	(0.074)	(0.088)	(0.115)	(0.099)	(0.097)	(0.073)	(0.064)	(0.086)	(0.113)
SES	0.41***	0.22	0.33***	0.49***	0.47***	0.53***	0.19**	0.26**	0.19***	0.21***	0.25***	0.25**
	(0.049)	(0.118)	(0.077)	(0.068)	(0.070)	(0.081)	(0.066)	(0.084)	(0.054)	(0.042)	(0.041)	(0.085)
SCHOOL TYPE	0.07	0.04	0.22	0.08	0.10	-0.00	-0.15	-0.07	0.09	0.03	0.00	0.03
	(0.090)	(0.203)	(0.147)	(0.172)	(0.142)	(0.096)	(0.126)	(0.175)	(0.100)	(0.084)	(0.139)	(0.123)
STU-TEA RATIO	0.01	0.01	0.02	0.01	0.01	0.00	0.02*	0.02	0.02	0.02	0.00	0.01
	(0.009)	(0.016)	(0.014)	(0.013)	(0.013)	(0.019)	(0.012)	(0.013)	(0.013)	(0.010)	(0.011)	(0.017)
SCHOOL CHOICE	-0.11	-0.18	-0.13	-0.06	-0.10	-0.25	-0.04	0.03	-0.01	-0.00	0.06	-0.08
	(0.111)	(0.270)	(0.116)	(0.114)	(0.140)	(0.207)	(0.151)	(0.177)	(0.117)	(0.130)	(0.150)	(0.178)
PRESCORE	0.28***	0.29***	0.29***	0.31***	0.26***	0.18***	0.30***	0.32***	0.29***	0.31***	0.30***	0.36***
	(0.023)	(0.063)	(0.028)	(0.035)	(0.040)	(0.051)	(0.030)	(0.038)	(0.028)	(0.025)	(0.025)	(0.028)
SELF-STUDY	0.12	0.27	-0.02	-0.09	0.18	0.18	0.05	-0.21	0.10	0.16	0.02	0.06
	(0.097)	(0.161)	(0.130)	(0.110)	(0.113)	(0.169)	(0.137)	(0.121)	(0.142)	(0.117)	(0.149)	(0.139)
SELF-ESTEEM	0.40***	0.51***	0.45***	0.39**	0.40***	0.36**	0.38***	0.39**	0.28**	0.30***	0.29***	0.16
	(0.064)	(0.130)	(0.097)	(0.118)	(0.109)	(0.131)	(0.089)	(0.118)	(0.087)	(0.052)	(0.075)	(0.093)
English PT in grade 10	0.13	0.37	0.18	0.13	-0.04	0.02	0.15	0.20	0.11	0.07	0.08	-0.04
	(0.087)	(0.232)	(0.156)	(0.112)	(0.103)	(0.146)	(0.113)	(0.146)	(0.095)	(0.090)	(0.104)	(0.128)
English PT in grade 11	0.14	0.31	0.11	0.01	0.01	0.09	0.02	0.02	0.05	0.08	0.10	0.06
	(0.082)	(0.182)	(0.116)	(0.099)	(0.141)	(0.141)	(0.124)	(0.136)	(0.104)	(0.093)	(0.122)	(0.113)
English PT in grade 12	0.23**	0.36***	0.31***	0.28**	0.18	0.13	0.36*	0.33	0.17	0.37***	0.34***	0.18
	(0.082)	(0.085)	(0.066)	(0.099)	(0.108)	(0.198)	(0.150)	(0.184)	(0.095)	(0.093)	(0.091)	(0.147)
Constant	3.05***	1.03	1.89***	2.80***	4.60***	6.17***	3.55***	1.03*	2.32***	3.29***	4.56***	5.61***
	(0.347)	(0.596)	(0.405)	(0.347)	(0.330)	(0.613)	(0.467)	(0.453)	(0.409)	(0.414)	(0.393)	(0.468)
Observations	1,678	1,678	1,678	1,678	1,678	1,678	909	2,178	2,178	2,178	2,178	2,178
R-squared	0.257						0.210					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table N.10. Long-term heterogeneous effects of one year math tutoring in middle school on the CSAT math achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of Math PT in middle school	-0.04	0.06	-0.24	-0.06	0.13	0.14	-0.34	0.03	0.14	0.19*	0.13	0.21
	(0.192)	(0.244)	(0.339)	(0.229)	(0.249)	(0.254)	(0.475)	(0.122)	(0.105)	(0.088)	(0.072)	(0.126)
URBAN	-0.23	0.04	-0.19	-0.15	-0.60	-0.34	-0.47	-0.31	-0.31*	-0.26*	-0.19	-0.22
	(0.291)	(0.659)	(0.363)	(0.521)	(0.417)	(0.329)	(0.322)	(0.193)	(0.135)	(0.117)	(0.135)	(0.187)
GENDER (1=female)	-0.52**	-0.10	-0.33	-0.80***	-0.44*	-0.64*	-0.74***	-0.07	-0.22*	-0.30**	-0.41***	-0.26*
	(0.192)	(0.244)	(0.267)	(0.191)	(0.220)	(0.254)	(0.216)	(0.144)	(0.100)	(0.115)	(0.102)	(0.131)
SES	0.19	0.06	0.27	0.21	0.22*	0.45**	0.14	0.15	0.12	0.28***	0.29***	0.24*
	(0.140)	(0.292)	(0.252)	(0.201)	(0.095)	(0.161)	(0.151)	(0.079)	(0.096)	(0.071)	(0.073)	(0.102)
SCHOOL TYPE	-0.11	-0.24	-0.60	-0.20	-0.02	0.50	-0.09	0.21	-0.05	-0.09	0.14	0.12
	(0.265)	(0.491)	(0.350)	(0.527)	(0.484)	(0.437)	(0.290)	(0.124)	(0.092)	(0.147)	(0.146)	(0.201)
STU-TEA RATIO	0.02	0.03	0.04	0.01	0.01	0.02	0.02	0.01	0.01	0.00	-0.00	0.02
	(0.020)	(0.018)	(0.022)	(0.026)	(0.035)	(0.031)	(0.022)	(0.011)	(0.012)	(0.011)	(0.017)	(0.014)
SCHOOL CHOICE	0.07	0.13	-0.03	0.14	-0.14	0.29	-0.17	-0.22	-0.17	-0.24*	-0.16	-0.25
	(0.306)	(0.553)	(0.343)	(0.537)	(0.625)	(0.357)	(0.335)	(0.169)	(0.133)	(0.112)	(0.132)	(0.201)
PRESCORE	0.33***	0.25*	0.27**	0.37***	0.41***	0.35***	0.35***	0.23***	0.20***	0.26***	0.28***	0.27***
	(0.058)	(0.104)	(0.103)	(0.054)	(0.075)	(0.092)	(0.063)	(0.047)	(0.036)	(0.026)	(0.030)	(0.032)
SELF-STUDY	0.06	0.02	0.22	-0.03	-0.03	-0.41	0.15	0.21	0.28*	0.26*	0.21	0.08
	(0.316)	(0.565)	(0.524)	(0.447)	(0.487)	(0.448)	(0.359)	(0.207)	(0.127)	(0.109)	(0.133)	(0.155)
SELF-ESTEEM	0.03	0.33	-0.13	-0.34	0.17	0.26	-0.12	0.21	0.11	0.03	0.07	0.22*
	(0.173)	(0.294)	(0.225)	(0.183)	(0.246)	(0.189)	(0.194)	(0.121)	(0.103)	(0.100)	(0.097)	(0.101)
Math PT in grade 10	0.13	0.29	0.42	0.10	0.12	0.11	0.33	0.47**	0.51***	0.27*	0.16	-0.04
	(0.206)	(0.326)	(0.260)	(0.316)	(0.264)	(0.223)	(0.239)	(0.149)	(0.137)	(0.132)	(0.109)	(0.200)
Math PT in grade 11	0.66**	1.31***	0.90*	0.85*	0.50	-0.15	0.69**	0.71***	0.70***	0.49***	0.47***	0.46**
	(0.230)	(0.342)	(0.408)	(0.362)	(0.442)	(0.242)	(0.255)	(0.097)	(0.125)	(0.094)	(0.131)	(0.153)
Math PT in grade 12	0.39	-0.21	-0.39	0.42	0.85*	0.87**	0.06	0.65***	0.64***	0.64***	0.46***	0.34**
	(0.291)	(0.465)	(0.548)	(0.416)	(0.365)	(0.293)	(0.325)	(0.155)	(0.094)	(0.093)	(0.138)	(0.117)
Constant	3.06***	0.22	1.86	3.45**	4.33***	5.33***	3.89***	1.21**	2.32***	3.78***	4.93***	5.52***
	(0.858)	(1.167)	(1.503)	(1.323)	(1.227)	(1.091)	(0.974)	(0.440)	(0.530)	(0.536)	(0.578)	(0.510)
Observations	344	344	344	344	344	344	266	2,145	2,145	2,145	2,145	2,145
R-squared	0.235						0.258					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table N.11. Long-term heterogeneous effects of two years math tutoring in middle school on the CSAT math achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of Math PT in middle school	0.13	0.36	0.09	0.10	0.15	-0.05	0.13	0.05	0.22	0.31*	0.21	0.34
	(0.166)	(0.440)	(0.184)	(0.215)	(0.331)	(0.276)	(0.442)	(0.230)	(0.201)	(0.157)	(0.166)	(0.326)
URBAN	-0.07	0.15	-0.10	-0.29	-0.23	0.21	-0.17	-0.31	-0.31	-0.26*	-0.19	-0.22
	(0.206)	(0.525)	(0.214)	(0.215)	(0.267)	(0.300)	(0.238)	(0.190)	(0.174)	(0.103)	(0.139)	(0.191)
GENDER (1=female)	0.13	0.36	0.25	0.04	0.12	-0.01	-0.36*	-0.07	-0.21*	-0.30***	-0.40***	-0.25
	(0.138)	(0.306)	(0.236)	(0.188)	(0.174)	(0.272)	(0.161)	(0.145)	(0.093)	(0.088)	(0.122)	(0.137)
SES	0.05	-0.09	0.09	0.16	0.11	-0.05	0.14	0.15*	0.12	0.27***	0.28***	0.23**
	(0.104)	(0.348)	(0.173)	(0.158)	(0.130)	(0.147)	(0.112)	(0.069)	(0.091)	(0.061)	(0.073)	(0.083)
SCHOOL TYPE	0.31	-0.09	0.10	0.17	0.45	0.77	0.05	0.21	-0.06	-0.10	0.13	0.11
	(0.175)	(0.440)	(0.237)	(0.253)	(0.319)	(0.426)	(0.208)	(0.129)	(0.079)	(0.114)	(0.132)	(0.188)
STU-TEA RATIO	-0.00	0.00	0.00	-0.00	-0.01	0.00	0.02	0.01	0.01	0.00	-0.00	0.02*
	(0.014)	(0.034)	(0.014)	(0.014)	(0.021)	(0.018)	(0.018)	(0.018)	(0.013)	(0.011)	(0.012)	(0.009)
SCHOOL CHOICE	-0.14	-0.00	-0.16	-0.35	-0.41	-0.07	-0.07	-0.22	-0.17	-0.24	-0.16	-0.25
	(0.213)	(0.683)	(0.280)	(0.253)	(0.304)	(0.295)	(0.243)	(0.249)	(0.177)	(0.127)	(0.147)	(0.177)
PRESCORE	0.24***	0.26**	0.26***	0.27***	0.24***	0.23**	0.25***	0.23***	0.20***	0.26***	0.28***	0.26***
	(0.039)	(0.090)	(0.040)	(0.050)	(0.067)	(0.077)	(0.049)	(0.035)	(0.039)	(0.021)	(0.029)	(0.027)
SELF-STUDY	0.17	0.52*	0.15	-0.10	0.20	-0.15	0.03	0.20	0.28*	0.25*	0.20	0.07
	(0.231)	(0.262)	(0.236)	(0.253)	(0.386)	(0.425)	(0.259)	(0.192)	(0.130)	(0.107)	(0.143)	(0.126)
SELF-ESTEEM	0.24	0.30	0.19	0.22	0.28	0.23	0.23	0.21	0.11	0.04	0.07	0.23*
	(0.130)	(0.247)	(0.213)	(0.203)	(0.174)	(0.171)	(0.147)	(0.128)	(0.107)	(0.096)	(0.093)	(0.102)
Math PT in grade 10	0.03	0.21	0.23	0.11	-0.08	-0.21	0.35	0.46*	0.48**	0.24	0.14	-0.08
	(0.155)	(0.297)	(0.181)	(0.205)	(0.298)	(0.327)	(0.197)	(0.213)	(0.165)	(0.148)	(0.133)	(0.120)
Math PT in grade 11	0.21	0.56	0.17	0.06	0.32	-0.29	0.41*	0.70***	0.69***	0.47**	0.46***	0.44**
	(0.158)	(0.333)	(0.142)	(0.201)	(0.285)	(0.325)	(0.194)	(0.152)	(0.136)	(0.168)	(0.119)	(0.152)
Math PT in grade 12	0.36*	-0.14	0.28	0.44	0.43	0.68*	0.89***	0.65***	0.63***	0.63***	0.45***	0.33**
	(0.175)	(0.416)	(0.275)	(0.257)	(0.250)	(0.289)	(0.214)	(0.174)	(0.116)	(0.097)	(0.110)	(0.116)
Constant	3.40***	0.64	2.29***	3.85***	4.84***	5.53***	3.30***	1.21	2.29***	3.75***	4.91***	5.48***
	(0.598)	(2.029)	(0.592)	(0.610)	(0.945)	(0.783)	(0.730)	(0.684)	(0.433)	(0.411)	(0.536)	(0.512)
Observations	421	421	421	421	421	421	466	2,145	2,145	2,145	2,145	2,145
R-squared	0.181						0.230					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table N.12. Long-term heterogeneous effects of three years math tutoring in middle school on the CSAT math achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of Math PT in middle school	-0.15	-0.07	-0.04	-0.26	-0.37*	-0.24	0.56	0.12	0.51	0.71	0.48	0.77
	(0.143)	(0.267)	(0.250)	(0.194)	(0.185)	(0.160)	(0.461)	(0.366)	(0.415)	(0.449)	(0.556)	(0.598)
URBAN	-0.07	-0.27	-0.26	-0.02	0.05	0.06	-0.19	-0.31	-0.30	-0.25*	-0.18	-0.21
	(0.109)	(0.184)	(0.136)	(0.123)	(0.180)	(0.211)	(0.120)	(0.196)	(0.167)	(0.110)	(0.124)	(0.151)
GENDER (1=female)	-0.20**	-0.12	-0.19	-0.22*	-0.27**	-0.35**	-0.21*	-0.07	-0.20*	-0.28**	-0.39***	-0.24*
	(0.076)	(0.122)	(0.118)	(0.087)	(0.093)	(0.130)	(0.086)	(0.145)	(0.092)	(0.100)	(0.096)	(0.102)
SES	0.23***	0.20**	0.15	0.30***	0.30**	0.36***	0.19**	0.15*	0.11	0.26***	0.28***	0.22***
	(0.052)	(0.069)	(0.089)	(0.081)	(0.104)	(0.072)	(0.060)	(0.063)	(0.088)	(0.074)	(0.079)	(0.062)
SCHOOL TYPE	-0.05	0.13	-0.07	-0.22	0.08	0.03	-0.13	0.21	-0.05	-0.09	0.14	0.12
	(0.097)	(0.131)	(0.134)	(0.179)	(0.146)	(0.211)	(0.110)	(0.137)	(0.097)	(0.101)	(0.128)	(0.178)
STU-TEA RATIO	0.01	-0.02*	-0.00	0.00	0.01	0.04***	0.01	0.01	0.01	-0.00	-0.01	0.02
	(0.010)	(0.011)	(0.014)	(0.013)	(0.012)	(0.010)	(0.012)	(0.019)	(0.012)	(0.014)	(0.017)	(0.019)
SCHOOL CHOICE	-0.15	-0.35*	-0.25	-0.09	-0.09	0.04	-0.26*	-0.22	-0.16	-0.23	-0.16	-0.23
	(0.119)	(0.158)	(0.143)	(0.153)	(0.194)	(0.224)	(0.130)	(0.281)	(0.168)	(0.122)	(0.146)	(0.168)
PRESCORE	0.24***	0.23***	0.21***	0.26***	0.23***	0.25***	0.24***	0.23***	0.20***	0.25***	0.28***	0.26***
	(0.024)	(0.046)	(0.050)	(0.040)	(0.035)	(0.048)	(0.027)	(0.035)	(0.032)	(0.032)	(0.032)	(0.030)
SELF-STUDY	0.21*	0.26	0.30*	0.25	0.27	0.04	0.18	0.20	0.26*	0.23	0.19	0.05
	(0.103)	(0.177)	(0.115)	(0.137)	(0.189)	(0.202)	(0.113)	(0.167)	(0.132)	(0.137)	(0.160)	(0.164)
SELF-ESTEEM	0.23***	0.28**	0.18	0.15	0.27*	0.43***	0.19*	0.21	0.10	0.02	0.06	0.21*
	(0.069)	(0.106)	(0.093)	(0.135)	(0.108)	(0.080)	(0.077)	(0.108)	(0.074)	(0.086)	(0.104)	(0.102)
Math PT in grade 10	0.42***	0.76***	0.58***	0.41*	0.42*	0.15	0.38**	0.45*	0.44*	0.17	0.10	-0.15
	(0.107)	(0.226)	(0.154)	(0.164)	(0.189)	(0.247)	(0.133)	(0.200)	(0.180)	(0.167)	(0.153)	(0.183)
Math PT in grade 11	0.59***	0.63***	0.75***	0.59***	0.38**	0.50**	0.49***	0.70***	0.68***	0.46***	0.45***	0.43**
	(0.099)	(0.155)	(0.108)	(0.105)	(0.127)	(0.159)	(0.116)	(0.162)	(0.150)	(0.087)	(0.099)	(0.151)
Math PT in grade 12	0.55***	0.80***	0.64***	0.59***	0.47***	0.23*	0.55***	0.66***	0.64***	0.64***	0.47***	0.35**
	(0.087)	(0.149)	(0.120)	(0.129)	(0.130)	(0.117)	(0.096)	(0.195)	(0.094)	(0.113)	(0.129)	(0.116)
Constant	3.56***	1.98***	2.68***	3.55***	4.86***	5.02***	3.31***	1.17	2.13***	3.52***	4.76***	5.24***
	(0.374)	(0.500)	(0.436)	(0.501)	(0.426)	(0.573)	(0.491)	(0.866)	(0.538)	(0.440)	(0.526)	(0.697)
Observations	1,668	1,668	1,668	1,668	1,668	1,668	1,369	2,145	2,145	2,145	2,145	2,145
R-squared	0.256						0.242					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table O.1. Long-term heterogeneous effects of private tutoring in grade 7 on the CSAT achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
PT in G7	0.14	0.28	0.17	0.13	0.09	-0.00	0.42	0.04	0.19	0.57	0.39	0.20
	(0.087)	(0.280)	(0.144)	(0.107)	(0.119)	(0.168)	(0.274)	(0.579)	(0.383)	(0.356)	(0.451)	(0.638)
URBANICITY	-0.00	0.03	-0.03	-0.05	0.01	0.05	-0.03	0.06	-0.06	-0.12	-0.08	-0.10
	(0.084)	(0.164)	(0.106)	(0.137)	(0.112)	(0.114)	(0.087)	(0.175)	(0.091)	(0.121)	(0.088)	(0.135)
GENDER (1=female)	0.07	0.21*	0.14*	0.03	0.02	-0.14	0.06	0.20	0.14	0.02	-0.03	-0.17
	(0.058)	(0.100)	(0.065)	(0.085)	(0.080)	(0.100)	(0.060)	(0.107)	(0.074)	(0.076)	(0.112)	(0.118)
SES	0.28***	0.18	0.24**	0.32***	0.35***	0.34***	0.25***	0.14	0.27***	0.31***	0.33***	0.30***
	(0.040)	(0.091)	(0.079)	(0.068)	(0.065)	(0.049)	(0.043)	(0.078)	(0.068)	(0.076)	(0.068)	(0.085)
SCHOOL TYPE (1=private)	0.13	0.09	0.14	0.07	0.09	0.15	0.10	0.15	0.12	0.08	0.09	0.13
	(0.074)	(0.124)	(0.078)	(0.072)	(0.103)	(0.103)	(0.077)	(0.156)	(0.092)	(0.105)	(0.111)	(0.179)
STU-TEA RATIO	0.00	0.01	0.02*	0.00	-0.00	-0.01	0.01	0.01	0.02	0.00	0.00	-0.00
	(0.007)	(0.016)	(0.008)	(0.010)	(0.009)	(0.015)	(0.007)	(0.016)	(0.009)	(0.012)	(0.012)	(0.016)
SCHOOL CHOICE	-0.04	0.14	0.02	-0.04	-0.04	-0.11	-0.05	0.10	-0.03	-0.11	-0.10	-0.20
	(0.090)	(0.201)	(0.084)	(0.117)	(0.116)	(0.113)	(0.093)	(0.201)	(0.115)	(0.136)	(0.105)	(0.125)
PRESCORE (G6)	0.25***	0.21***	0.24***	0.28***	0.27***	0.23***	0.25***	0.22***	0.25***	0.26***	0.28***	0.23***
	(0.018)	(0.042)	(0.026)	(0.027)	(0.028)	(0.037)	(0.019)	(0.037)	(0.026)	(0.030)	(0.029)	(0.039)
STUDY HOURS (1= >10hrs /week)	0.13	0.31**	0.10	-0.04	0.26*	-0.04	0.14	0.33***	0.12	0.02	0.27*	0.01
	(0.082)	(0.111)	(0.123)	(0.167)	(0.125)	(0.164)	(0.084)	(0.079)	(0.083)	(0.100)	(0.106)	(0.131)
SELF ESTEEM	0.28***	0.35***	0.29***	0.29***	0.23***	0.34***	0.27***	0.34***	0.27***	0.28***	0.21**	0.30***
	(0.052)	(0.079)	(0.060)	(0.063)	(0.050)	(0.086)	(0.054)	(0.078)	(0.073)	(0.075)	(0.064)	(0.083)
PT in G8	0.17	0.39	0.17	0.13	0.17	0.26	0.14	0.54*	0.11	-0.00	0.06	0.19
	(0.094)	(0.212)	(0.143)	(0.139)	(0.127)	(0.204)	(0.120)	(0.218)	(0.169)	(0.114)	(0.217)	(0.258)
PT in G9	-0.11	-0.13	-0.11	-0.16	-0.12	-0.19	-0.22*	-0.22	-0.13	-0.21	-0.27	-0.21
	(0.093)	(0.173)	(0.093)	(0.115)	(0.155)	(0.201)	(0.104)	(0.152)	(0.106)	(0.160)	(0.149)	(0.187)
PT in G10	0.19*	0.45*	0.27**	0.25**	0.13	-0.02	0.19*	0.50**	0.28**	0.27	0.16	0.05
	(0.080)	(0.180)	(0.092)	(0.089)	(0.170)	(0.121)	(0.084)	(0.185)	(0.091)	(0.151)	(0.138)	(0.134)
PT in G11	0.31***	0.55***	0.35***	0.23*	0.27*	0.15	0.30***	0.47**	0.36***	0.25*	0.26**	0.13
	(0.075)	(0.116)	(0.059)	(0.091)	(0.114)	(0.103)	(0.078)	(0.154)	(0.105)	(0.104)	(0.098)	(0.174)
PT in G12	0.32***	0.32**	0.30***	0.36***	0.29**	0.49***	0.32***	0.39**	0.29**	0.31***	0.32***	0.55***
	(0.065)	(0.102)	(0.077)	(0.086)	(0.088)	(0.117)	(0.068)	(0.120)	(0.099)	(0.083)	(0.096)	(0.124)
Constant	3.14***	0.66	1.83***	3.18***	4.20***	5.77***	3.01***	0.84	1.96***	3.19***	4.09***	5.77***
	(0.276)	(0.827)	(0.363)	(0.364)	(0.281)	(0.558)	(0.306)	(0.720)	(0.432)	(0.479)	(0.587)	(0.655)
Observations	1,905	1,905	1,905	1,905	1,905	1,905	1,800	1,888	1,888	1,888	1,888	1,888
R-squared	0.296						0.287					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table O.2. Long-term heterogeneous effects of private tutoring in grade 8 on the CSAT achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
PT in G8	0.09	0.34	0.19	0.17	0.07	0.06	-0.18	-0.50	0.23	-0.00	0.01	-0.28
	(0.086)	(0.205)	(0.158)	(0.108)	(0.106)	(0.121)	(0.293)	(0.714)	(0.465)	(0.301)	(0.349)	(0.679)
URBANICITY	-0.03	-0.12	0.05	-0.09	-0.04	0.09	-0.05	-0.12	0.05	-0.13	-0.03	-0.06
	(0.075)	(0.139)	(0.106)	(0.089)	(0.096)	(0.125)	(0.078)	(0.157)	(0.095)	(0.123)	(0.110)	(0.124)
GENDER (1=female)	-0.11*	0.17	-0.01	-0.12*	-0.26***	-0.26***	-0.13*	0.11	-0.03	-0.10	-0.27**	-0.29**
	(0.053)	(0.122)	(0.065)	(0.052)	(0.072)	(0.068)	(0.055)	(0.093)	(0.087)	(0.061)	(0.102)	(0.106)
SES	0.18***	0.14**	0.15**	0.18***	0.25***	0.18**	0.14***	0.09	0.12*	0.17**	0.20**	0.10
	(0.036)	(0.045)	(0.049)	(0.039)	(0.055)	(0.059)	(0.038)	(0.085)	(0.050)	(0.055)	(0.068)	(0.065)
SCHOOL TYPE (1=private)	0.13*	0.17	0.07	0.19*	0.17	0.21	0.10	0.11	0.07	0.13	0.11	0.16
	(0.067)	(0.102)	(0.083)	(0.079)	(0.092)	(0.134)	(0.069)	(0.152)	(0.065)	(0.074)	(0.103)	(0.156)
STU-TEA RATIO	-0.01	0.00	0.01	-0.01	-0.01	-0.00	-0.01	0.00	0.00	-0.01	-0.01	0.00
	(0.007)	(0.014)	(0.012)	(0.008)	(0.008)	(0.015)	(0.007)	(0.011)	(0.011)	(0.007)	(0.007)	(0.014)
SCHOOL CHOICE	0.04	0.04	0.14	0.01	0.08	0.02	0.03	0.01	0.13	-0.01	0.06	-0.09
	(0.081)	(0.134)	(0.082)	(0.100)	(0.099)	(0.128)	(0.084)	(0.138)	(0.080)	(0.095)	(0.098)	(0.086)
PRESCORE (G6)	0.95***	0.92***	0.93***	0.97***	0.98***	0.96***	0.97***	1.00***	0.92***	0.99***	0.99***	1.02***
	(0.039)	(0.093)	(0.051)	(0.032)	(0.048)	(0.070)	(0.041)	(0.091)	(0.061)	(0.063)	(0.046)	(0.060)
STUDY HOURS	0.08	0.23	0.09	-0.01	0.12	-0.02	0.09	0.15	0.10	0.03	0.15	0.12
(1= >10hrs /week)	(0.074)	(0.124)	(0.086)	(0.106)	(0.104)	(0.153)	(0.077)	(0.144)	(0.072)	(0.101)	(0.096)	(0.156)
SELF ESTEEM	0.21***	0.22*	0.23***	0.18***	0.23***	0.30***	0.20***	0.12	0.23***	0.18***	0.19***	0.23
	(0.046)	(0.093)	(0.067)	(0.040)	(0.057)	(0.083)	(0.048)	(0.080)	(0.066)	(0.046)	(0.046)	(0.131)
PT in G7	-0.06	0.12	-0.05	-0.14	-0.11	-0.16	0.02	0.43	-0.09	-0.11	-0.14	-0.08
	(0.080)	(0.167)	(0.140)	(0.100)	(0.078)	(0.156)	(0.110)	(0.248)	(0.176)	(0.130)	(0.144)	(0.198)
PT in G9	-0.12	-0.23	-0.14	-0.05	-0.21*	-0.17	-0.04	0.10	-0.19	-0.08	-0.14	-0.08
	(0.085)	(0.160)	(0.069)	(0.093)	(0.104)	(0.154)	(0.132)	(0.329)	(0.186)	(0.149)	(0.181)	(0.346)
PT in G10	0.08	0.26	0.27*	0.11	0.00	-0.10	0.09	0.31*	0.24	0.14	0.01	-0.09
	(0.073)	(0.140)	(0.112)	(0.110)	(0.108)	(0.161)	(0.077)	(0.122)	(0.142)	(0.104)	(0.108)	(0.163)
PT in G11	0.30***	0.41**	0.32***	0.23*	0.16*	0.14	0.30***	0.36*	0.32**	0.19*	0.13	0.10
	(0.068)	(0.133)	(0.085)	(0.095)	(0.076)	(0.141)	(0.070)	(0.142)	(0.114)	(0.095)	(0.110)	(0.156)
PT in G12	0.19**	0.19	0.10	0.20*	0.25***	0.29***	0.21***	0.19	0.11	0.20**	0.30**	0.32*
	(0.060)	(0.154)	(0.073)	(0.090)	(0.071)	(0.084)	(0.062)	(0.100)	(0.070)	(0.065)	(0.093)	(0.129)
Constant	5.24***	2.78***	3.77***	5.44***	6.48***	7.14***	5.36***	3.15***	3.99***	5.57***	6.50***	7.44***
	(0.236)	(0.606)	(0.422)	(0.293)	(0.323)	(0.513)	(0.254)	(0.373)	(0.345)	(0.281)	(0.343)	(0.493)
Observations	1,934	1,934	1,934	1,934	1,934	1,934	1,770	1,782	1,782	1,782	1,782	1,782
R-squared	0.405						0.403					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table O.3. Long-term heterogeneous effects of private tutoring in grade 9 on the CSAT achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
PT in G9	-0.07	-0.08	-0.05	-0.09	-0.27	-0.21	0.31	0.08	-0.19	0.19	0.40	0.79
	(0.081)	(0.183)	(0.108)	(0.110)	(0.140)	(0.124)	(0.385)	(0.532)	(0.526)	(0.301)	(0.797)	(0.596)
URBANICITY	-0.04	0.10	0.05	0.04	-0.16	-0.17	-0.09	-0.01	0.02	-0.04	-0.11	0.02
	(0.075)	(0.143)	(0.121)	(0.107)	(0.136)	(0.105)	(0.081)	(0.155)	(0.086)	(0.071)	(0.106)	(0.115)
GENDER (1=female)	-0.17**	0.07	-0.04	-0.21***	-0.26**	-0.35***	-0.17**	0.02	-0.08	-0.24***	-0.27***	-0.33***
	(0.052)	(0.109)	(0.074)	(0.059)	(0.083)	(0.082)	(0.059)	(0.112)	(0.068)	(0.049)	(0.047)	(0.082)
SES	0.18***	0.10	0.18***	0.15**	0.21**	0.17**	0.17***	0.08*	0.11*	0.09*	0.18*	0.13
	(0.036)	(0.085)	(0.051)	(0.049)	(0.072)	(0.060)	(0.039)	(0.042)	(0.055)	(0.044)	(0.086)	(0.076)
SCHOOL TYPE (1=private)	0.13	0.11	0.10	0.12**	0.15	0.18	0.10	0.16	0.08	0.06	0.11	0.11
	(0.065)	(0.101)	(0.076)	(0.040)	(0.088)	(0.119)	(0.070)	(0.109)	(0.095)	(0.060)	(0.090)	(0.134)
STU-TEA RATIO	-0.00	0.00	0.00	-0.00	-0.01	0.00	-0.00	0.01	0.01	-0.00	-0.00	0.01
	(0.006)	(0.012)	(0.011)	(0.005)	(0.009)	(0.012)	(0.007)	(0.012)	(0.010)	(0.006)	(0.010)	(0.012)
SCHOOL CHOICE	0.02	0.11	0.06	0.08	-0.07	-0.01	-0.04	0.06	0.05	0.01	-0.05	0.08
	(0.080)	(0.122)	(0.114)	(0.116)	(0.148)	(0.120)	(0.087)	(0.137)	(0.106)	(0.082)	(0.120)	(0.140)
PRESCORE (G6)	0.84***	0.87***	0.85***	0.89***	0.88***	0.80***	0.82***	0.91***	0.88***	0.87***	0.87***	0.79***
	(0.036)	(0.082)	(0.057)	(0.056)	(0.050)	(0.051)	(0.038)	(0.045)	(0.055)	(0.043)	(0.051)	(0.066)
STUDY HOURS	0.09	0.15	0.05	0.09	0.03	0.07	0.10	0.15	-0.07	-0.00	0.09	0.06
(1= >10hrs /week)	(0.073)	(0.110)	(0.094)	(0.064)	(0.102)	(0.092)	(0.078)	(0.079)	(0.077)	(0.065)	(0.116)	(0.095)
SELF ESTEEM	0.26***	0.28***	0.27***	0.26***	0.30***	0.30***	0.22***	0.26**	0.29***	0.25***	0.24***	0.20***
	(0.045)	(0.071)	(0.069)	(0.042)	(0.062)	(0.059)	(0.051)	(0.090)	(0.055)	(0.043)	(0.060)	(0.046)
PT in G8	0.02	0.12	0.03	0.05	0.01	-0.00	-0.17	-0.04	-0.01	-0.08	-0.31	-0.46
	(0.081)	(0.217)	(0.133)	(0.119)	(0.132)	(0.179)	(0.178)	(0.233)	(0.248)	(0.149)	(0.409)	(0.343)
PT in G10	0.16*	0.31***	0.22**	0.20*	0.05	-0.06	0.16	0.42*	0.32*	0.21**	0.06	-0.15
	(0.071)	(0.086)	(0.070)	(0.087)	(0.137)	(0.111)	(0.085)	(0.170)	(0.126)	(0.077)	(0.149)	(0.184)
PT in G11	0.31***	0.43**	0.38***	0.21**	0.24**	0.34***	0.27**	0.37**	0.31*	0.23***	0.23**	0.30*
	(0.066)	(0.134)	(0.086)	(0.077)	(0.078)	(0.102)	(0.083)	(0.120)	(0.155)	(0.069)	(0.089)	(0.126)
PT in G12	0.22***	0.27**	0.16	0.19**	0.29***	0.20*	0.25***	0.26***	0.17	0.16*	0.22**	0.16*
	(0.059)	(0.098)	(0.085)	(0.069)	(0.082)	(0.082)	(0.063)	(0.065)	(0.085)	(0.074)	(0.074)	(0.071)
Constant	5.25***	2.88***	4.09***	5.15***	6.65***	7.19***	5.22***	2.80***	4.06***	5.21***	6.26***	6.53***
	(0.229)	(0.345)	(0.341)	(0.242)	(0.308)	(0.389)	(0.270)	(0.416)	(0.278)	(0.249)	(0.416)	(0.438)
Observations	2,021	2,021	2,021	2,021	2,021	2,021	1,785	2,335	2,335	2,335	2,335	2,335
R-squared	0.390						0.378					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table O.4. Long-term heterogeneous effects of verbal tutoring in grade 7 on the CSAT verbal achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
VERBAL PT in G7	-0.04	0.01	-0.05	-0.08	0.01	-0.14	-0.08	-0.58	0.07	-0.13	0.28	-0.11
	(0.071)	(0.140)	(0.098)	(0.088)	(0.128)	(0.147)	(0.188)	(0.542)	(0.324)	(0.336)	(0.370)	(0.587)
URBANICITY	-0.01	-0.04	0.02	-0.05	0.19	-0.10	-0.01	-0.04	-0.02	-0.06	0.13	-0.09
	(0.094)	(0.197)	(0.145)	(0.127)	(0.158)	(0.190)	(0.097)	(0.152)	(0.110)	(0.091)	(0.150)	(0.250)
GENDER (1=female)	0.25***	0.44***	0.28***	0.22**	0.18	0.04	0.24***	0.41**	0.24*	0.21*	0.15	-0.06
	(0.065)	(0.106)	(0.085)	(0.085)	(0.115)	(0.110)	(0.067)	(0.132)	(0.100)	(0.101)	(0.098)	(0.083)
SES	0.23***	0.29**	0.20**	0.24**	0.26**	0.25**	0.21***	0.30***	0.22***	0.23***	0.24***	0.22*
	(0.044)	(0.092)	(0.070)	(0.077)	(0.079)	(0.080)	(0.045)	(0.065)	(0.061)	(0.069)	(0.066)	(0.089)
SCHOOL TYPE (1=private)	0.09	0.06	0.19	0.10	-0.01	0.05	0.08	0.17	0.20***	0.12	0.02	-0.00
	(0.081)	(0.178)	(0.108)	(0.119)	(0.147)	(0.107)	(0.084)	(0.193)	(0.060)	(0.089)	(0.114)	(0.126)
STU-TEA RATIO	0.01	0.01	0.02	0.01	-0.00	0.01	0.01	0.01	0.02	0.01	0.00	0.01
	(0.008)	(0.015)	(0.016)	(0.012)	(0.010)	(0.013)	(0.008)	(0.013)	(0.014)	(0.010)	(0.013)	(0.017)
SCHOOL CHOICE	0.05	-0.03	0.09	0.03	0.24	0.02	0.05	-0.03	0.07	0.01	0.24	-0.00
	(0.101)	(0.191)	(0.144)	(0.134)	(0.143)	(0.173)	(0.104)	(0.190)	(0.155)	(0.122)	(0.151)	(0.224)
PRESCORE (G6)	0.29***	0.28***	0.29***	0.29***	0.30***	0.33***	0.29***	0.28***	0.28***	0.29***	0.29***	0.34***
	(0.020)	(0.035)	(0.027)	(0.024)	(0.035)	(0.034)	(0.021)	(0.056)	(0.029)	(0.023)	(0.034)	(0.026)
STUDY HOURS (1= >10hrs /week)	0.03	-0.01	0.18	0.11	-0.02	-0.14	0.04	-0.04	0.19	0.15	0.02	-0.09
	(0.092)	(0.183)	(0.145)	(0.119)	(0.130)	(0.125)	(0.094)	(0.128)	(0.108)	(0.106)	(0.140)	(0.151)
SELF ESTEEM	0.30***	0.41***	0.28***	0.36***	0.29**	0.16*	0.30***	0.47**	0.29**	0.35***	0.28**	0.12
	(0.058)	(0.104)	(0.061)	(0.065)	(0.090)	(0.082)	(0.060)	(0.149)	(0.091)	(0.061)	(0.090)	(0.089)
VERBAL PT in G8	-0.02	-0.04	0.04	0.02	-0.17	-0.06	-0.03	0.16	0.00	0.01	-0.28	-0.13
	(0.076)	(0.112)	(0.101)	(0.113)	(0.164)	(0.164)	(0.095)	(0.181)	(0.138)	(0.162)	(0.193)	(0.240)
VERBAL PT in G9	-0.13	-0.00	-0.05	-0.16*	-0.19	-0.27**	-0.12	0.04	-0.09	-0.11	-0.22*	-0.21
	(0.075)	(0.163)	(0.096)	(0.080)	(0.124)	(0.105)	(0.081)	(0.142)	(0.129)	(0.114)	(0.101)	(0.162)
VERBAL PT in G10	0.03	0.11	0.04	0.02	-0.05	-0.02	0.03	0.18	0.04	0.03	-0.05	-0.04
	(0.068)	(0.123)	(0.086)	(0.059)	(0.098)	(0.112)	(0.071)	(0.147)	(0.092)	(0.108)	(0.117)	(0.147)
VERBAL PT in G11	0.08	-0.05	0.03	0.05	0.16	0.20	0.07	-0.04	0.10	0.05	0.16	0.25
	(0.081)	(0.132)	(0.107)	(0.091)	(0.166)	(0.126)	(0.083)	(0.147)	(0.086)	(0.099)	(0.155)	(0.131)
VERBAL PT in G12	0.33***	0.21	0.05	0.36**	0.46**	0.39**	0.35***	0.29	0.13	0.42*	0.42	0.36
	(0.101)	(0.117)	(0.103)	(0.118)	(0.146)	(0.145)	(0.102)	(0.196)	(0.148)	(0.204)	(0.229)	(0.207)
Constant	3.32***	1.25*	1.91***	3.54***	4.42***	5.62***	3.32***	1.46**	2.13***	3.49***	4.36***	5.66***
	(0.301)	(0.577)	(0.510)	(0.370)	(0.373)	(0.452)	(0.313)	(0.566)	(0.573)	(0.369)	(0.402)	(0.619)
Observations	2,032	2,032	2,032	2,032	2,032	2,032	1,921	2,013	2,013	2,013	2,013	2,013
R-squared	0.198						0.194					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table O.5. Long-term heterogeneous effects of verbal tutoring in grade 8 on the CSAT verbal achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
VERBAL PT in G8	-0.04	0.05	-0.03	-0.09	-0.08	0.00	-0.33	-0.29	-0.52*	-0.42*	-0.47*	-0.37
	(0.071)	(0.103)	(0.113)	(0.127)	(0.120)	(0.127)	(0.176)	(0.458)	(0.261)	(0.174)	(0.196)	(0.413)
URBANICITY	-0.05	0.02	-0.02	-0.03	-0.00	-0.05	-0.04	0.00	0.03	-0.06	-0.06	-0.05
	(0.088)	(0.148)	(0.082)	(0.108)	(0.147)	(0.155)	(0.090)	(0.221)	(0.210)	(0.134)	(0.147)	(0.146)
GENDER (1=female)	0.07	0.30**	0.11	0.06	-0.06	-0.14	0.06	0.21	0.09	0.03	-0.10	-0.14
	(0.061)	(0.113)	(0.088)	(0.076)	(0.095)	(0.114)	(0.063)	(0.132)	(0.111)	(0.076)	(0.083)	(0.093)
SES	0.11**	0.10	0.10*	0.07	0.12*	0.11	0.07	0.11	0.09	0.04	0.10**	0.14*
	(0.041)	(0.102)	(0.047)	(0.055)	(0.052)	(0.073)	(0.043)	(0.098)	(0.058)	(0.064)	(0.036)	(0.068)
SCHOOL TYPE (1=private)	0.10	0.14	0.17	0.09	0.12	0.08	0.07	0.07	0.12	0.02	0.05	-0.01
	(0.076)	(0.110)	(0.094)	(0.106)	(0.108)	(0.130)	(0.078)	(0.148)	(0.085)	(0.096)	(0.109)	(0.122)
STU-TEA RATIO	-0.00	-0.01	-0.00	-0.00	-0.01	-0.00	-0.00	-0.01	0.00	0.00	-0.01	-0.01
	(0.007)	(0.014)	(0.013)	(0.011)	(0.014)	(0.014)	(0.008)	(0.016)	(0.014)	(0.011)	(0.008)	(0.011)
SCHOOL CHOICE	0.14	0.01	0.12	0.21	0.23	0.17	0.15	0.08	0.11	0.17	0.15	0.22
	(0.094)	(0.180)	(0.135)	(0.108)	(0.168)	(0.142)	(0.097)	(0.221)	(0.179)	(0.093)	(0.151)	(0.163)
PRESCORE (G6)	0.95***	1.04***	0.97***	0.99***	0.97***	0.89***	0.96***	1.03***	0.96***	1.01***	0.98***	0.91***
	(0.043)	(0.089)	(0.057)	(0.067)	(0.065)	(0.060)	(0.045)	(0.092)	(0.079)	(0.080)	(0.080)	(0.094)
STUDY HOURS (1= >10hrs /week)	-0.02	-0.08	0.06	0.07	-0.01	-0.33**	-0.00	-0.05	0.06	0.08	0.07	-0.27
	(0.086)	(0.198)	(0.106)	(0.088)	(0.085)	(0.117)	(0.089)	(0.160)	(0.111)	(0.111)	(0.126)	(0.141)
SELF ESTEEM	0.24***	0.25**	0.22*	0.30***	0.24**	0.23**	0.25***	0.22	0.23*	0.27***	0.23***	0.20*
	(0.053)	(0.083)	(0.087)	(0.067)	(0.086)	(0.074)	(0.055)	(0.159)	(0.090)	(0.069)	(0.068)	(0.082)
VERBAL PT in G7	-0.12	-0.19	-0.08	-0.09	-0.08	-0.10	-0.03	-0.20	0.07	0.02	0.05	0.05
	(0.067)	(0.123)	(0.096)	(0.111)	(0.091)	(0.094)	(0.084)	(0.139)	(0.133)	(0.091)	(0.127)	(0.191)
VERBAL PT in G9	-0.08	-0.02	-0.01	-0.09	-0.20*	-0.34**	0.03	0.07	0.13	0.04	-0.08	-0.23
	(0.071)	(0.127)	(0.068)	(0.078)	(0.080)	(0.104)	(0.092)	(0.172)	(0.108)	(0.128)	(0.097)	(0.171)
VERBAL PT in G10	-0.02	-0.05	0.01	0.00	-0.04	-0.05	-0.02	-0.12	0.06	0.07	-0.01	-0.05
	(0.064)	(0.115)	(0.064)	(0.107)	(0.076)	(0.118)	(0.066)	(0.109)	(0.090)	(0.082)	(0.079)	(0.125)
VERBAL PT in G11	0.10	0.15	-0.04	0.08	0.11	0.34**	0.08	0.09	-0.02	0.05	0.07	0.25
	(0.075)	(0.114)	(0.096)	(0.092)	(0.099)	(0.107)	(0.077)	(0.147)	(0.095)	(0.087)	(0.130)	(0.146)
VERBAL PT in G12	0.20*	-0.03	0.12	0.21	0.25*	0.31*	0.23*	0.10	0.18	0.21*	0.26*	0.34*
	(0.095)	(0.145)	(0.139)	(0.117)	(0.103)	(0.122)	(0.096)	(0.177)	(0.141)	(0.095)	(0.118)	(0.135)
Constant	5.39***	3.50***	4.40***	5.28***	6.59***	7.55***	5.47***	3.72***	4.50***	5.40***	6.83***	7.57***
	(0.263)	(0.499)	(0.412)	(0.265)	(0.537)	(0.491)	(0.272)	(0.480)	(0.398)	(0.292)	(0.406)	(0.316)
Observations	2,064	2,064	2,064	2,064	2,064	2,064	1,889	1,906	1,906	1,906	1,906	1,906
R-squared	0.282						0.278					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table O.6. Long-term heterogeneous effects of verbal tutoring in grade 9 on the CSAT verbal achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
VERBAL PT in G9	-0.07	0.09	0.01	-0.10	-0.05	-0.32*	0.07	-0.19	0.05	-0.12	0.01	0.74
	(0.072)	(0.104)	(0.093)	(0.117)	(0.152)	(0.146)	(0.290)	(0.594)	(0.350)	(0.237)	(0.431)	(0.673)
URBANICITY	-0.03	0.12	0.01	0.02	0.04	0.06	-0.05	0.06	0.02	0.02	0.05	0.04
	(0.089)	(0.158)	(0.153)	(0.125)	(0.122)	(0.170)	(0.097)	(0.124)	(0.139)	(0.089)	(0.144)	(0.164)
GENDER (1=female)	0.03	0.16	0.06	0.08	-0.09	-0.20	0.04	0.16	0.09	0.02	-0.22**	-0.10
	(0.063)	(0.098)	(0.075)	(0.080)	(0.091)	(0.127)	(0.072)	(0.111)	(0.055)	(0.076)	(0.075)	(0.129)
SES	0.12**	0.14	0.11*	0.12*	0.14	0.18*	0.12*	0.13	0.07	0.08	0.08	0.07
	(0.043)	(0.092)	(0.054)	(0.050)	(0.076)	(0.083)	(0.046)	(0.080)	(0.048)	(0.049)	(0.059)	(0.073)
SCHOOL TYPE (1=private)	0.11	0.16	0.22*	0.07	0.11	0.04	0.08	0.11	0.14	0.05	0.15	0.00
	(0.078)	(0.132)	(0.088)	(0.108)	(0.116)	(0.176)	(0.083)	(0.169)	(0.111)	(0.109)	(0.104)	(0.116)
STU-TEA RATIO	0.00	-0.01	0.00	0.00	-0.01	0.01	0.00	-0.01	0.00	0.01	-0.00	0.00
	(0.008)	(0.015)	(0.011)	(0.007)	(0.014)	(0.013)	(0.008)	(0.016)	(0.008)	(0.009)	(0.013)	(0.014)
SCHOOL CHOICE	0.13	0.04	0.19	0.19	0.19	0.31	0.11	0.03	0.17	0.14*	0.15	0.14
	(0.096)	(0.181)	(0.157)	(0.109)	(0.138)	(0.170)	(0.103)	(0.159)	(0.139)	(0.062)	(0.123)	(0.133)
PRESCORE (G6)	0.83***	0.95***	0.93***	0.85***	0.81***	0.78***	0.82***	1.00***	0.92***	0.90***	0.85***	0.87***
	(0.042)	(0.104)	(0.072)	(0.067)	(0.070)	(0.064)	(0.045)	(0.063)	(0.062)	(0.048)	(0.051)	(0.063)
STUDY HOURS (1= >10hrs /week)	-0.01	-0.02	0.12	0.03	-0.05	-0.20	0.02	0.03	0.02	-0.04	-0.01	-0.25
	(0.088)	(0.234)	(0.122)	(0.093)	(0.102)	(0.182)	(0.093)	(0.153)	(0.088)	(0.098)	(0.099)	(0.141)
SELF ESTEEM	0.33***	0.27**	0.30***	0.35***	0.36**	0.19**	0.29***	0.25**	0.37***	0.24***	0.36***	0.21*
	(0.054)	(0.104)	(0.080)	(0.084)	(0.114)	(0.072)	(0.059)	(0.091)	(0.063)	(0.062)	(0.084)	(0.089)
VERBAL PT in G7	-0.09	-0.06	-0.05	-0.02	-0.18	-0.11	-0.12	-0.02	-0.12	-0.09	-0.21	-0.29*
	(0.069)	(0.153)	(0.109)	(0.101)	(0.120)	(0.131)	(0.078)	(0.159)	(0.104)	(0.084)	(0.119)	(0.146)
VERBAL PT in G8	-0.06	-0.03	-0.03	-0.09	-0.11	-0.10	-0.10	-0.01	-0.04	0.02	-0.13	-0.49*
	(0.073)	(0.137)	(0.097)	(0.122)	(0.144)	(0.114)	(0.133)	(0.273)	(0.161)	(0.125)	(0.172)	(0.211)
VERBAL PT in G10	-0.02	-0.03	-0.01	0.03	-0.03	0.01	-0.02	-0.07	0.04	0.07	0.05	-0.10
	(0.065)	(0.119)	(0.081)	(0.084)	(0.114)	(0.104)	(0.081)	(0.158)	(0.137)	(0.112)	(0.118)	(0.125)
VERBAL PT in G11	0.10	0.03	0.14	0.09	0.20	0.20	0.09	-0.06	0.02	0.05	0.16	0.05
	(0.077)	(0.130)	(0.108)	(0.088)	(0.105)	(0.114)	(0.082)	(0.113)	(0.137)	(0.101)	(0.107)	(0.138)
VERBAL PT in G12	0.20*	0.01	0.06	0.11	0.25*	0.25	0.20*	0.04	0.20	0.08	0.20	0.23*
	(0.097)	(0.213)	(0.144)	(0.115)	(0.122)	(0.182)	(0.103)	(0.196)	(0.168)	(0.152)	(0.169)	(0.115)
Constant	5.40***	3.57***	4.16***	5.20***	6.59***	7.34***	5.36***	3.74***	4.17***	5.25***	6.77***	7.28***
	(0.268)	(0.485)	(0.397)	(0.328)	(0.476)	(0.485)	(0.298)	(0.405)	(0.404)	(0.250)	(0.379)	(0.434)
Observations	2,044	2,044	2,044	2,044	2,044	2,044	1,812	2,273	2,273	2,273	2,273	2,273
R-squared	0.252						0.243					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table O.7. Long-term heterogeneous effects of English tutoring in grade 7 on the CSAT English achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
ENGLISH PT in G7	0.10	0.19	0.01	0.11	0.16	-0.07	0.65**	0.32	0.05	0.70***	0.91**	0.98*
	(0.085)	(0.167)	(0.108)	(0.107)	(0.120)	(0.166)	(0.251)	(0.336)	(0.453)	(0.199)	(0.302)	(0.407)
URBANICITY	0.03	0.22	-0.11	-0.02	0.04	0.16	-0.01	0.12	-0.12	-0.09	-0.11	0.04
	(0.090)	(0.233)	(0.121)	(0.085)	(0.119)	(0.142)	(0.094)	(0.184)	(0.099)	(0.087)	(0.128)	(0.136)
GENDER (1=female)	0.24***	0.33*	0.32***	0.25*	0.12	0.07	0.23***	0.29*	0.28***	0.23***	0.11	0.02
	(0.062)	(0.133)	(0.096)	(0.102)	(0.092)	(0.088)	(0.065)	(0.138)	(0.083)	(0.065)	(0.093)	(0.115)
SES	0.39***	0.22*	0.36***	0.48***	0.44***	0.43***	0.37***	0.28**	0.36***	0.44***	0.44***	0.39***
	(0.043)	(0.093)	(0.055)	(0.064)	(0.077)	(0.077)	(0.046)	(0.100)	(0.053)	(0.051)	(0.050)	(0.069)
SCHOOL TYPE (1=private)	0.15	0.15	0.24	0.13	0.18	0.22	0.12	0.14	0.25**	0.07	0.09	0.18
	(0.079)	(0.180)	(0.131)	(0.126)	(0.128)	(0.180)	(0.083)	(0.168)	(0.090)	(0.088)	(0.151)	(0.136)
STU-TEA RATIO	0.01	0.00	0.02	0.01	0.01	0.00	0.01	0.00	0.02	0.02	0.01	0.00
	(0.008)	(0.016)	(0.012)	(0.008)	(0.008)	(0.012)	(0.008)	(0.018)	(0.013)	(0.010)	(0.013)	(0.013)
SCHOOL CHOICE	-0.16	-0.10	-0.22	-0.10	-0.15	-0.24	-0.17	-0.09	-0.21	-0.12	-0.18	-0.26*
	(0.097)	(0.225)	(0.166)	(0.110)	(0.141)	(0.173)	(0.101)	(0.194)	(0.126)	(0.065)	(0.102)	(0.122)
PRESCORE (G6)	0.26***	0.30***	0.29***	0.28***	0.27***	0.20***	0.26***	0.27***	0.28***	0.28***	0.26***	0.18***
	(0.020)	(0.050)	(0.037)	(0.026)	(0.027)	(0.033)	(0.020)	(0.039)	(0.020)	(0.035)	(0.035)	(0.049)
STUDY HOURS (1= >10hrs /week)	0.11	0.21	0.02	-0.06	0.10	0.15	0.12	0.25	0.05	-0.09	0.12	0.19
	(0.088)	(0.145)	(0.117)	(0.097)	(0.132)	(0.117)	(0.091)	(0.175)	(0.127)	(0.112)	(0.144)	(0.124)
SELF ESTEEM	0.37***	0.50***	0.40***	0.40***	0.32***	0.31***	0.35***	0.42***	0.36***	0.36***	0.29***	0.33***
	(0.056)	(0.103)	(0.112)	(0.092)	(0.064)	(0.085)	(0.058)	(0.090)	(0.073)	(0.086)	(0.074)	(0.089)
ENGLISH PT in G8	0.22*	0.35*	0.19	0.17	0.31*	0.22	0.05	0.16	0.16	-0.07	0.03	-0.12
	(0.097)	(0.176)	(0.151)	(0.159)	(0.157)	(0.172)	(0.124)	(0.222)	(0.185)	(0.133)	(0.193)	(0.200)
ENGLISH PT in G9	-0.04	-0.02	0.04	0.05	-0.20	-0.04	-0.14	-0.12	-0.01	-0.01	-0.38*	-0.28
	(0.099)	(0.181)	(0.209)	(0.174)	(0.111)	(0.159)	(0.109)	(0.204)	(0.179)	(0.101)	(0.161)	(0.152)
ENGLISH PT in G10	0.08	0.26	0.10	0.12	-0.04	0.03	0.06	0.43	0.17	0.06	-0.10	0.02
	(0.073)	(0.138)	(0.104)	(0.072)	(0.097)	(0.119)	(0.077)	(0.224)	(0.149)	(0.092)	(0.103)	(0.137)
ENGLISH PT in G11	0.24***	0.37*	0.21**	0.13	0.11	0.20*	0.24**	0.46**	0.22**	0.12	0.13	0.18
	(0.071)	(0.186)	(0.077)	(0.089)	(0.099)	(0.080)	(0.074)	(0.171)	(0.075)	(0.096)	(0.101)	(0.127)
ENGLISH PT in G12	0.20**	0.35*	0.25**	0.21*	0.17*	0.04	0.20**	0.32	0.27*	0.24**	0.16	0.11
	(0.075)	(0.146)	(0.092)	(0.089)	(0.082)	(0.132)	(0.077)	(0.171)	(0.107)	(0.087)	(0.091)	(0.140)
Constant	3.08***	0.25	1.84**	2.86***	4.33***	5.95***	2.88***	0.51	1.87***	2.65***	4.24***	5.85***
	(0.299)	(0.680)	(0.557)	(0.351)	(0.418)	(0.409)	(0.323)	(0.462)	(0.436)	(0.374)	(0.442)	(0.500)
Observations	2,302	2,302	2,302	2,302	2,302	2,302	2,179	2,281	2,281	2,281	2,281	2,281
R-squared	0.247						0.229					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table O.8. Long-term heterogeneous effects of English tutoring in grade 8 on the CSAT English achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
ENGLISH PT in G8	0.13	0.10	0.17	0.16	0.09	0.03	0.39	0.33	0.39	1.04*	0.20	0.60
	(0.090)	(0.164)	(0.129)	(0.102)	(0.125)	(0.170)	(0.317)	(0.507)	(0.437)	(0.430)	(0.389)	(0.467)
URBANICITY	-0.02	-0.13	-0.12	-0.09	0.02	0.19	-0.05	-0.17	-0.12	-0.17	-0.02	0.03
	(0.083)	(0.196)	(0.114)	(0.115)	(0.116)	(0.155)	(0.086)	(0.171)	(0.110)	(0.107)	(0.118)	(0.145)
GENDER (1=female)	0.03	0.13	0.18*	0.03	-0.06	-0.12	0.04	0.12	0.17	0.07	-0.03	-0.14
	(0.058)	(0.099)	(0.085)	(0.073)	(0.085)	(0.077)	(0.060)	(0.139)	(0.099)	(0.064)	(0.073)	(0.097)
SES	0.25***	0.13*	0.27***	0.27***	0.37***	0.29***	0.20***	0.14	0.22**	0.18*	0.31***	0.20**
	(0.040)	(0.063)	(0.043)	(0.065)	(0.049)	(0.057)	(0.043)	(0.080)	(0.074)	(0.088)	(0.065)	(0.075)
SCHOOL TYPE (1=private)	0.14*	0.19	0.25**	0.18*	0.06	0.02	0.13	0.11	0.21*	0.15	0.09	-0.01
	(0.073)	(0.158)	(0.085)	(0.089)	(0.080)	(0.135)	(0.076)	(0.122)	(0.096)	(0.085)	(0.072)	(0.139)
STU-TEA RATIO	-0.00	-0.00	-0.01	-0.00	-0.01	-0.01	-0.00	0.00	-0.01	-0.00	-0.02	-0.01
	(0.007)	(0.014)	(0.008)	(0.007)	(0.009)	(0.012)	(0.008)	(0.017)	(0.010)	(0.008)	(0.009)	(0.014)
SCHOOL CHOICE	-0.06	-0.21	-0.08	-0.09	-0.01	-0.13	-0.08	-0.20	-0.05	-0.13	-0.02	-0.24
	(0.089)	(0.168)	(0.126)	(0.124)	(0.107)	(0.139)	(0.093)	(0.195)	(0.093)	(0.125)	(0.120)	(0.188)
PRESCORE (G6)	0.99***	1.14***	1.04***	1.05***	0.95***	0.90***	1.03***	1.13***	1.07***	1.07***	0.97***	1.00***
	(0.042)	(0.067)	(0.080)	(0.066)	(0.067)	(0.105)	(0.045)	(0.067)	(0.055)	(0.068)	(0.061)	(0.082)
STUDY HOURS (1= >10hrs /week)	0.06	0.01	0.10	-0.02	0.05	0.06	0.07	-0.04	0.14	-0.00	0.06	0.12
	(0.081)	(0.127)	(0.107)	(0.092)	(0.136)	(0.122)	(0.084)	(0.154)	(0.133)	(0.074)	(0.155)	(0.118)
SELF ESTEEM	0.27***	0.35***	0.35***	0.25***	0.20**	0.19*	0.24***	0.32**	0.32***	0.24***	0.23***	0.09
	(0.051)	(0.096)	(0.064)	(0.065)	(0.077)	(0.087)	(0.053)	(0.111)	(0.071)	(0.060)	(0.062)	(0.122)
ENGLISH PT in G7	-0.08	0.16	-0.14	-0.09	-0.13	-0.14	-0.09	0.11	-0.18	-0.31	-0.04	-0.22
	(0.079)	(0.163)	(0.089)	(0.101)	(0.085)	(0.180)	(0.107)	(0.183)	(0.150)	(0.167)	(0.123)	(0.164)
ENGLISH PT in G9	-0.00	0.12	-0.03	-0.03	-0.01	0.02	-0.11	0.07	-0.01	-0.40**	-0.13	-0.17
	(0.091)	(0.203)	(0.115)	(0.099)	(0.141)	(0.227)	(0.148)	(0.295)	(0.215)	(0.152)	(0.180)	(0.301)
ENGLISH PT in G10	0.04	0.23*	0.09	0.03	-0.01	-0.02	0.03	0.23*	0.05	-0.02	0.01	-0.03
	(0.067)	(0.099)	(0.064)	(0.086)	(0.086)	(0.081)	(0.071)	(0.109)	(0.090)	(0.114)	(0.081)	(0.102)
ENGLISH PT in G11	0.21**	0.24	0.18**	0.13	0.15	0.14	0.18*	0.22	0.11	0.08	0.13	0.05
	(0.065)	(0.153)	(0.062)	(0.075)	(0.094)	(0.095)	(0.069)	(0.116)	(0.080)	(0.092)	(0.068)	(0.125)
ENGLISH PT in G12	0.15*	0.26	0.11	0.18	0.12	0.08	0.17*	0.27*	0.13	0.20*	0.12	0.06
	(0.069)	(0.149)	(0.099)	(0.108)	(0.122)	(0.175)	(0.072)	(0.104)	(0.091)	(0.083)	(0.098)	(0.161)
Constant	5.13***	3.00***	4.29***	5.16***	6.48***	7.39***	5.05***	2.78***	4.22***	5.11***	6.46***	7.48***
	(0.258)	(0.357)	(0.320)	(0.377)	(0.420)	(0.333)	(0.287)	(0.691)	(0.376)	(0.426)	(0.452)	(0.415)
Observations	2,339	2,339	2,339	2,339	2,339	2,339	2,148	2,161	2,161	2,161	2,161	2,161
R-squared	0.342						0.342					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table O.9. Long-term heterogeneous effects of English tutoring in grade 9 on the CSAT English achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
ENGLISH PT in G9	-0.05	0.09	-0.01	-0.08	-0.10	-0.05	0.51	0.17	0.59	0.66	0.64	0.35
	(0.092)	(0.175)	(0.137)	(0.116)	(0.161)	(0.217)	(0.389)	(0.483)	(0.684)	(0.477)	(0.693)	(0.793)
URBANICITY	0.01	0.17	-0.06	-0.06	-0.07	0.17	-0.02	0.00	-0.14	-0.11**	0.00	0.25*
	(0.083)	(0.135)	(0.098)	(0.071)	(0.115)	(0.140)	(0.089)	(0.150)	(0.074)	(0.043)	(0.110)	(0.120)
GENDER (1=female)	-0.05	0.02	0.02	-0.02	-0.07	-0.28*	-0.05	-0.04	0.04	-0.05	-0.13	-0.27*
	(0.059)	(0.127)	(0.079)	(0.088)	(0.089)	(0.141)	(0.064)	(0.115)	(0.096)	(0.054)	(0.066)	(0.118)
SES	0.26***	0.25**	0.24***	0.22***	0.31***	0.35***	0.25***	0.19**	0.23***	0.20***	0.28***	0.34***
	(0.041)	(0.077)	(0.044)	(0.047)	(0.063)	(0.069)	(0.044)	(0.073)	(0.040)	(0.046)	(0.061)	(0.063)
SCHOOL TYPE (1=private)	0.15*	0.01	0.25*	0.21**	0.17*	0.09	0.14	-0.02	0.18*	0.13	0.12	0.07
	(0.073)	(0.109)	(0.098)	(0.076)	(0.075)	(0.140)	(0.079)	(0.144)	(0.076)	(0.076)	(0.115)	(0.179)
STU-TEA RATIO	-0.00	0.00	0.01	0.00	-0.01	0.00	-0.00	0.01	0.01	-0.00	-0.01	-0.00
	(0.007)	(0.014)	(0.018)	(0.011)	(0.012)	(0.015)	(0.008)	(0.012)	(0.011)	(0.010)	(0.009)	(0.009)
SCHOOL CHOICE	-0.06	0.02	-0.02	-0.03	-0.24	-0.07	-0.10	-0.08	-0.04	-0.09	-0.15	-0.04
	(0.090)	(0.133)	(0.108)	(0.094)	(0.130)	(0.181)	(0.096)	(0.158)	(0.077)	(0.084)	(0.150)	(0.164)
PRESCORE (G6)	0.92***	1.17***	0.98***	0.95***	0.89***	0.79***	0.91***	1.18***	0.96***	0.91***	0.89***	0.77***
	(0.040)	(0.080)	(0.084)	(0.057)	(0.063)	(0.096)	(0.043)	(0.080)	(0.079)	(0.046)	(0.033)	(0.057)
STUDY HOURS (1= >10hrs /week)	0.08	0.23	0.05	0.05	0.07	0.07	0.09	0.18	0.06	0.03	0.05	0.17
	(0.081)	(0.142)	(0.073)	(0.082)	(0.106)	(0.127)	(0.087)	(0.130)	(0.093)	(0.118)	(0.118)	(0.154)
SELF ESTEEM	0.33***	0.36***	0.40***	0.36***	0.29***	0.18*	0.30***	0.37***	0.37***	0.36***	0.34***	0.18*
	(0.051)	(0.099)	(0.080)	(0.057)	(0.060)	(0.076)	(0.056)	(0.102)	(0.048)	(0.058)	(0.055)	(0.079)
ENGLISH PT in G7	-0.03	0.14	0.04	-0.05	-0.10	-0.11	-0.09	0.06	-0.10	-0.19	-0.25	-0.16
	(0.079)	(0.189)	(0.125)	(0.105)	(0.086)	(0.160)	(0.092)	(0.185)	(0.080)	(0.100)	(0.156)	(0.152)
ENGLISH PT in G8	0.12	-0.01	-0.02	0.21	0.10	0.07	-0.10	-0.13	-0.20	-0.05	-0.21	-0.22
	(0.090)	(0.194)	(0.189)	(0.146)	(0.127)	(0.232)	(0.167)	(0.250)	(0.214)	(0.208)	(0.242)	(0.298)
ENGLISH PT in G10	0.07	0.21	0.15	-0.00	0.05	0.03	0.06	0.23	0.10	0.01	-0.01	0.04
	(0.068)	(0.134)	(0.113)	(0.092)	(0.126)	(0.174)	(0.081)	(0.171)	(0.138)	(0.063)	(0.112)	(0.148)
ENGLISH PT in G11	0.22***	0.16	0.18*	0.26***	0.16	0.10	0.21**	0.29*	0.19**	0.22**	0.17	0.13
	(0.066)	(0.168)	(0.089)	(0.051)	(0.110)	(0.100)	(0.073)	(0.129)	(0.072)	(0.068)	(0.096)	(0.121)
ENGLISH PT in G12	0.17*	0.25	0.21*	0.17*	0.17*	0.03	0.16*	0.18	0.25***	0.18**	0.12	-0.10
	(0.069)	(0.140)	(0.084)	(0.073)	(0.079)	(0.140)	(0.074)	(0.151)	(0.066)	(0.062)	(0.091)	(0.116)
Constant	5.18***	2.79***	4.01***	5.08***	6.71***	7.51***	5.07***	3.00***	3.87***	5.10***	6.48***	7.34***
	(0.259)	(0.372)	(0.467)	(0.243)	(0.330)	(0.553)	(0.303)	(0.450)	(0.356)	(0.316)	(0.414)	(0.422)
Observations	2,319	2,319	2,319	2,319	2,319	2,319	2,062	2,277	2,277	2,277	2,277	2,277
R-squared	0.337						0.326					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table O.10. Long-term heterogeneous effects of math tutoring in grade 7 on the CSAT math achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
MATH PT in G7	0.11	0.36**	0.12	0.06	-0.02	0.14	-0.13	0.03	-0.26	-0.54	-0.06	2.62*
	(0.091)	(0.128)	(0.200)	(0.134)	(0.166)	(0.112)	(0.450)	(0.731)	(0.593)	(0.515)	(0.765)	(1.164)
URBANICITY	-0.05	-0.17	-0.14	-0.04	0.06	-0.03	-0.07	-0.22	-0.13	-0.07	-0.02	-0.29
	(0.097)	(0.175)	(0.130)	(0.147)	(0.156)	(0.146)	(0.102)	(0.180)	(0.087)	(0.135)	(0.165)	(0.206)
GENDER (1=female)	-0.21**	-0.03	-0.25**	-0.26**	-0.34***	-0.31*	-0.25***	-0.10	-0.24	-0.30***	-0.41***	-0.21*
	(0.067)	(0.088)	(0.096)	(0.086)	(0.087)	(0.127)	(0.071)	(0.142)	(0.140)	(0.087)	(0.109)	(0.100)
SES	0.21***	0.15**	0.13	0.27***	0.34***	0.29***	0.21***	0.17**	0.20**	0.30***	0.30***	0.21**
	(0.046)	(0.058)	(0.075)	(0.049)	(0.079)	(0.070)	(0.051)	(0.066)	(0.075)	(0.054)	(0.065)	(0.074)
SCHOOL TYPE (1=private)	0.05	0.11	-0.09	-0.07	0.22	0.26*	0.07	0.18	-0.05	-0.03	0.14	0.17
	(0.085)	(0.106)	(0.131)	(0.154)	(0.127)	(0.119)	(0.090)	(0.104)	(0.106)	(0.110)	(0.126)	(0.139)
STU-TEA RATIO	0.00	-0.00	0.02	0.01	-0.00	0.02	0.01	-0.00	0.02	0.01	0.00	0.01
	(0.008)	(0.021)	(0.017)	(0.012)	(0.010)	(0.012)	(0.009)	(0.016)	(0.012)	(0.010)	(0.012)	(0.011)
SCHOOL CHOICE	-0.09	-0.18	-0.07	-0.04	-0.05	-0.10	-0.13	-0.24	-0.02	-0.11	-0.10	-0.25
	(0.104)	(0.145)	(0.163)	(0.143)	(0.131)	(0.157)	(0.108)	(0.180)	(0.101)	(0.158)	(0.144)	(0.224)
PRESCORE (G6)	0.23***	0.22***	0.21***	0.25***	0.23***	0.24***	0.22***	0.21***	0.18***	0.24***	0.26***	0.23***
	(0.021)	(0.023)	(0.032)	(0.043)	(0.034)	(0.034)	(0.022)	(0.039)	(0.045)	(0.026)	(0.029)	(0.031)
STUDY HOURS	0.14	0.26	0.24	0.19	0.18	-0.03	0.16	0.26	0.28*	0.18	0.13	-0.09
(1= >10hrs /week)	(0.094)	(0.164)	(0.130)	(0.103)	(0.114)	(0.126)	(0.097)	(0.172)	(0.112)	(0.101)	(0.145)	(0.118)
SELF ESTEEM	0.24***	0.33***	0.16*	0.14	0.24*	0.38***	0.23***	0.32**	0.17	0.14	0.15	0.34***
	(0.060)	(0.089)	(0.073)	(0.072)	(0.104)	(0.079)	(0.062)	(0.105)	(0.102)	(0.081)	(0.112)	(0.071)
MATH PT in G8	-0.04	0.07	0.03	0.01	-0.05	-0.37*	0.04	0.23	0.13	0.19	-0.03	-1.21**
	(0.104)	(0.184)	(0.151)	(0.146)	(0.220)	(0.164)	(0.176)	(0.336)	(0.251)	(0.249)	(0.356)	(0.459)
MATH PT in G9	-0.16	-0.29	-0.10	-0.27*	-0.27**	-0.02	-0.17	-0.41*	-0.05	-0.12	-0.30	-0.40**
	(0.107)	(0.196)	(0.184)	(0.113)	(0.096)	(0.132)	(0.131)	(0.202)	(0.189)	(0.198)	(0.191)	(0.154)
MATH PT in G10	0.30***	0.44*	0.47***	0.25	0.30**	-0.02	0.33***	0.60***	0.47***	0.31*	0.32*	-0.06
	(0.088)	(0.192)	(0.112)	(0.151)	(0.112)	(0.146)	(0.092)	(0.152)	(0.115)	(0.138)	(0.132)	(0.184)
MATH PT in G11	0.62***	0.77***	0.77***	0.69***	0.45**	0.50***	0.65***	0.77***	0.87***	0.68***	0.54***	0.50***
	(0.083)	(0.152)	(0.112)	(0.127)	(0.140)	(0.149)	(0.088)	(0.166)	(0.114)	(0.092)	(0.095)	(0.150)
MATH PT in G12	0.55***	0.75***	0.62***	0.62***	0.52***	0.42***	0.58***	0.77***	0.62***	0.71***	0.54***	0.35**
	(0.078)	(0.162)	(0.141)	(0.105)	(0.142)	(0.117)	(0.082)	(0.158)	(0.132)	(0.137)	(0.115)	(0.129)
Constant	3.57***	1.13*	2.10***	3.54***	5.19***	5.82***	3.74***	1.44*	2.30***	3.85***	5.03***	5.52***
	(0.320)	(0.466)	(0.366)	(0.618)	(0.543)	(0.554)	(0.354)	(0.600)	(0.483)	(0.465)	(0.537)	(0.810)
Observations	2,294	2,294	2,294	2,294	2,294	2,294	2,172	2,265	2,265	2,265	2,265	2,265
R-squared	0.238						0.236					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table O.11. Long-term heterogeneous effects of math tutoring in grade 8 on the CSAT math achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
MATH PT in G8	-0.07	0.04	-0.02	0.05	-0.13	-0.32	0.01	-0.84	-0.29	0.15	-0.05	-0.21
	(0.098)	(0.216)	(0.121)	(0.127)	(0.159)	(0.171)	(0.362)	(0.562)	(0.374)	(0.650)	(0.700)	(0.633)
URBANICITY	-0.09	-0.24	-0.20	-0.01	-0.02	-0.16	-0.12	-0.23	-0.14	-0.09	-0.03	-0.12
	(0.091)	(0.186)	(0.176)	(0.110)	(0.142)	(0.144)	(0.094)	(0.132)	(0.150)	(0.107)	(0.110)	(0.215)
GENDER (1=female)	-0.39***	-0.17	-0.22**	-0.42***	-0.51***	-0.49***	-0.41***	-0.18	-0.29**	-0.46***	-0.53***	-0.54***
	(0.065)	(0.113)	(0.082)	(0.080)	(0.076)	(0.087)	(0.067)	(0.106)	(0.099)	(0.087)	(0.080)	(0.118)
SES	0.10*	-0.00	0.02	0.13*	0.17*	0.11	0.08	-0.01	0.02	0.12	0.15*	0.10
	(0.045)	(0.065)	(0.085)	(0.054)	(0.072)	(0.060)	(0.047)	(0.088)	(0.089)	(0.072)	(0.072)	(0.089)
SCHOOL TYPE (1=private)	0.09	0.17	-0.02	0.06	0.13	0.19	0.06	0.10	-0.05	0.04	0.09	0.13
	(0.081)	(0.097)	(0.117)	(0.127)	(0.112)	(0.166)	(0.084)	(0.119)	(0.119)	(0.104)	(0.131)	(0.158)
STU-TEA RATIO	-0.00	-0.01	-0.00	-0.00	-0.01	-0.01	-0.00	-0.01	0.00	-0.01	-0.01	-0.01
	(0.008)	(0.010)	(0.013)	(0.008)	(0.012)	(0.014)	(0.008)	(0.018)	(0.019)	(0.011)	(0.013)	(0.016)
SCHOOL CHOICE	-0.04	-0.11	-0.14	0.12	-0.06	-0.17	-0.06	-0.06	-0.11	0.04	-0.05	-0.17
	(0.099)	(0.212)	(0.194)	(0.170)	(0.146)	(0.207)	(0.102)	(0.218)	(0.167)	(0.133)	(0.157)	(0.214)
PRESCORE (G6)	0.87***	0.73***	0.81***	0.89***	0.94***	0.90***	0.90***	0.74***	0.89***	0.90***	0.98***	0.96***
	(0.048)	(0.087)	(0.083)	(0.079)	(0.059)	(0.096)	(0.050)	(0.108)	(0.080)	(0.087)	(0.065)	(0.052)
STUDY HOURS	0.06	0.20	0.09	0.11	0.05	0.09	0.03	0.11	0.14	0.06	0.03	0.07
(1= >10hrs /week)	(0.089)	(0.116)	(0.119)	(0.125)	(0.126)	(0.124)	(0.093)	(0.123)	(0.127)	(0.109)	(0.135)	(0.182)
SELF ESTEEM	0.15**	0.27*	0.08	0.12*	0.15	0.25**	0.14*	0.26	0.03	0.16*	0.10	0.24**
	(0.056)	(0.108)	(0.093)	(0.062)	(0.084)	(0.087)	(0.058)	(0.133)	(0.083)	(0.075)	(0.086)	(0.077)
MATH PT in G7	-0.03	0.27	0.11	-0.10	-0.17	0.09	-0.06	0.46*	0.14	-0.18	-0.22	-0.04
	(0.087)	(0.166)	(0.186)	(0.106)	(0.149)	(0.163)	(0.126)	(0.200)	(0.189)	(0.228)	(0.234)	(0.200)
MATH PT in G9	-0.12	-0.10	-0.11	-0.13	-0.22*	0.05	-0.19	0.21	-0.17	-0.26	-0.23	-0.16
	(0.102)	(0.182)	(0.150)	(0.136)	(0.104)	(0.122)	(0.159)	(0.278)	(0.219)	(0.245)	(0.237)	(0.228)
MATH PT in G10	0.18*	0.28*	0.45***	0.13	0.11	-0.12	0.18*	0.46*	0.48***	0.13	0.05	-0.20
	(0.084)	(0.129)	(0.125)	(0.125)	(0.150)	(0.172)	(0.089)	(0.179)	(0.127)	(0.104)	(0.149)	(0.161)
MATH PT in G11	0.63***	0.74***	0.69***	0.63***	0.52***	0.59***	0.61***	0.74***	0.61***	0.66***	0.53***	0.62***
	(0.079)	(0.179)	(0.157)	(0.090)	(0.092)	(0.171)	(0.083)	(0.166)	(0.151)	(0.106)	(0.079)	(0.140)
MATH PT in G12	0.38***	0.67***	0.48***	0.45***	0.34***	0.22	0.38***	0.60***	0.44***	0.42***	0.32***	0.17
	(0.075)	(0.131)	(0.111)	(0.084)	(0.077)	(0.134)	(0.078)	(0.121)	(0.109)	(0.089)	(0.090)	(0.155)
Constant	5.44***	2.90***	3.87***	5.22***	7.06***	8.00***	5.54***	2.97***	4.15***	5.58***	7.21***	8.35***
	(0.284)	(0.524)	(0.559)	(0.475)	(0.418)	(0.541)	(0.309)	(0.648)	(0.557)	(0.585)	(0.455)	(0.619)
Observations	2,330	2,330	2,330	2,330	2,330	2,330	2,142	2,153	2,153	2,153	2,153	2,153
R-squared	0.298						0.297					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table O.12. Long-term heterogeneous effects of math tutoring in grade 9 on the CSAT math achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
MATH PT in G9	-0.14	0.06	-0.21	-0.20	-0.19	-0.14	0.44	0.10	0.27	0.53	0.48	0.62
	(0.102)	(0.209)	(0.180)	(0.170)	(0.131)	(0.154)	(0.437)	(0.452)	(0.613)	(0.621)	(0.489)	(0.644)
URBANICITY	-0.06	-0.08	-0.07	-0.04	-0.01	-0.08	-0.12	-0.11	-0.14	-0.15	-0.05	-0.13
	(0.092)	(0.139)	(0.106)	(0.129)	(0.114)	(0.175)	(0.098)	(0.198)	(0.136)	(0.133)	(0.136)	(0.188)
GENDER (1=female)	-0.46***	-0.22	-0.31***	-0.48***	-0.55***	-0.65***	-0.47***	-0.22	-0.31***	-0.53***	-0.56***	-0.67***
	(0.066)	(0.156)	(0.090)	(0.090)	(0.127)	(0.120)	(0.072)	(0.125)	(0.085)	(0.070)	(0.075)	(0.095)
SES	0.10*	0.04	-0.00	0.10	0.11	0.24**	0.09	0.04	0.04	0.09	0.11	0.17*
	(0.045)	(0.095)	(0.064)	(0.078)	(0.081)	(0.087)	(0.048)	(0.084)	(0.084)	(0.076)	(0.074)	(0.081)
SCHOOL TYPE (1=private)	0.08	0.15	0.04	0.04	0.12	0.18	0.05	0.08	-0.05	0.01	0.10	0.26*
	(0.081)	(0.150)	(0.125)	(0.123)	(0.105)	(0.165)	(0.086)	(0.144)	(0.115)	(0.145)	(0.096)	(0.120)
STU-TEA RATIO	-0.00	-0.01	0.00	-0.00	-0.00	0.01	-0.00	-0.01	0.01	-0.01	-0.01	0.01
	(0.008)	(0.012)	(0.010)	(0.011)	(0.009)	(0.014)	(0.009)	(0.012)	(0.015)	(0.014)	(0.014)	(0.014)
SCHOOL CHOICE	-0.04	-0.06	-0.05	0.02	-0.05	0.07	-0.14	-0.03	-0.06	-0.11	-0.11	-0.13
	(0.099)	(0.150)	(0.143)	(0.168)	(0.098)	(0.184)	(0.106)	(0.196)	(0.146)	(0.122)	(0.162)	(0.164)
PRESCORE (G6)	0.81***	0.75***	0.79***	0.89***	0.93***	0.76***	0.79***	0.71***	0.70***	0.88***	0.93***	0.76***
	(0.045)	(0.092)	(0.085)	(0.094)	(0.083)	(0.078)	(0.048)	(0.070)	(0.073)	(0.077)	(0.082)	(0.049)
STUDY HOURS	0.08	0.27	0.13	0.11	0.08	-0.03	0.09	0.17	0.15	0.12	0.11	0.07
(1= >10hrs /week)	(0.090)	(0.145)	(0.121)	(0.131)	(0.117)	(0.162)	(0.097)	(0.237)	(0.152)	(0.162)	(0.111)	(0.110)
SELF ESTEEM	0.21***	0.22***	0.21**	0.14	0.25**	0.28**	0.16**	0.19	0.17*	0.09	0.20**	0.19*
	(0.056)	(0.064)	(0.071)	(0.088)	(0.078)	(0.099)	(0.062)	(0.101)	(0.086)	(0.073)	(0.070)	(0.076)
MATH PT in G7	0.01	0.28*	0.09	-0.13	-0.10	0.08	-0.09	0.11	-0.04	-0.22	-0.20*	-0.07
	(0.087)	(0.133)	(0.167)	(0.117)	(0.122)	(0.178)	(0.103)	(0.141)	(0.132)	(0.136)	(0.100)	(0.226)
MATH PT in G8	-0.10	-0.09	0.14	0.02	-0.19	-0.41*	-0.25	-0.10	-0.07	-0.23	-0.31	-0.62**
	(0.099)	(0.147)	(0.141)	(0.169)	(0.178)	(0.189)	(0.175)	(0.209)	(0.222)	(0.237)	(0.205)	(0.192)
MATH PT in G10	0.20*	0.36*	0.41**	0.15	0.05	-0.10	0.17	0.28	0.37	0.12	-0.08	-0.22
	(0.085)	(0.159)	(0.156)	(0.127)	(0.168)	(0.173)	(0.105)	(0.156)	(0.199)	(0.162)	(0.129)	(0.117)
MATH PT in G11	0.65***	0.68***	0.69***	0.66***	0.57***	0.48**	0.61***	0.68***	0.62***	0.54***	0.59***	0.47***
	(0.079)	(0.135)	(0.150)	(0.145)	(0.144)	(0.170)	(0.090)	(0.140)	(0.151)	(0.070)	(0.086)	(0.134)
MATH PT in G12	0.38***	0.55**	0.44***	0.39***	0.32**	0.20	0.37***	0.64***	0.52***	0.39***	0.29*	0.27
	(0.075)	(0.191)	(0.110)	(0.116)	(0.103)	(0.103)	(0.080)	(0.128)	(0.071)	(0.097)	(0.126)	(0.139)
Constant	5.45***	2.82***	3.77***	5.49***	7.00***	7.86***	5.47***	2.88***	3.61***	5.72***	6.95***	7.94***
	(0.285)	(0.416)	(0.400)	(0.501)	(0.346)	(0.507)	(0.332)	(0.627)	(0.489)	(0.481)	(0.420)	(0.514)
Observations	2,310	2,310	2,310	2,310	2,310	2,310	2,055	2,252	2,252	2,252	2,252	2,252
R-squared	0.296						0.284					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table P.1. Heterogeneous effects of one year of private tutoring in high school on the CSAT overall achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of PT in high school	0.06	0.22	0.17	0.19*	-0.00	-0.27	0.36	0.41	0.57***	0.46***	0.35	0.26
	(0.104)	(0.152)	(0.125)	(0.090)	(0.145)	(0.140)	(0.376)	(0.246)	(0.157)	(0.107)	(0.198)	(0.255)
URBAN	-0.12	-0.20	-0.16	0.02	-0.11	-0.01	-0.27	-0.01	-0.10	-0.01	-0.12	0.04
	(0.159)	(0.200)	(0.220)	(0.169)	(0.302)	(0.229)	(0.189)	(0.120)	(0.104)	(0.099)	(0.117)	(0.074)
GENDER (1=female)	-0.15	-0.02	0.03	-0.10	-0.28*	-0.27	-0.23	0.18	0.04	-0.11	-0.20	-0.20
	(0.100)	(0.161)	(0.113)	(0.128)	(0.135)	(0.157)	(0.122)	(0.114)	(0.051)	(0.079)	(0.134)	(0.144)
SES	0.11	0.00	0.14	0.24*	0.06	0.23*	0.09	0.13	0.14**	0.15***	0.25***	0.25***
	(0.080)	(0.194)	(0.132)	(0.097)	(0.104)	(0.104)	(0.100)	(0.088)	(0.052)	(0.041)	(0.068)	(0.061)
SCHOOL TYPE	0.03	0.11	-0.09	0.16	-0.00	-0.14	0.09	0.19*	0.14	0.15*	0.21*	0.22**
	(0.105)	(0.153)	(0.124)	(0.111)	(0.164)	(0.160)	(0.124)	(0.094)	(0.086)	(0.071)	(0.098)	(0.086)
SCHOOL TRACK	0.34*	0.51*	0.68***	0.44**	0.36*	0.20	0.46*	1.26***	0.87***	0.47***	0.52***	0.54**
	(0.141)	(0.228)	(0.133)	(0.143)	(0.152)	(0.247)	(0.181)	(0.177)	(0.239)	(0.132)	(0.146)	(0.195)
STU-TEA RATIO	-0.01	0.04	-0.02	-0.03	-0.01	-0.00	-0.02	-0.05**	-0.03*	-0.04**	-0.03	-0.03
	(0.020)	(0.047)	(0.029)	(0.020)	(0.018)	(0.021)	(0.024)	(0.020)	(0.014)	(0.011)	(0.022)	(0.027)
SCHOOL CHOICE	-0.06	0.14	-0.02	0.05	-0.06	-0.31	-0.23	-0.19	-0.15	-0.15	-0.18	-0.20
	(0.155)	(0.258)	(0.156)	(0.173)	(0.264)	(0.235)	(0.185)	(0.133)	(0.099)	(0.109)	(0.142)	(0.116)
PRESCORE (G9)	0.82***	0.90***	0.75***	0.80***	0.89***	0.86***	0.80***	0.77***	0.70***	0.76***	0.69***	0.66***
	(0.071)	(0.074)	(0.075)	(0.082)	(0.107)	(0.082)	(0.085)	(0.104)	(0.051)	(0.046)	(0.063)	(0.058)
SELF-STUDY	0.46***	0.56**	0.45**	0.34***	0.35	0.61***	0.35*	0.27*	0.17*	0.31***	0.37***	0.40***
	(0.121)	(0.176)	(0.157)	(0.095)	(0.207)	(0.159)	(0.144)	(0.121)	(0.068)	(0.066)	(0.102)	(0.098)
SELF-ESTEEM	0.28***	0.13	0.20	0.27*	0.34**	0.29	0.34**	0.47***	0.46***	0.41***	0.41***	0.28*
	(0.084)	(0.156)	(0.124)	(0.121)	(0.128)	(0.158)	(0.104)	(0.079)	(0.085)	(0.049)	(0.072)	(0.117)
PT in middle school	-0.06	-0.06	0.01	-0.08	-0.11	-0.20*	-0.10	0.13	0.05	-0.03	-0.05	-0.09
	(0.047)	(0.046)	(0.065)	(0.055)	(0.078)	(0.089)	(0.065)	(0.085)	(0.077)	(0.055)	(0.077)	(0.062)
Constant	5.09***	2.20*	3.79***	5.12***	6.37***	7.69***	5.56***	2.81***	3.80***	5.36***	6.40***	7.13***
	(0.449)	(1.011)	(0.667)	(0.436)	(0.653)	(0.675)	(0.561)	(0.566)	(0.415)	(0.287)	(0.356)	(0.440)
Observations	639	639	639	639	639	639	465	1,571	1,571	1,571	1,571	1,571
R-squared	0.327						0.319					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table P.2. Heterogeneous effects of two years of private tutoring in high school on the CSAT overall achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of PT in high school	0.29**	0.45**	0.52***	0.37**	0.09	0.14	0.51	0.51	0.71***	0.57***	0.44	0.32
	(0.101)	(0.149)	(0.122)	(0.117)	(0.152)	(0.194)	(0.304)	(0.285)	(0.162)	(0.127)	(0.241)	(0.326)
URBAN	-0.22	-0.14	-0.16	-0.10	-0.29	-0.13	-0.20	-0.03	-0.12	-0.03	-0.14	0.03
	(0.119)	(0.154)	(0.127)	(0.139)	(0.188)	(0.210)	(0.137)	(0.166)	(0.097)	(0.087)	(0.129)	(0.109)
GENDER (1=female)	-0.12	-0.01	-0.08	-0.14	-0.21	-0.26*	-0.08	0.17	0.02	-0.12	-0.21	-0.21
	(0.083)	(0.115)	(0.103)	(0.114)	(0.119)	(0.123)	(0.097)	(0.109)	(0.078)	(0.083)	(0.163)	(0.131)
SES	0.10	0.03	0.06	0.12**	0.16	0.24*	0.08	0.11	0.11	0.12**	0.23***	0.23**
	(0.054)	(0.092)	(0.061)	(0.039)	(0.129)	(0.100)	(0.064)	(0.056)	(0.058)	(0.046)	(0.068)	(0.083)
SCHOOL TYPE	0.05	0.08	0.07	0.11	0.06	-0.02	0.07	0.19	0.13	0.14	0.20*	0.22*
	(0.085)	(0.182)	(0.128)	(0.081)	(0.123)	(0.143)	(0.098)	(0.110)	(0.095)	(0.083)	(0.097)	(0.087)
SCHOOL TRACK	0.54***	0.95***	0.57***	0.53***	0.61*	0.24	0.66***	1.20***	0.79**	0.40*	0.47*	0.50
	(0.134)	(0.265)	(0.155)	(0.120)	-0.254	(0.341)	(0.170)	(0.214)	(0.242)	(0.177)	(0.186)	(0.277)
STU-TEA RATIO	-0.03	-0.00	-0.03	-0.03	-0.03	-0.05	-0.05*	-0.05*	-0.03*	-0.04*	-0.03	-0.03
	(0.018)	(0.033)	(0.025)	(0.028)	(0.035)	(0.043)	(0.021)	(0.028)	(0.016)	(0.015)	(0.028)	(0.029)
SCHOOL CHOICE	-0.29*	-0.20	-0.17	-0.19	-0.45**	-0.39*	-0.26	-0.18	-0.13	-0.13	-0.16	-0.19
	(0.123)	(0.178)	(0.121)	(0.175)	(0.158)	(0.195)	(0.148)	(0.210)	(0.081)	(0.120)	(0.160)	(0.144)
PRESCORE (G9)	0.74***	0.81***	0.81***	0.79***	0.72***	0.69***	0.70***	0.77***	0.70***	0.77***	0.69***	0.66***
	(0.056)	(0.116)	(0.069)	(0.079)	(0.118)	(0.092)	(0.065)	(0.096)	(0.045)	(0.050)	(0.075)	(0.074)
SELF-STUDY	0.40***	0.22	0.40***	0.39***	0.31*	0.42*	0.42***	0.26	0.16	0.30***	0.36**	0.39**
	(0.093)	(0.137)	(0.071)	(0.103)	(0.134)	(0.203)	(0.109)	(0.144)	(0.101)	(0.082)	(0.130)	(0.132)
SELF-ESTEEM	0.31***	0.50***	0.28***	0.21*	0.27**	0.29**	0.35***	0.47***	0.46***	0.41***	0.41***	0.28**
	(0.067)	(0.131)	(0.061)	(0.082)	(0.090)	(0.090)	(0.080)	(0.056)	(0.084)	(0.059)	(0.099)	(0.106)
PT in middle school	0.02	0.04	0.03	-0.03	0.02	-0.04	0.03	0.11	0.01	-0.05	-0.07	-0.10
	(0.047)	(0.085)	(0.064)	(0.056)	(0.082)	(0.091)	(0.071)	(0.095)	(0.056)	(0.055)	(0.069)	(0.075)
Constant	5.51***	2.95***	4.31***	5.37***	6.81***	8.16***	5.44***	2.90***	3.92***	5.46***	6.48***	7.18***
	(0.386)	(0.588)	(0.530)	(0.567)	(0.514)	(1.025)	(0.459)	(0.576)	(0.417)	(0.326)	(0.482)	(0.610)
Observations	826	826	826	826	826	826	627	1,571	1,571	1,571	1,571	1,571
R-squared	0.407						0.402					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table P.3. Heterogeneous effects of three years of private tutoring in high school on the CSAT overall achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of PT in high school	0.59***	0.56*	0.72***	0.64***	0.48***	0.45**	0.51*	0.54*	0.75***	0.61***	0.46*	0.34
	(0.105)	(0.245)	(0.166)	(0.173)	(0.140)	(0.175)	(0.251)	(0.268)	(0.184)	(0.160)	(0.214)	(0.329)
URBAN	-0.08	-0.04	-0.03	-0.11	-0.18	-0.04	-0.11	-0.01	-0.10	-0.01	-0.13	0.04
	(0.108)	(0.238)	(0.141)	(0.172)	(0.238)	(0.113)	(0.120)	(0.132)	(0.112)	(0.095)	(0.167)	(0.100)
GENDER (1=female)	-0.04	0.19*	0.04	-0.04	-0.15	-0.25	-0.05	0.18	0.04	-0.11	-0.20	-0.20**
	(0.072)	(0.091)	(0.093)	(0.094)	(0.132)	(0.161)	(0.082)	(0.126)	(0.058)	(0.062)	(0.144)	(0.075)
SES	0.13**	0.07	0.12	0.15*	0.22*	0.27**	0.13*	0.10	0.10	0.12**	0.23**	0.23**
	(0.048)	(0.088)	(0.081)	(0.066)	(0.086)	(0.086)	(0.058)	(0.087)	(0.060)	(0.036)	(0.072)	(0.077)
SCHOOL TYPE	0.21**	0.20	0.18	0.32**	0.25**	0.26*	0.23**	0.18	0.11	0.13	0.20**	0.21*
	(0.074)	(0.122)	(0.101)	(0.111)	(0.087)	(0.111)	(0.082)	(0.107)	(0.066)	(0.069)	(0.076)	(0.094)
SCHOOL TRACK	0.52***	0.91***	0.36*	0.60**	0.56**	0.55***	0.75***	1.20***	0.79***	0.40*	0.47**	0.50
	(0.132)	(0.260)	(0.173)	(0.191)	(0.201)	(0.153)	(0.165)	(0.194)	(0.223)	(0.174)	(0.151)	(0.422)
STU-TEA RATIO	-0.05**	-0.03	-0.03	-0.07*	-0.07**	-0.08**	-0.04*	-0.05	-0.03	-0.04*	-0.03	-0.03
	(0.016)	(0.024)	(0.027)	(0.027)	(0.024)	(0.030)	(0.019)	(0.033)	(0.019)	(0.017)	(0.018)	(0.023)
SCHOOL CHOICE	-0.11	-0.04	-0.02	-0.01	-0.18	-0.14	-0.17	-0.16	-0.11	-0.11	-0.15	-0.18
	(0.115)	(0.217)	(0.128)	(0.173)	(0.200)	(0.149)	(0.129)	(0.144)	(0.080)	(0.113)	(0.155)	(0.126)
PRESCORE (G9)	0.73***	0.87***	0.82***	0.75***	0.69***	0.62***	0.68***	0.76***	0.68***	0.75***	0.68***	0.66***
	(0.051)	(0.097)	(0.088)	(0.067)	(0.058)	(0.072)	(0.057)	(0.078)	(0.055)	(0.042)	(0.067)	(0.063)
SELF-STUDY	0.26**	0.29**	0.13	0.25*	0.33*	0.27*	0.16	0.25*	0.15*	0.30***	0.36***	0.39**
	(0.081)	(0.097)	(0.124)	(0.120)	(0.139)	(0.116)	(0.090)	(0.104)	(0.078)	(0.080)	(0.104)	(0.137)
SELF-ESTEEM	0.43***	0.46***	0.46***	0.43***	0.44***	0.31*	0.48***	0.48***	0.47***	0.41***	0.41***	0.29**
	(0.061)	(0.083)	(0.102)	(0.084)	(0.095)	(0.122)	(0.068)	(0.076)	(0.076)	(0.063)	(0.083)	(0.100)
PT in middle school	-0.03	0.10	0.01	-0.05	-0.00	-0.11	0.03	0.11	0.01	-0.05	-0.07	-0.10
	(0.050)	(0.115)	(0.097)	(0.078)	(0.066)	(0.096)	(0.071)	(0.073)	(0.058)	(0.041)	(0.081)	(0.092)
Constant	5.44***	2.59***	4.13***	5.55***	6.77***	8.03***	5.24***	2.91***	3.93***	5.46***	6.48***	7.19***
	(0.356)	(0.666)	(0.534)	(0.455)	(0.527)	(0.854)	(0.407)	(0.624)	(0.427)	(0.360)	(0.440)	(0.624)
Observations	985	985	985	985	985	985	782	1,571	1,571	1,571	1,571	1,571
R-squared	0.453						0.442					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table P.4. Heterogeneous effects of one year of verbal tutoring in high school on the CSAT verbal achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of Verbal PT in high school	0.01	-0.11	-0.05	0.06	0.08	-0.09	0.54	0.7	0.36	0.83*	0.88*	0.55
	(0.071)	(0.092)	(0.078)	(0.073)	(0.090)	(0.108)	(0.464)	-0.687	-0.429	-0.337	-0.366	-0.599
URBAN	-0.03	-0.12	-0.02	-0.10	-0.03	-0.14	-0.09	-0.03	0.01	-0.15	-0.00	-0.03
	(0.101)	(0.195)	(0.152)	(0.130)	(0.158)	(0.188)	(0.124)	(0.167)	(0.134)	(0.132)	(0.158)	(0.140)
GENDER (1=female)	0.12	0.20	0.18*	0.11	-0.01	0.02	0.03	0.28*	0.22*	0.03	-0.21*	-0.22
	(0.072)	(0.188)	(0.093)	(0.074)	(0.121)	(0.157)	(0.090)	(0.112)	(0.091)	(0.105)	(0.103)	(0.124)
SES	0.08	0.01	0.12	0.16**	0.05	0.03	0.04	0.05	0.11	0.09	0.02	0.11
	(0.047)	(0.135)	(0.073)	(0.049)	(0.051)	(0.041)	(0.060)	(0.106)	(0.064)	(0.052)	(0.060)	(0.096)
SCHOOL TYPE	0.08	0.08	0.12	0.04	0.07	0.09	0.03	0.06	0.10	0.00	0.03	-0.06
	(0.072)	(0.141)	(0.120)	(0.086)	(0.089)	(0.148)	(0.084)	(0.129)	(0.089)	(0.083)	(0.076)	(0.163)
SCHOOL TRACK	0.58***	0.59***	0.91***	0.76***	0.49***	0.36	0.68***	0.86***	1.05***	0.92***	0.53*	0.68
	(0.119)	(0.168)	(0.168)	(0.146)	(0.118)	(0.226)	(0.151)	(0.219)	(0.179)	(0.176)	(0.239)	(0.379)
STU-TEA RATIO	-0.02	-0.02	-0.02	-0.03*	-0.03	-0.01	-0.02	-0.05	-0.03	-0.04	-0.00	-0.05
	(0.016)	(0.024)	(0.027)	(0.014)	(0.019)	(0.029)	(0.020)	(0.033)	(0.020)	(0.021)	(0.024)	(0.030)
SCHOOL CHOICE	-0.01	-0.01	-0.03	-0.05	0.04	-0.22	0.03	0.07	0.04	-0.05	0.15	-0.06
	(0.105)	(0.158)	(0.126)	(0.096)	(0.170)	(0.225)	(0.126)	(0.206)	(0.180)	(0.140)	(0.139)	(0.145)
PRESCORE (G9)	0.77***	0.87***	0.66***	0.78***	0.76***	0.81***	0.76***	0.69***	0.63***	0.76***	0.75***	0.71***
	(0.048)	(0.089)	(0.057)	(0.070)	(0.052)	(0.058)	(0.057)	(0.123)	(0.062)	(0.040)	(0.053)	(0.069)
SELF-STUDY	0.11	0.14	0.12	-0.04	0.10	0.16	0.11	0.13	0.05	0.01	0.14	0.24
	(0.078)	(0.127)	(0.104)	(0.108)	(0.125)	(0.162)	(0.092)	(0.131)	(0.117)	(0.083)	(0.108)	(0.167)
SELF-ESTEEM	0.31***	0.31*	0.37***	0.31***	0.31***	0.25*	0.34***	0.56***	0.53***	0.38***	0.31***	0.21
	(0.060)	(0.146)	(0.087)	(0.084)	(0.092)	(0.109)	(0.071)	(0.141)	(0.064)	(0.040)	(0.076)	(0.125)
Verbal PT in middle school	-0.08*	-0.01	-0.08*	-0.08**	-0.13**	-0.11*	-0.13*	-0.08	-0.10*	-0.15**	-0.20***	-0.22*
	(0.031)	(0.057)	(0.035)	(0.028)	(0.044)	(0.042)	(0.052)	(0.079)	(0.052)	(0.047)	(0.041)	(0.092)
Constant	5.26***	3.21***	4.06***	5.42***	6.59***	7.52***	5.07***	3.07***	3.73***	5.37***	6.09***	8.13***
	(0.333)	(0.616)	(0.474)	(0.321)	(0.434)	(0.609)	(0.448)	(0.769)	(0.554)	(0.514)	(0.437)	(0.691)
Observations	1,596	1,596	1,596	1,596	1,596	1,596	1,227	1,672	1,672	1,672	1,672	1,672
R-squared	0.256						0.230					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table P.5. Heterogeneous effects of two years of verbal tutoring in high school on the CSAT verbal achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of Verbal PT in high school	0.24**	0.43**	0.15	0.23*	0.20	0.28*	0.34	0.38	0.19	0.45	0.47*	0.30
	(0.093)	(0.161)	(0.131)	(0.117)	(0.139)	(0.129)	(0.240)	(0.429)	(0.278)	(0.232)	(0.206)	(0.363)
URBAN	-0.17	-0.13	-0.09	-0.30	-0.15	-0.09	-0.12	-0.04	0.01	-0.15	-0.01	-0.03
	(0.121)	(0.195)	(0.147)	(0.204)	(0.221)	(0.187)	(0.139)	(0.168)	(0.159)	(0.172)	(0.166)	(0.169)
GENDER (1=female)	0.14	0.12	0.22*	0.17	0.11	-0.16	0.11	0.31*	0.24*	0.06	-0.17	-0.20
	(0.081)	(0.121)	(0.099)	(0.115)	(0.142)	(0.144)	(0.093)	(0.155)	(0.097)	(0.067)	(0.097)	(0.154)
SES	0.10	0.02	0.13*	0.11*	0.09	0.07	0.09	0.04	0.11	0.08	0.02	0.11
	(0.053)	(0.109)	(0.052)	(0.049)	(0.086)	(0.121)	(0.066)	(0.166)	(0.057)	(0.049)	(0.062)	(0.075)
SCHOOL TYPE	-0.01	0.02	0.06	0.01	-0.05	-0.19	-0.04	0.07	0.10	0.02	0.05	-0.05
	(0.083)	(0.136)	(0.102)	(0.084)	(0.127)	(0.174)	(0.095)	(0.168)	(0.114)	(0.093)	(0.110)	(0.126)
SCHOOL TRACK	0.64***	0.76**	0.83***	0.72***	0.53**	0.42	0.81***	0.89***	1.06***	0.96***	0.58***	0.71*
	(0.138)	(0.257)	(0.210)	(0.174)	(0.190)	(0.248)	(0.168)	(0.241)	(0.208)	(0.179)	(0.118)	(0.327)
STU-TEA RATIO	-0.01	-0.03	-0.03	-0.04	-0.01	0.01	-0.02	-0.05	-0.03	-0.04*	-0.01	-0.06
	(0.018)	(0.031)	(0.027)	(0.019)	(0.024)	(0.033)	(0.021)	(0.038)	(0.021)	(0.018)	(0.026)	(0.037)
SCHOOL CHOICE	-0.08	0.03	-0.00	-0.19	0.04	-0.10	-0.04	0.05	0.03	-0.07	0.13	-0.07
	(0.123)	(0.175)	(0.173)	(0.170)	(0.206)	(0.175)	(0.137)	(0.153)	(0.151)	(0.164)	(0.135)	(0.160)
PRESCORE (G9)	0.66***	0.79***	0.68***	0.71***	0.64***	0.66***	0.66***	0.68***	0.63***	0.75***	0.75***	0.70***
	(0.055)	(0.082)	(0.091)	(0.057)	(0.049)	(0.118)	(0.063)	(0.105)	(0.068)	(0.049)	(0.064)	(0.088)
SELF-STUDY	0.20*	0.11	0.11	0.09	0.23	0.39**	0.20	0.14	0.06	0.02	0.15	0.25*
	(0.089)	(0.171)	(0.132)	(0.090)	(0.143)	(0.148)	(0.102)	(0.126)	(0.086)	(0.095)	(0.112)	(0.100)
SELF-ESTEEM	0.42***	0.35*	0.49***	0.50***	0.44***	0.29***	0.45***	0.57***	0.53***	0.40***	0.33***	0.22*
	(0.065)	(0.162)	(0.089)	(0.089)	(0.105)	(0.089)	(0.075)	(0.095)	(0.081)	(0.060)	(0.072)	(0.098)
Verbal PT in middle school	-0.10**	-0.05	-0.16***	-0.07*	-0.15*	-0.15*	-0.12*	-0.06	-0.09*	-0.12*	-0.17**	-0.20**
	(0.036)	(0.066)	(0.045)	(0.037)	(0.060)	(0.066)	(0.046)	(0.061)	(0.038)	(0.059)	(0.061)	(0.063)
Constant	5.27***	3.52***	4.35***	5.72***	6.13***	7.44***	5.15***	3.24***	3.82***	5.58***	6.31***	8.27***
	(0.381)	(0.702)	(0.700)	(0.476)	(0.722)	(0.614)	(0.444)	(0.663)	(0.466)	(0.537)	(0.388)	(0.623)
Observations	1,208	1,208	1,208	1,208	1,208	1,208	938	1,672	1,672	1,672	1,672	1,672
R-squared	0.273						0.275					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table P.6. Heterogeneous effects of three years of verbal tutoring in high school on the CSAT verbal achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of Verbal PT in high school	0.23	0.32	0.01	0.16	0.46*	0.51*	0.23	0.42	0.21	0.50	0.53**	0.33
	(0.143)	(0.269)	(0.188)	(0.175)	(0.221)	(0.245)	(0.258)	(0.549)	(0.346)	(0.309)	(0.173)	(0.304)
URBAN	-0.16	-0.34	-0.11	-0.19	0.07	-0.08	-0.09	-0.03	0.02	-0.14	0.01	-0.02
	(0.136)	(0.276)	(0.180)	(0.193)	(0.198)	(0.279)	(0.155)	(0.152)	(0.157)	(0.166)	(0.138)	(0.169)
GENDER (1=female)	0.17	0.15	0.21	0.25*	0.20	-0.16	0.15	0.31	0.24*	0.06	-0.18*	-0.20
	(0.092)	(0.197)	(0.127)	(0.118)	(0.179)	(0.141)	(0.107)	(0.169)	(0.113)	(0.082)	(0.089)	(0.115)
SES	0.07	-0.06	0.01	0.14*	0.05	-0.01	0.08	0.06	0.11	0.10	0.04	0.12
	(0.061)	(0.178)	(0.108)	(0.068)	(0.075)	(0.103)	(0.073)	(0.145)	(0.063)	(0.053)	(0.049)	(0.095)
SCHOOL TYPE	-0.08	-0.01	-0.02	-0.09	-0.12	-0.11	-0.11	0.07	0.10	0.02	0.05	-0.05
	(0.093)	(0.206)	(0.135)	(0.097)	(0.125)	(0.184)	(0.107)	(0.149)	(0.088)	(0.081)	(0.096)	(0.122)
SCHOOL TRACK	0.66***	0.65*	0.78***	0.83***	0.54**	0.49	0.82***	0.91***	1.07***	0.98***	0.59***	0.72
	(0.149)	(0.320)	(0.197)	(0.162)	(0.191)	(0.301)	(0.187)	(0.219)	(0.188)	(0.134)	(0.155)	(0.485)
STU-TEA RATIO	-0.03	-0.02	-0.04	-0.04*	-0.04	0.02	-0.02	-0.05	-0.03	-0.04**	-0.01	-0.06
	(0.020)	(0.040)	(0.029)	(0.022)	(0.036)	(0.031)	(0.024)	(0.045)	(0.022)	(0.015)	(0.025)	(0.033)
SCHOOL CHOICE	-0.19	-0.24	-0.24	-0.19	0.09	-0.16	-0.13	0.05	0.03	-0.08	0.12	-0.08
	(0.137)	(0.236)	(0.160)	(0.173)	(0.179)	(0.260)	(0.154)	(0.211)	(0.181)	(0.149)	(0.165)	(0.184)
PRESCORE (G9)	0.72***	0.89***	0.71***	0.75***	0.66***	0.64***	0.66***	0.67***	0.62***	0.74***	0.73***	0.69***
	(0.063)	(0.112)	(0.086)	(0.064)	(0.130)	(0.103)	(0.074)	(0.112)	(0.067)	(0.052)	(0.061)	(0.075)
SELF-STUDY	0.14	0.24	0.07	-0.01	0.20	0.20	0.17	0.14	0.06	0.02	0.16	0.25*
	(0.103)	(0.192)	(0.106)	(0.103)	(0.175)	(0.164)	(0.118)	(0.202)	(0.088)	(0.088)	(0.103)	(0.117)
SELF-ESTEEM	0.41***	0.33*	0.51***	0.40***	0.43***	0.36**	0.43***	0.57***	0.53***	0.40***	0.33***	0.22
	(0.074)	(0.151)	(0.105)	(0.073)	(0.090)	(0.134)	(0.087)	(0.134)	(0.083)	(0.070)	(0.090)	(0.129)
Verbal PT in middle school	-0.07	-0.04	-0.11	-0.06	-0.12	-0.12	-0.06	-0.04	-0.08	-0.11*	-0.15**	-0.19***
	(0.039)	(0.064)	(0.075)	(0.045)	(0.060)	(0.068)	(0.047)	(0.071)	(0.057)	(0.044)	(0.050)	(0.055)
Constant	5.56***	3.69***	4.86***	5.63***	6.30***	7.29***	5.22***	3.26**	3.83***	5.60***	6.33***	8.28***
	(0.422)	(0.941)	(0.540)	(0.553)	(0.549)	(0.674)	(0.498)	(1.078)	(0.599)	(0.424)	(0.566)	(0.546)
Observations	988	988	988	988	988	988	760	1,672	1,672	1,672	1,672	1,672
R-squared	0.290						0.270					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table P.7. Heterogeneous effects of one year of English tutoring in high school on the CSAT English achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of English PT in high school	-0.12	-0.22	-0.15	-0.17	-0.06	0.00	0.41	0.61*	0.57**	0.47*	0.31	0.12
	(0.090)	(0.174)	(0.107)	(0.104)	(0.120)	(0.184)	(0.349)	(0.264)	(0.194)	(0.210)	(0.175)	(0.279)
URBAN	0.04	0.08	0.02	-0.01	0.09	0.37	-0.03	0.05	-0.17	-0.05	0.02	0.26*
	(0.128)	(0.281)	(0.178)	(0.179)	(0.185)	(0.231)	(0.150)	(0.258)	(0.139)	(0.104)	(0.107)	(0.132)
GENDER (1=female)	0.16	0.42***	0.31**	0.14	0.05	0.00	0.14	0.30*	0.19*	0.07	-0.01	-0.19*
	(0.088)	(0.127)	(0.113)	(0.106)	(0.117)	(0.130)	(0.104)	(0.122)	(0.082)	(0.069)	(0.067)	(0.076)
SES	0.26***	0.10	0.22***	0.26*	0.36***	0.32***	0.24**	0.20	0.23**	0.29***	0.31***	0.33***
	(0.066)	(0.065)	(0.059)	(0.104)	(0.061)	(0.091)	(0.082)	(0.143)	(0.083)	(0.062)	(0.087)	(0.083)
SCHOOL TYPE	0.09	0.36	0.18	-0.00	0.04	0.10	0.21	0.42*	0.20*	0.13	0.22*	0.22*
	(0.091)	(0.198)	(0.106)	(0.131)	(0.142)	(0.128)	(0.106)	(0.166)	(0.099)	(0.089)	(0.098)	(0.106)
SCHOOL TRACK	0.57***	0.97***	0.99***	0.48***	0.60**	0.64*	0.67***	1.05***	0.87***	0.68**	0.76***	0.90***
	(0.139)	(0.185)	(0.224)	(0.141)	(0.190)	(0.316)	(0.182)	(0.148)	(0.204)	(0.220)	(0.153)	(0.179)
STU-TEA RATIO	-0.02	-0.05*	-0.04	-0.03	-0.02	-0.03	-0.04	-0.04	-0.04	-0.06*	-0.05*	-0.04
	(0.018)	(0.023)	(0.029)	(0.022)	(0.026)	(0.041)	(0.022)	(0.021)	(0.021)	(0.023)	(0.023)	(0.029)
SCHOOL CHOICE	-0.13	0.12	-0.15	-0.29	-0.03	0.05	-0.22	-0.17	-0.30*	-0.20	-0.12	0.05
	(0.131)	(0.266)	(0.187)	(0.183)	(0.224)	(0.180)	(0.154)	(0.238)	(0.130)	(0.109)	(0.131)	(0.157)
PRESCORE (G9)	0.79***	1.03***	0.84***	0.85***	0.79***	0.64***	0.80***	0.92***	0.81***	0.78***	0.73***	0.55***
	(0.059)	(0.093)	(0.115)	(0.090)	(0.118)	(0.130)	(0.072)	(0.094)	(0.079)	(0.064)	(0.060)	(0.069)
SELF-STUDY	0.41***	0.44**	0.30**	0.53***	0.28	0.35	0.28*	0.19	0.27**	0.36***	0.34**	0.28
	(0.100)	(0.142)	(0.099)	(0.113)	(0.158)	(0.187)	(0.119)	(0.143)	(0.086)	(0.094)	(0.112)	(0.157)
SELF-ESTEEM	0.44***	0.48***	0.47***	0.46***	0.37***	0.43***	0.46***	0.51***	0.50***	0.44***	0.37***	0.44***
	(0.074)	(0.114)	(0.067)	(0.072)	(0.107)	(0.093)	(0.089)	(0.116)	(0.061)	(0.050)	(0.075)	(0.096)
English PT in middle school	0.02	0.07	0.09	0.00	-0.03	-0.06	-0.02	0.09	0.05	-0.00	-0.07	-0.05
	(0.043)	(0.063)	(0.055)	(0.048)	(0.053)	(0.069)	(0.059)	(0.051)	(0.049)	(0.073)	(0.059)	(0.063)
Constant	4.78***	1.94**	3.41***	5.29***	5.69***	6.64***	4.88***	2.02**	3.69***	5.36***	6.31***	6.96***
	(0.402)	(0.691)	(0.602)	(0.565)	(0.607)	(0.600)	(0.491)	(0.697)	(0.466)	(0.461)	(0.456)	(0.666)
Observations	1,157	1,157	1,157	1,157	1,157	1,157	878	1,887	1,887	1,887	1,887	1,887
R-squared	0.327						0.298					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table P.8. Heterogeneous effects of two years of English tutoring in high school on the CSAT English achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of English PT in high school	0.22*	0.11	0.22	0.26	0.14	0.10	0.18	0.61	0.57***	0.47*	0.31	0.12
	(0.090)	(0.238)	(0.129)	(0.160)	(0.141)	(0.162)	(0.221)	(0.336)	(0.153)	(0.227)	(0.181)	(0.177)
URBAN	-0.21	0.16	-0.38*	-0.18	-0.32*	0.10	-0.20	0.05	-0.16	-0.05	0.03	0.26
	(0.118)	(0.359)	(0.189)	(0.159)	(0.155)	(0.174)	(0.134)	(0.209)	(0.159)	(0.129)	(0.119)	(0.151)
GENDER (1=female)	0.02	0.02	0.09	0.13	0.02	-0.05	0.02	0.30*	0.19*	0.07	-0.01	-0.19
	(0.081)	(0.137)	(0.127)	(0.099)	(0.151)	(0.127)	(0.093)	(0.140)	(0.095)	(0.055)	(0.092)	(0.111)
SES	0.18***	0.15	0.13**	0.17*	0.30***	0.29***	0.17**	0.17	0.19**	0.26***	0.29***	0.32***
	(0.052)	(0.097)	(0.051)	(0.075)	(0.072)	(0.074)	(0.063)	(0.110)	(0.061)	(0.046)	(0.072)	(0.071)
SCHOOL TYPE	0.11	-0.05	0.15	0.12	0.17	0.13	0.17	0.42***	0.20*	0.14	0.22	0.22
	(0.083)	(0.193)	(0.096)	(0.119)	(0.118)	(0.138)	(0.095)	(0.125)	(0.102)	(0.101)	(0.131)	(0.138)
SCHOOL TRACK	0.62***	0.54*	0.80***	0.55***	0.69***	0.93**	0.76***	1.06***	0.88***	0.69***	0.76***	0.90***
	(0.140)	(0.226)	(0.190)	(0.128)	(0.192)	(0.334)	(0.166)	(0.150)	(0.168)	(0.158)	(0.179)	(0.200)
STU-TEA RATIO	-0.04	-0.01	-0.04	-0.04	-0.05	-0.07***	-0.05*	-0.04	-0.04	-0.06*	-0.05	-0.05
	(0.018)	(0.021)	(0.024)	(0.025)	(0.034)	(0.016)	(0.022)	(0.026)	(0.032)	(0.027)	(0.027)	(0.027)
SCHOOL CHOICE	-0.31*	-0.02	-0.41*	-0.36***	-0.41*	-0.21	-0.29*	-0.17	-0.31	-0.21	-0.12	0.05
	(0.121)	(0.324)	(0.187)	(0.095)	(0.168)	(0.142)	(0.137)	(0.168)	(0.171)	(0.138)	(0.107)	(0.152)
PRESCORE (G9)	0.79***	1.09***	0.89***	0.75***	0.69***	0.72***	0.79***	0.90***	0.79***	0.77***	0.72***	0.54***
	(0.057)	(0.151)	(0.090)	(0.057)	(0.084)	(0.094)	(0.064)	(0.080)	(0.052)	(0.045)	(0.083)	(0.060)
SELF-STUDY	0.42***	0.38	0.41*	0.44***	0.48***	0.33*	0.36***	0.15	0.24*	0.33*	0.32***	0.28**
	(0.090)	(0.257)	(0.168)	(0.115)	(0.144)	(0.164)	(0.105)	(0.141)	(0.103)	(0.130)	(0.092)	(0.106)
SELF-ESTEEM	0.40***	0.54***	0.40***	0.41***	0.33*	0.24	0.41***	0.53***	0.51***	0.45***	0.37***	0.45***
	(0.066)	(0.136)	(0.091)	(0.082)	(0.134)	(0.132)	(0.076)	(0.083)	(0.053)	(0.060)	(0.088)	(0.071)
English PT in middle school	0.01	0.11	0.11	-0.01	0.00	-0.09	0.05	0.07	0.04	-0.01	-0.08	-0.05
	(0.045)	(0.100)	(0.078)	(0.059)	(0.074)	(0.069)	(0.060)	(0.085)	(0.066)	(0.044)	(0.065)	(0.055)
Constant	5.48***	2.58**	4.27***	5.47***	6.77***	7.73***	5.45***	2.18***	3.83***	5.48***	6.39***	6.99***
	(0.394)	(0.837)	(0.611)	(0.390)	(0.523)	(0.513)	(0.461)	(0.550)	(0.422)	(0.394)	(0.415)	(0.559)
Observations	1,228	1,228	1,228	1,228	1,228	1,228	956	1,887	1,887	1,887	1,887	1,887
R-squared	0.363						0.352					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table P.9. Heterogeneous effects of three years of English tutoring in high school on the CSAT English achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of English PT in high school	0.36***	0.37	0.49***	0.44**	0.19	0.06	0.29	0.49*	0.45***	0.37	0.25	0.10
	(0.100)	(0.231)	(0.121)	(0.142)	(0.116)	(0.166)	(0.164)	(0.221)	(0.130)	(0.213)	(0.181)	(0.245)
URBAN	-0.16	-0.25	-0.31*	-0.09	0.04	0.20	-0.16	0.05	-0.16	-0.05	0.03	0.26
	(0.133)	(0.278)	(0.137)	(0.127)	(0.120)	(0.256)	(0.146)	(0.229)	(0.148)	(0.123)	(0.128)	(0.153)
GENDER (1=female)	0.10	0.17	0.19	0.14	0.04	0.00	0.09	0.29*	0.18	0.06	-0.02	-0.19
	(0.088)	(0.174)	(0.122)	(0.090)	(0.138)	(0.125)	(0.100)	(0.116)	(0.114)	(0.082)	(0.107)	(0.100)
SES	0.25***	0.18	0.21**	0.21*	0.34**	0.38***	0.23**	0.18	0.21***	0.27***	0.30***	0.32***
	(0.064)	(0.154)	(0.078)	(0.092)	(0.105)	(0.097)	(0.077)	(0.094)	(0.060)	(0.065)	(0.067)	(0.045)
SCHOOL TYPE	0.09	0.23	0.05	-0.04	0.12	0.13	0.16	0.42**	0.20*	0.13	0.22**	0.22***
	(0.092)	(0.213)	(0.096)	(0.108)	(0.116)	(0.209)	(0.103)	(0.161)	(0.089)	(0.073)	(0.073)	(0.066)
SCHOOL TRACK	0.54***	0.69**	0.59*	0.45*	0.60**	0.23	0.66***	1.10***	0.92***	0.72***	0.78***	0.91***
	(0.146)	(0.239)	(0.284)	(0.202)	(0.185)	(0.283)	(0.174)	(0.244)	(0.197)	(0.182)	(0.145)	(0.258)
STU-TEA RATIO	-0.04*	-0.01	-0.01	-0.05*	-0.06*	-0.05	-0.04	-0.04	-0.03	-0.06	-0.05*	-0.04
	(0.019)	(0.043)	(0.030)	(0.026)	(0.028)	(0.043)	(0.022)	(0.029)	(0.029)	(0.030)	(0.022)	(0.027)
SCHOOL CHOICE	-0.20	-0.07	-0.22	-0.16	-0.07	0.02	-0.25	-0.19	-0.32*	-0.22	-0.13	0.05
	(0.135)	(0.258)	(0.158)	(0.148)	(0.169)	(0.224)	(0.149)	(0.231)	(0.162)	(0.147)	(0.142)	(0.147)
PRESCORE (G9)	0.80***	1.00***	0.86***	0.84***	0.81***	0.65***	0.77***	0.89***	0.79***	0.76***	0.72***	0.54***
	(0.061)	(0.143)	(0.109)	(0.083)	(0.096)	(0.129)	(0.068)	(0.111)	(0.083)	(0.046)	(0.056)	(0.071)
SELF-STUDY	0.18	0.20	0.09	0.14	0.18	0.30	0.03	0.18	0.26*	0.35***	0.34***	0.28**
	(0.099)	(0.281)	(0.155)	(0.117)	(0.165)	(0.193)	(0.111)	(0.177)	(0.110)	(0.093)	(0.088)	(0.108)
SELF-ESTEEM	0.51***	0.48***	0.48***	0.48***	0.41***	0.54***	0.54***	0.52***	0.50***	0.44***	0.37***	0.45***
	(0.074)	(0.145)	(0.081)	(0.099)	(0.110)	(0.141)	(0.083)	(0.126)	(0.086)	(0.074)	(0.077)	(0.075)
English PT in middle school	0.03	0.12	0.09	0.00	0.00	-0.04	0.09	0.10	0.07	0.01	-0.06	-0.04
	(0.048)	(0.098)	(0.094)	(0.069)	(0.089)	(0.097)	(0.057)	(0.064)	(0.057)	(0.057)	(0.079)	(0.054)
Constant	5.32***	2.36**	3.83***	5.61***	6.38***	7.46***	5.29***	2.19***	3.85***	5.49***	6.40***	7.00***
	(0.416)	(0.877)	(0.594)	(0.579)	(0.621)	(0.942)	(0.481)	(0.462)	(0.525)	(0.553)	(0.397)	(0.602)
Observations	963	963	963	963	963	963	757	1,887	1,887	1,887	1,887	1,887
R-squared	0.399						0.377					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table P.10. Heterogeneous effects of one year of math tutoring in high school on the CSAT math achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
1 year of Math PT in high school	0.20	0.26	0.34	0.24	0.12	-0.01	0.56	0.75**	1.08***	1.03***	0.91***	0.70***
	(0.111)	(0.230)	(0.181)	(0.141)	(0.197)	(0.168)	(0.374)	(0.276)	(0.193)	(0.208)	(0.163)	(0.168)
URBAN	-0.05	-0.10	-0.11	0.18	-0.16	0.10	-0.15	-0.20	0.03	-0.03	-0.01	-0.16
	(0.162)	(0.344)	(0.215)	(0.199)	(0.235)	(0.383)	(0.190)	(0.140)	(0.171)	(0.124)	(0.164)	(0.211)
GENDER (1=female)	-0.41***	-0.12	-0.16	-0.46***	-0.56***	-0.44*	-0.50***	-0.29*	-0.37***	-0.53***	-0.49***	-0.52***
	(0.107)	(0.198)	(0.169)	(0.131)	(0.124)	(0.173)	(0.128)	(0.125)	(0.086)	(0.091)	(0.098)	(0.125)
SES	0.00	-0.15	-0.06	0.07	0.01	0.10	-0.06	0.01	0.05	0.06	0.18*	0.21**
	(0.079)	(0.223)	(0.152)	(0.086)	(0.115)	(0.082)	(0.099)	(0.114)	(0.071)	(0.091)	(0.084)	(0.074)
SCHOOL TYPE	0.17	0.11	0.12	0.19	0.39*	0.18	0.19	0.16	0.27**	0.06	0.21*	0.28*
	(0.110)	(0.282)	(0.244)	(0.164)	(0.174)	(0.162)	(0.128)	(0.095)	(0.085)	(0.121)	(0.105)	(0.135)
SCHOOL TRACK	0.25	0.37*	0.21	0.57*	0.36	-0.01	0.28	0.71**	0.44	0.29	0.37*	0.40
	(0.156)	(0.177)	(0.188)	(0.244)	(0.200)	(0.202)	(0.200)	(0.227)	(0.338)	(0.246)	(0.186)	(0.290)
STU-TEA RATIO	-0.01	-0.03	-0.01	-0.02	-0.02	0.01	-0.02	-0.05	-0.02	-0.04	-0.04	-0.03
	(0.022)	(0.048)	(0.039)	(0.020)	(0.026)	(0.025)	(0.026)	(0.028)	(0.036)	(0.023)	(0.029)	(0.023)
SCHOOL CHOICE	0.01	0.05	0.09	0.26	-0.07	-0.23	-0.11	-0.55**	-0.13	-0.17	-0.16	-0.33
	(0.162)	(0.409)	(0.155)	(0.187)	(0.197)	(0.286)	(0.192)	(0.173)	(0.128)	(0.132)	(0.160)	(0.205)
PRESCORE (G9)	0.82***	0.73***	0.84***	0.90***	0.91***	0.69***	0.78***	0.79***	0.75***	0.86***	0.78***	0.66***
	(0.072)	(0.103)	(0.134)	(0.105)	(0.141)	(0.099)	(0.084)	(0.098)	(0.090)	(0.054)	(0.053)	(0.075)
SELF-STUDY	0.72***	0.76**	0.74***	0.72***	0.64**	0.86***	0.68***	0.36*	0.39***	0.49***	0.44***	0.45***
	(0.125)	(0.239)	(0.215)	(0.098)	(0.214)	(0.132)	(0.147)	(0.170)	(0.113)	(0.091)	(0.107)	(0.113)
SELF-ESTEEM	0.29**	0.35*	0.31*	0.28	0.19	0.40**	0.37***	0.41***	0.25*	0.29**	0.22**	0.23**
	(0.088)	(0.137)	(0.156)	(0.145)	(0.176)	(0.138)	(0.105)	(0.072)	(0.098)	(0.097)	(0.076)	(0.086)
Math PT in middle school	-0.08	0.06	-0.03	-0.13*	-0.13	-0.17*	-0.14*	0.06	-0.01	-0.09	-0.17**	-0.08
	(0.050)	(0.099)	(0.070)	(0.051)	(0.075)	(0.077)	(0.067)	(0.077)	(0.071)	(0.054)	(0.066)	(0.062)
Constant	4.97***	2.34	3.32***	4.55***	6.61***	7.52***	5.36***	3.63***	3.60***	5.79***	6.91***	7.95***
	(0.483)	(1.220)	(0.671)	(0.657)	(0.735)	(0.719)	(0.597)	(0.563)	(0.619)	(0.528)	(0.577)	(0.648)
Observations	910	910	910	910	910	910	680	1,899	1,899	1,899	1,899	1,899
R-squared	0.259						0.247					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table P.11. Heterogeneous effects of two years of math tutoring in high school on the CSAT math achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
2 years of Math PT in high school	0.73***	0.74***	0.89***	0.68**	0.60**	0.42*	1.01***	0.81**	1.17***	1.12***	0.98***	0.76**
	(0.116)	(0.211)	(0.186)	(0.220)	(0.225)	(0.202)	(0.283)	(0.288)	(0.210)	(0.254)	(0.258)	(0.260)
URBAN	-0.21	-0.43*	-0.29*	-0.26	-0.16	-0.17	-0.24	-0.25*	-0.03	-0.09	-0.06	-0.20
	(0.140)	(0.217)	(0.137)	(0.232)	(0.189)	(0.245)	(0.158)	(0.118)	(0.141)	(0.138)	(0.199)	(0.186)
GENDER (1=female)	-0.36***	-0.16	-0.31*	-0.44***	-0.39*	-0.40**	-0.31**	-0.27*	-0.33*	-0.49***	-0.46***	-0.49***
	(0.097)	(0.228)	(0.128)	(0.133)	(0.169)	(0.139)	(0.111)	(0.130)	(0.133)	(0.095)	(0.087)	(0.148)
SES	-0.00	-0.08	-0.09	-0.02	0.06	0.14	-0.02	-0.01	0.02	0.03	0.16	0.19*
	(0.065)	(0.087)	(0.084)	(0.074)	(0.105)	(0.093)	(0.078)	(0.094)	(0.063)	(0.066)	(0.090)	(0.076)
SCHOOL TYPE	0.11	0.14	0.17	0.03	0.16	0.13	0.11	0.17	0.29**	0.09	0.23	0.30**
	(0.099)	(0.249)	(0.127)	(0.145)	(0.135)	(0.140)	(0.113)	(0.146)	(0.101)	(0.122)	(0.139)	(0.114)
SCHOOL TRACK	0.44**	0.81*	0.38	0.67**	0.31	0.03	0.50*	0.67**	0.37	0.23	0.31	0.35
	(0.163)	(0.316)	(0.200)	(0.252)	(0.223)	(0.282)	(0.206)	(0.228)	(0.334)	(0.245)	(0.247)	(0.311)
STU-TEA RATIO	-0.05*	-0.04	-0.04	-0.04	-0.06	-0.04	-0.06*	-0.05	-0.01	-0.04*	-0.04*	-0.03
	(0.021)	(0.035)	(0.032)	(0.030)	(0.032)	(0.032)	(0.025)	(0.027)	(0.032)	(0.018)	(0.015)	(0.028)
SCHOOL CHOICE	-0.27	-0.59*	-0.18	-0.27	-0.32	-0.42	-0.36*	-0.54***	-0.12	-0.16	-0.15	-0.32*
	(0.143)	(0.245)	(0.171)	(0.269)	(0.215)	(0.251)	(0.165)	(0.145)	(0.150)	(0.183)	(0.150)	(0.162)
PRESCORE (G9)	0.78***	0.70***	0.84***	0.87***	0.78***	0.65***	0.70***	0.77***	0.72***	0.83***	0.75***	0.63***
	(0.066)	(0.145)	(0.104)	(0.083)	(0.106)	(0.114)	(0.075)	(0.079)	(0.092)	(0.081)	(0.066)	(0.077)
SELF-STUDY	0.58***	0.43	0.57***	0.57***	0.67***	0.65**	0.50***	0.35	0.38***	0.48***	0.43**	0.44**
	(0.106)	(0.222)	(0.165)	(0.126)	(0.160)	(0.239)	(0.125)	(0.185)	(0.099)	(0.113)	(0.141)	(0.170)
SELF-ESTEEM	0.25**	0.28	0.14	0.17	0.20	0.43*	0.27**	0.44***	0.30**	0.34***	0.26***	0.26*
	(0.078)	(0.184)	(0.154)	(0.129)	(0.114)	(0.168)	(0.091)	(0.085)	(0.112)	(0.068)	(0.070)	(0.124)
Math PT in middle school	-0.05	0.02	-0.09	-0.07	-0.01	-0.06	-0.06	0.04	-0.03	-0.11	-0.20**	-0.10
	(0.053)	(0.076)	(0.059)	(0.073)	(0.088)	(0.135)	(0.072)	(0.079)	(0.073)	(0.070)	(0.069)	(0.081)
Constant	5.81***	3.51***	4.50***	5.83***	7.22***	8.56***	5.98***	3.68***	3.67***	5.86***	6.96***	7.99***
	(0.443)	(0.672)	(0.505)	(0.775)	(0.809)	(0.620)	(0.517)	(0.549)	(0.497)	(0.511)	(0.536)	(0.738)
Observations	1,083	1,083	1,083	1,083	1,083	1,083	832	1,899	1,899	1,899	1,899	1,899
R-squared	0.324						0.308					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table P.12. Heterogeneous effects of three years of math tutoring in high school on the CSAT math achievement

	OLS						2SLAD					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
3 years of Math PT in high school	1.18***	1.32***	1.35***	1.21***	0.98***	0.93***	1.08***	0.91*	1.32***	1.26***	1.10***	0.85**
	(0.121)	(0.233)	(0.185)	(0.176)	(0.233)	(0.245)	(0.246)	(0.363)	(0.228)	(0.269)	(0.333)	(0.327)
URBAN	-0.03	-0.09	0.03	0.06	-0.13	0.15	-0.03	-0.20	0.04	-0.02	0.00	-0.15
	(0.133)	(0.165)	(0.188)	(0.190)	(0.153)	(0.242)	(0.148)	(0.181)	(0.122)	(0.109)	(0.168)	(0.185)
GENDER (1=female)	-0.30***	-0.05	-0.17	-0.36**	-0.45***	-0.44***	-0.36***	-0.26*	-0.32**	-0.49***	-0.45***	-0.49**
	(0.090)	(0.129)	(0.175)	(0.125)	(0.129)	(0.123)	(0.102)	(0.128)	(0.104)	(0.096)	(0.096)	(0.152)
SES	0.06	0.01	-0.11	0.04	0.18*	0.11	0.08	-0.02	-0.01	0.01	0.14	0.17
	(0.061)	(0.098)	(0.104)	(0.080)	(0.076)	(0.096)	(0.075)	(0.122)	(0.062)	(0.078)	(0.102)	(0.109)
SCHOOL TYPE	0.06	-0.24	0.04	0.13	0.17	0.37**	0.04	0.15	0.26**	0.05	0.20*	0.28**
	(0.092)	(0.172)	(0.141)	(0.118)	(0.126)	(0.137)	(0.103)	(0.143)	(0.095)	(0.091)	(0.104)	(0.106)
SCHOOL TRACK	0.39*	0.12	0.16	0.50	0.49	0.20	0.52**	0.69***	0.40	0.25	0.33*	0.37
	(0.157)	(0.270)	(0.227)	(0.292)	(0.329)	(0.258)	(0.193)	(0.200)	(0.296)	(0.174)	(0.167)	(0.249)
STU-TEA RATIO	-0.03	-0.02	0.01	-0.03	-0.07*	-0.05	-0.02	-0.05	-0.01	-0.04	-0.04	-0.03
	(0.021)	(0.035)	(0.041)	(0.032)	(0.026)	(0.038)	(0.024)	(0.030)	(0.023)	(0.022)	(0.021)	(0.030)
SCHOOL CHOICE	-0.10	-0.38	0.06	0.14	-0.28	-0.11	-0.20	-0.49*	-0.05	-0.09	-0.09	-0.27
	(0.141)	(0.207)	(0.192)	(0.233)	(0.203)	(0.224)	(0.160)	(0.198)	(0.146)	(0.157)	(0.201)	(0.192)
PRESCORE (G9)	0.72***	0.74***	0.79***	0.82***	0.71***	0.62***	0.66***	0.74***	0.68***	0.79***	0.72***	0.61***
	(0.065)	(0.168)	(0.089)	(0.086)	(0.091)	(0.087)	(0.074)	(0.087)	(0.100)	(0.073)	(0.084)	(0.085)
SELF-STUDY	0.46***	0.31	0.45**	0.58***	0.36**	0.27	0.33**	0.33	0.34**	0.45***	0.40***	0.42**
	(0.100)	(0.217)	(0.170)	(0.116)	(0.138)	(0.177)	(0.114)	(0.168)	(0.130)	(0.098)	(0.097)	(0.153)
SELF-ESTEEM	0.32***	0.37**	0.42***	0.29***	0.27*	0.34**	0.37***	0.44***	0.29***	0.33***	0.25***	0.25*
	(0.075)	(0.133)	(0.115)	(0.052)	(0.109)	(0.113)	(0.083)	(0.103)	(0.087)	(0.084)	(0.072)	(0.099)
Math PT in middle school	-0.12*	-0.02	-0.02	-0.20*	-0.16	-0.16	-0.09	0.05	-0.02	-0.10	-0.19**	-0.09
	(0.055)	(0.082)	(0.117)	(0.083)	(0.101)	(0.099)	(0.070)	(0.066)	(0.059)	(0.053)	(0.070)	(0.079)
Constant	5.40***	3.43***	3.08***	5.06***	7.63***	8.13***	5.42***	3.65***	3.62***	5.82***	6.93***	7.96***
	(0.440)	(0.783)	(0.881)	(0.670)	(0.692)	(0.846)	(0.500)	(0.594)	(0.585)	(0.580)	(0.602)	(0.696)
Observations	1,081	1,081	1,081	1,081	1,081	1,081	854	1,899	1,899	1,899	1,899	1,899
R-squared	0.401						0.386					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table Q.1. Effects of private tutoring in grade 10 on the CSAT average achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
PT in G10	0.07	0.26*	0.22*	0.08	-0.05	-0.14	0.20	0.09	0.43	0.37	-0.18	0.01
	(0.073)	(0.115)	(0.102)	(0.094)	(0.104)	(0.151)	(0.335)	(0.579)	(0.630)	(0.289)	(0.409)	(0.476)
URBANICITY	-0.06	-0.05	-0.05	-0.04	-0.11	0.04	-0.09	-0.14	-0.06	-0.07	-0.17	0.04
	(0.076)	(0.119)	(0.094)	(0.121)	(0.145)	(0.136)	(0.082)	(0.127)	(0.098)	(0.107)	(0.134)	(0.135)
GENDER (1=female)	-0.07	0.09	0.00	-0.07	-0.18*	-0.25**	-0.10	0.07	-0.03	-0.15*	-0.18	-0.31**
	(0.052)	(0.107)	(0.076)	(0.078)	(0.080)	(0.081)	(0.060)	(0.115)	(0.069)	(0.065)	(0.106)	(0.116)
SES	0.13***	0.07	0.10*	0.16***	0.19***	0.22***	0.13***	0.05	0.09	0.15***	0.21**	0.24***
	(0.035)	(0.053)	(0.042)	(0.032)	(0.056)	(0.057)	(0.039)	(0.049)	(0.049)	(0.035)	(0.079)	(0.067)
SCHOOL TYPE (1=private)	0.17**	0.12	0.15	0.22*	0.19*	0.11	0.17**	0.13	0.13	0.20*	0.18	0.15
	(0.053)	(0.089)	(0.082)	(0.087)	(0.095)	(0.066)	(0.058)	(0.125)	(0.083)	(0.087)	(0.099)	(0.107)
SCHOOL TRACK	0.56***	0.91***	0.73***	0.53***	0.53***	0.49**	0.59***	1.07***	0.65*	0.53*	0.58***	0.48*
(1=general)	(0.094)	(0.184)	(0.158)	(0.131)	(0.132)	(0.180)	(0.121)	(0.213)	(0.262)	(0.220)	(0.168)	(0.221)
STU-TEA RATIO	-0.03**	-0.03	-0.03	-0.04***	-0.03*	-0.04	-0.04**	-0.03	-0.02	-0.06***	-0.03	-0.04
	(0.012)	(0.026)	(0.019)	(0.013)	(0.014)	(0.022)	(0.013)	(0.022)	(0.016)	(0.015)	(0.019)	(0.025)
SCHOOL CHOICE	-0.09	-0.10	-0.02	-0.03	-0.13	-0.16	-0.14	-0.21	-0.05	-0.14	-0.24	-0.16
	(0.080)	(0.125)	(0.088)	(0.125)	(0.141)	(0.163)	(0.088)	(0.117)	(0.083)	(0.095)	(0.134)	(0.131)
PRESCORE (G9VEM_Z)	0.74***	0.84***	0.78***	0.78***	0.71***	0.65***	0.72***	0.85***	0.73***	0.75***	0.69***	0.64***
	(0.036)	(0.085)	(0.051)	(0.053)	(0.065)	(0.053)	(0.039)	(0.089)	(0.067)	(0.050)	(0.062)	(0.068)
STUDY HOURS	0.34***	0.28***	0.30***	0.30***	0.42***	0.41***	0.33***	0.25***	0.20*	0.32***	0.42***	0.37***
(1= >10hrs /week)	(0.057)	(0.081)	(0.064)	(0.060)	(0.084)	(0.093)	(0.062)	(0.073)	(0.079)	(0.085)	(0.090)	(0.075)
SELF ESTEEM	0.35***	0.40***	0.33***	0.34***	0.37***	0.26*	0.34***	0.37***	0.35***	0.34***	0.36***	0.29***
	(0.044)	(0.097)	(0.048)	(0.056)	(0.079)	(0.100)	(0.048)	(0.084)	(0.076)	(0.059)	(0.065)	(0.086)
TOTAL PT in middle school	-0.01	0.05	0.03	-0.02	-0.04	-0.10	-0.02	0.06	0.02	-0.04	-0.03	-0.11
	(0.033)	(0.086)	(0.046)	(0.052)	(0.053)	(0.064)	(0.044)	(0.087)	(0.083)	(0.044)	(0.068)	(0.076)
PT in G11	0.25***	0.30*	0.27**	0.19**	0.16	0.19	0.22*	0.31	0.27	0.11	0.21	0.08
	(0.067)	(0.116)	(0.093)	(0.072)	(0.114)	(0.125)	(0.102)	(0.194)	(0.149)	(0.113)	(0.137)	(0.190)
PT in G12	0.26***	0.16	0.17*	0.28***	0.37***	0.32**	0.26***	0.23*	0.19	0.28***	0.35***	0.35***
	(0.059)	(0.108)	(0.077)	(0.085)	(0.100)	(0.099)	(0.067)	(0.100)	(0.099)	(0.072)	(0.091)	(0.096)
Constant	5.14***	2.85***	3.87***	5.26***	6.29***	7.50***	5.28***	3.04***	3.72***	5.63***	6.49***	7.61***
	(0.257)	(0.544)	(0.380)	(0.366)	(0.286)	(0.673)	(0.293)	(0.375)	(0.390)	(0.287)	(0.425)	(0.503)
Observations	1,940	1,940	1,940	1,940	1,940	1,940	1,680	1,701	1,701	1,701	1,701	1,701
R-squared	0.421						0.407					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table Q.2. Effects of private tutoring in grade 11 on the CSAT average achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
PT in G11	0.25***	0.30*	0.27**	0.19*	0.16	0.19	0.36	2.86	1.51	1.69	0.00	1.03
	(0.067)	(0.120)	(0.102)	(0.078)	(0.098)	(0.137)	(0.283)	(2.018)	(1.321)	(0.906)	(1.533)	(2.368)
URBANICITY	-0.06	-0.05	-0.05	-0.04	-0.11	0.04	-0.06	-0.17	-0.05	-0.00	-0.17	0.05
	(0.076)	(0.121)	(0.051)	(0.070)	(0.110)	(0.107)	(0.078)	(0.141)	(0.098)	(0.101)	(0.142)	(0.133)
GENDER (1=female)	-0.07	0.09	0.00	-0.07	-0.18*	-0.25***	-0.08	0.15	-0.01	-0.04	-0.16	-0.22*
	(0.052)	(0.055)	(0.059)	(0.047)	(0.079)	(0.069)	(0.054)	(0.109)	(0.062)	(0.063)	(0.098)	(0.105)
SES	0.13***	0.07	0.10*	0.16***	0.19**	0.22***	0.12***	-0.05	0.07	0.12**	0.20*	0.19
	(0.035)	(0.053)	(0.046)	(0.039)	(0.059)	(0.031)	(0.037)	(0.096)	(0.056)	(0.042)	(0.087)	(0.103)
SCHOOL TYPE (1=private)	0.17**	0.12	0.15	0.22**	0.19	0.11	0.18***	0.11	0.13	0.15**	0.18*	0.13
	(0.053)	(0.103)	(0.077)	(0.072)	(0.104)	(0.099)	(0.055)	(0.094)	(0.076)	(0.054)	(0.075)	(0.098)
SCHOOL TRACK (1=general)	0.56***	0.91***	0.73***	0.53***	0.53***	0.49***	0.56***	0.75**	0.56*	0.41**	0.50***	0.40
	(0.094)	(0.266)	(0.170)	(0.109)	(0.120)	(0.117)	(0.099)	(0.258)	(0.246)	(0.158)	(0.149)	(0.254)
STU-TEA RATIO	-0.03**	-0.03	-0.03	-0.04**	-0.03*	-0.04*	-0.03**	-0.03	-0.03	-0.05***	-0.03**	-0.04
	(0.012)	(0.021)	(0.018)	(0.015)	(0.017)	(0.017)	(0.012)	(0.027)	(0.023)	(0.013)	(0.013)	(0.019)
SCHOOL CHOICE	-0.09	-0.10	-0.02	-0.03	-0.13	-0.16	-0.10	-0.18	-0.05	-0.06	-0.21	-0.17
	(0.080)	(0.149)	(0.085)	(0.108)	(0.115)	(0.130)	(0.082)	(0.127)	(0.121)	(0.112)	(0.157)	(0.122)
PRESCORE (G9VEM_Z)	0.74***	0.84***	0.78***	0.78***	0.71***	0.65***	0.72***	0.68***	0.73***	0.73***	0.69***	0.60***
	(0.036)	(0.093)	(0.051)	(0.040)	(0.061)	(0.041)	(0.038)	(0.093)	(0.077)	(0.060)	(0.071)	(0.074)
STUDY HOURS	0.34***	0.28**	0.30***	0.30***	0.42***	0.41***	0.31***	0.16	0.19**	0.25***	0.40***	0.32***
(1= >10hrs /week)	(0.057)	(0.085)	(0.059)	(0.053)	(0.075)	(0.090)	(0.059)	(0.111)	(0.060)	(0.056)	(0.074)	(0.094)
SELF ESTEEM	0.35***	0.40***	0.33***	0.34***	0.37***	0.26**	0.37***	0.40***	0.35***	0.34***	0.39***	0.30***
	(0.044)	(0.073)	(0.054)	(0.066)	(0.059)	(0.078)	(0.045)	(0.077)	(0.052)	(0.059)	(0.070)	(0.080)
TOTAL PT in middle school	-0.01	0.05	0.03	-0.02	-0.04	-0.10	-0.03	-0.11	-0.05	-0.12	-0.02	-0.15
	(0.033)	(0.088)	(0.044)	(0.027)	(0.053)	(0.052)	(0.041)	(0.115)	(0.074)	(0.079)	(0.114)	(0.141)
PT in G10	0.07	0.26	0.22	0.08	-0.05	-0.14	0.04	-0.51	-0.06	-0.31	0.00	-0.29
	(0.073)	(0.156)	(0.120)	(0.094)	(0.100)	(0.159)	(0.107)	(0.630)	(0.401)	(0.240)	(0.472)	(0.653)
PT in G12	0.26***	0.16*	0.17*	0.28***	0.37**	0.32***	0.23*	-0.50	-0.18	-0.19	0.41	0.03
	(0.059)	(0.077)	(0.074)	(0.060)	(0.112)	(0.080)	(0.095)	(0.563)	(0.407)	(0.283)	(0.471)	(0.693)
Constant	5.14***	2.85***	3.87***	5.26***	6.29***	7.50***	5.16***	2.80***	3.79***	5.26***	6.45***	7.32***
	(0.257)	(0.481)	(0.333)	(0.327)	(0.263)	(0.423)	(0.267)	(0.596)	(0.528)	(0.301)	(0.439)	(0.568)
Observations	1,940	1,940	1,940	1,940	1,940	1,940	1,827	1,883	1,883	1,883	1,883	1,883
R-squared	0.421						0.413					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table Q.3. Effects of private tutoring in grade 12 on the CSAT average achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
PT in G12	0.26***	0.16	0.17	0.28**	0.37***	0.32***	0.16	0.10	0.17	0.10	0.07	0.09
	(0.059)	(0.084)	(0.088)	(0.086)	(0.086)	(0.074)	(0.145)	(0.199)	(0.182)	(0.243)	(0.243)	(0.227)
URBANICITY	-0.06	-0.05	-0.05	-0.04	-0.11	0.04	-0.06	-0.02	-0.07	-0.02	-0.08	0.11
	(0.076)	(0.105)	(0.076)	(0.088)	(0.086)	(0.090)	(0.080)	(0.127)	(0.095)	(0.104)	(0.158)	(0.120)
GENDER (1=female)	-0.07	0.09	0.00	-0.07	-0.18*	-0.25***	-0.06	0.15	0.04	-0.06	-0.22*	-0.21**
	(0.052)	(0.066)	(0.080)	(0.045)	(0.085)	(0.072)	(0.055)	(0.091)	(0.072)	(0.069)	(0.095)	(0.078)
SES	0.13***	0.07	0.10**	0.16***	0.19***	0.22***	0.13***	0.07	0.12	0.16**	0.20*	0.25***
	(0.035)	(0.058)	(0.035)	(0.039)	(0.049)	(0.045)	(0.037)	(0.054)	(0.075)	(0.049)	(0.084)	(0.067)
SCHOOL TYPE (1=private)	0.17**	0.12	0.15	0.22***	0.19	0.11	0.15**	0.15	0.17*	0.24***	0.20*	0.14*
	(0.053)	(0.069)	(0.077)	(0.065)	(0.098)	(0.089)	(0.056)	(0.079)	(0.077)	(0.058)	(0.080)	(0.070)
SCHOOL TRACK (1=general)	0.56***	0.91***	0.73***	0.53***	0.53***	0.49*	0.61***	0.94***	0.69***	0.57***	0.58***	0.42
	(0.094)	(0.228)	(0.196)	(0.077)	(0.125)	(0.193)	(0.104)	(0.190)	(0.200)	(0.150)	(0.139)	(0.267)
STU-TEA RATIO	-0.03**	-0.03	-0.03*	-0.04***	-0.03*	-0.04**	-0.03**	-0.02	-0.03	-0.05**	-0.04*	-0.03*
	(0.012)	(0.020)	(0.015)	(0.013)	(0.014)	(0.013)	(0.012)	(0.017)	(0.022)	(0.017)	(0.016)	(0.016)
SCHOOL CHOICE	-0.09	-0.10	-0.02	-0.03	-0.13	-0.16	-0.12	-0.09	-0.03	-0.06	-0.15	-0.13
	(0.080)	(0.175)	(0.099)	(0.101)	(0.115)	(0.092)	(0.084)	(0.172)	(0.109)	(0.106)	(0.174)	(0.149)
PRESCORE (G9VEM_Z)	0.74***	0.84***	0.78***	0.78***	0.71***	0.65***	0.73***	0.83***	0.76***	0.77***	0.70***	0.68***
	(0.036)	(0.092)	(0.046)	(0.043)	(0.063)	(0.056)	(0.037)	(0.068)	(0.049)	(0.049)	(0.068)	(0.059)
STUDY HOURS	0.34***	0.28***	0.30***	0.30***	0.42***	0.41***	0.34***	0.31**	0.25**	0.33***	0.41***	0.44***
(1= >10hrs /week)	(0.057)	(0.065)	(0.067)	(0.067)	(0.088)	(0.090)	(0.060)	(0.115)	(0.091)	(0.087)	(0.088)	(0.092)
SELF ESTEEM	0.35***	0.40***	0.33***	0.34***	0.37***	0.26***	0.38***	0.50***	0.34***	0.38***	0.39***	0.27**
	(0.044)	(0.085)	(0.059)	(0.057)	(0.054)	(0.072)	(0.046)	(0.063)	(0.055)	(0.052)	(0.091)	(0.087)
TOTAL PT in middle school	-0.01	0.05	0.03	-0.02	-0.04	-0.10	-0.01	0.06	0.03	0.01	-0.05	-0.08
	(0.033)	(0.074)	(0.046)	(0.035)	(0.046)	(0.067)	(0.036)	(0.078)	(0.059)	(0.038)	(0.051)	(0.056)
PT in G10	0.07	0.26	0.22**	0.08	-0.05	-0.14	0.06	0.27*	0.26	0.08	-0.02	-0.22
	(0.073)	(0.147)	(0.072)	(0.105)	(0.092)	(0.139)	(0.078)	(0.134)	(0.144)	(0.097)	(0.109)	(0.185)
PT in G11	0.25***	0.30*	0.27*	0.19**	0.16	0.19*	0.31***	0.32*	0.27	0.30*	0.32*	0.26*
	(0.067)	(0.136)	(0.121)	(0.075)	(0.090)	(0.089)	(0.086)	(0.129)	(0.157)	(0.127)	(0.163)	(0.130)
Constant	5.14***	2.85***	3.87***	5.26***	6.29***	7.50***	5.16***	2.61***	3.72***	5.20***	6.39***	7.35***
	(0.257)	(0.488)	(0.333)	(0.351)	(0.327)	(0.394)	(0.272)	(0.581)	(0.526)	(0.381)	(0.372)	(0.516)
Observations	1,940	1,940	1,940	1,940	1,940	1,940	1,752	1,752	1,752	1,752	1,752	1,752
R-squared	0.421						0.422					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_avg (average score on the CSAT)

Table. Q.4. Effects of verbal tutoring in grade 10 on the CSAT verbal achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
VERBAL PT in G10	0.00	0.07	0.00	-0.02	0.00	-0.16	0.11	0.15	-0.21	0.05	-0.08	-0.10
	(0.064)	(0.124)	(0.084)	(0.081)	(0.064)	(0.120)	(0.291)	(0.958)	(0.585)	(0.760)	(0.311)	(0.574)
URBANICITY	-0.04	0.08	-0.01	-0.14	-0.04	-0.11	-0.05	-0.06	0.07	-0.08	-0.03	-0.08
	(0.090)	(0.102)	(0.125)	(0.122)	(0.125)	(0.158)	(0.102)	(0.157)	(0.110)	(0.148)	(0.122)	(0.187)
GENDER (1=female)	0.10	0.17	0.18*	0.11	-0.00	-0.03	0.04	0.26	0.17	-0.00	-0.15	-0.12
	(0.062)	(0.107)	(0.082)	(0.075)	(0.076)	(0.094)	(0.069)	(0.138)	(0.109)	(0.108)	(0.122)	(0.126)
SES	0.08*	0.01	0.12*	0.10*	0.09*	0.10*	0.08	0.02	0.13	0.12	0.09	0.15
	(0.040)	(0.138)	(0.059)	(0.042)	(0.044)	(0.049)	(0.047)	(0.109)	(0.088)	(0.073)	(0.074)	(0.079)
SCHOOL TYPE (1=private)	0.09	0.02	0.13	0.12	0.06	0.03	0.07	0.03	0.17	0.06	0.07	0.01
	(0.063)	(0.117)	(0.077)	(0.080)	(0.095)	(0.110)	(0.068)	(0.104)	(0.091)	(0.107)	(0.102)	(0.150)
SCHOOL TRACK (1=general)	0.66***	0.70***	0.98***	0.86***	0.51***	0.40	0.72***	0.83**	1.04***	0.98***	0.55***	0.48*
	(0.110)	(0.091)	(0.147)	(0.163)	(0.094)	(0.204)	(0.126)	(0.281)	(0.218)	(0.262)	(0.138)	(0.214)
STU-TEA RATIO	-0.03*	-0.04	-0.03	-0.05*	-0.03	-0.02	-0.03	-0.04	-0.02	-0.05*	-0.02	-0.02
	(0.014)	(0.036)	(0.017)	(0.020)	(0.018)	(0.019)	(0.015)	(0.037)	(0.021)	(0.024)	(0.019)	(0.019)
SCHOOL CHOICE	0.02	0.18	0.04	-0.02	0.10	-0.08	0.01	0.05	0.09	0.00	0.09	-0.14
	(0.094)	(0.154)	(0.129)	(0.128)	(0.118)	(0.166)	(0.102)	(0.189)	(0.135)	(0.163)	(0.097)	(0.177)
PRESCORE (G9VEM_Z)	0.72***	0.87***	0.67***	0.75***	0.71***	0.76***	0.72***	0.78***	0.64***	0.73***	0.73***	0.71***
	(0.041)	(0.095)	(0.063)	(0.049)	(0.053)	(0.074)	(0.045)	(0.082)	(0.071)	(0.047)	(0.064)	(0.101)
STUDY HOURS	0.17*	0.15	0.09	0.10	0.20*	0.30*	0.18*	0.09	0.12	0.10	0.18	0.21*
(1= >10hrs /week)	(0.068)	(0.111)	(0.081)	(0.100)	(0.092)	(0.120)	(0.073)	(0.110)	(0.071)	(0.107)	(0.123)	(0.096)
SELF ESTEEM	0.34***	0.35***	0.42***	0.35***	0.28**	0.24**	0.32***	0.37**	0.44***	0.37***	0.29**	0.25*
	(0.051)	(0.091)	(0.050)	(0.063)	(0.087)	(0.082)	(0.057)	(0.140)	(0.089)	(0.074)	(0.103)	(0.118)
VERBAL PT in middle school	-0.08**	-0.04	-0.09*	-0.05	-0.13***	-0.11**	-0.11**	-0.07	-0.07	-0.09	-0.14**	-0.16**
	(0.028)	(0.048)	(0.035)	(0.029)	(0.031)	(0.038)	(0.038)	(0.086)	(0.041)	(0.070)	(0.047)	(0.053)
VERBAL PT in G11	0.13	0.25	0.04	0.10	0.14	0.20*	0.11	0.18	0.12	0.07	0.14	0.22
	(0.075)	(0.131)	(0.092)	(0.091)	(0.099)	(0.102)	(0.102)	(0.347)	(0.208)	(0.213)	(0.195)	(0.214)
VERBAL PT in G12	0.21*	0.03	0.06	0.26**	0.31**	0.38*	0.23*	0.18	0.07	0.25	0.34**	0.40***
	(0.094)	(0.151)	(0.106)	(0.092)	(0.105)	(0.161)	(0.102)	(0.191)	(0.123)	(0.137)	(0.116)	(0.107)
Constant	5.27***	3.15***	3.99***	5.47***	6.47***	7.52***	5.31***	3.20***	3.77***	5.56***	6.51***	7.87***
	(0.296)	(0.706)	(0.409)	(0.467)	(0.393)	(0.428)	(0.329)	(0.692)	(0.479)	(0.500)	(0.317)	(0.331)
Observations	2,070	2,070	2,070	2,070	2,070	2,070	1,790	1,807	1,807	1,807	1,807	1,807
R-squared	0.269						0.261					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table Q.5. Effects of verbal tutoring in grade 11 on the CSAT verbal achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
VERBAL PT in G11	0.13	0.25*	0.04	0.10	0.14	0.20	0.05	1.45	-0.67	1.49	2.64	-4.08
	(0.075)	(0.100)	(0.095)	(0.074)	(0.122)	(0.171)	(0.279)	(3.226)	(3.329)	(3.780)	(2.371)	(3.274)
URBANICITY	-0.04	0.08	-0.01	-0.14	-0.04	-0.11	-0.02	-0.11	0.03	-0.16	-0.12	0.09
	(0.090)	(0.138)	(0.120)	(0.093)	(0.167)	(0.203)	(0.094)	(0.208)	(0.154)	(0.200)	(0.211)	(0.238)
GENDER (1=female)	0.10	0.17	0.18*	0.11	-0.00	-0.03	0.09	0.32	0.12	0.17	0.10	-0.25
	(0.062)	(0.110)	(0.082)	(0.083)	(0.080)	(0.081)	(0.064)	(0.198)	(0.199)	(0.202)	(0.159)	(0.169)
SES	0.08*	0.01	0.12*	0.10	0.09*	0.10	0.08	0.08	0.15	0.04	-0.01	0.27
	(0.040)	(0.105)	(0.057)	(0.053)	(0.044)	(0.080)	(0.043)	(0.187)	(0.178)	(0.137)	(0.085)	(0.140)
SCHOOL TYPE (1=private)	0.09	0.02	0.13	0.12	0.06	0.03	0.11	0.05	0.13	0.09	0.04	0.03
	(0.063)	(0.103)	(0.073)	(0.085)	(0.080)	(0.114)	(0.065)	(0.129)	(0.115)	(0.071)	(0.076)	(0.100)
SCHOOL TRACK (1=general)	0.66***	0.70***	0.98***	0.86***	0.51***	0.40	0.68***	0.75***	0.98***	0.83***	0.48**	0.50*
	(0.110)	(0.210)	(0.197)	(0.164)	(0.105)	(0.204)	(0.114)	(0.203)	(0.172)	(0.190)	(0.158)	(0.205)
STU-TEA RATIO	-0.03*	-0.04	-0.03	-0.05**	-0.03	-0.02	-0.03	-0.04	-0.04	-0.03	0.00	-0.05
	(0.014)	(0.025)	(0.017)	(0.017)	(0.024)	(0.022)	(0.014)	(0.036)	(0.033)	(0.038)	(0.026)	(0.031)
SCHOOL CHOICE	0.02	0.18	0.04	-0.02	0.10	-0.08	0.03	0.05	-0.07	0.00	0.19	-0.26
	(0.094)	(0.152)	(0.145)	(0.119)	(0.169)	(0.208)	(0.098)	(0.211)	(0.187)	(0.212)	(0.260)	(0.314)
PRESCORE (G9VEM_Z)	0.72***	0.87***	0.67***	0.75***	0.71***	0.76***	0.71***	0.76***	0.68***	0.75***	0.70***	0.76***
	(0.041)	(0.090)	(0.052)	(0.051)	(0.052)	(0.077)	(0.043)	(0.101)	(0.055)	(0.050)	(0.053)	(0.078)
STUDY HOURS	0.17*	0.15	0.09	0.10	0.20*	0.30*	0.16*	0.05	0.04	0.02	0.08	0.41*
(1= >10hrs /week)	(0.068)	(0.127)	(0.085)	(0.076)	(0.085)	(0.123)	(0.069)	(0.167)	(0.151)	(0.160)	(0.137)	(0.199)
SELF ESTEEM	0.34***	0.35***	0.42***	0.35***	0.28***	0.24**	0.35***	0.41**	0.44***	0.36***	0.30***	0.25*
	(0.051)	(0.097)	(0.066)	(0.063)	(0.047)	(0.092)	(0.053)	(0.132)	(0.058)	(0.059)	(0.060)	(0.108)
VERBAL PT in middle school	-0.08**	-0.04	-0.09***	-0.05	-0.13**	-0.11***	-0.07*	-0.05	-0.07	-0.09	-0.15*	-0.06
	(0.028)	(0.036)	(0.025)	(0.027)	(0.038)	(0.024)	(0.029)	(0.078)	(0.063)	(0.085)	(0.067)	(0.092)
VERBAL PT in G10	0.00	0.07	0.00	-0.02	0.00	-0.16	0.00	-0.19	0.13	-0.23	-0.42	0.60
	(0.064)	(0.105)	(0.069)	(0.068)	(0.089)	(0.121)	(0.080)	(0.565)	(0.544)	(0.618)	(0.406)	(0.583)
VERBAL PT in G12	0.21*	0.03	0.06	0.26*	0.31**	0.38	0.23	-0.38	0.32	-0.26	-0.57	1.84
	(0.094)	(0.136)	(0.065)	(0.115)	(0.110)	(0.203)	(0.130)	(1.158)	(1.138)	(1.374)	(0.871)	(1.088)
Constant	5.27***	3.15***	3.99***	5.47***	6.47***	7.52***	5.25***	3.16**	4.46***	5.00***	5.52***	8.92***
	(0.296)	(0.555)	(0.551)	(0.396)	(0.446)	(0.522)	(0.313)	(1.169)	(1.239)	(1.270)	(0.897)	(1.200)
Observations	2,070	2,070	2,070	2,070	2,070	2,070	1,952	2,010	2,010	2,010	2,010	2,010
R-squared	0.269						0.259					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table Q.6. Effects of verbal tutoring in grade 12 on the CSAT verbal achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
VERBAL PT in G12	0.21*	0.03	0.06	0.26**	0.31**	0.38*	0.09	0.14	-0.22	0.21	0.23	-0.38
	(0.094)	(0.207)	(0.126)	(0.087)	(0.106)	(0.178)	(0.260)	(0.214)	(0.280)	(0.450)	(0.403)	(0.357)
URBANICITY	-0.04	0.08	-0.01	-0.14	-0.04	-0.11	-0.02	0.01	0.04	-0.10	0.04	-0.03
	(0.090)	(0.183)	(0.125)	(0.133)	(0.134)	(0.251)	(0.094)	(0.192)	(0.109)	(0.083)	(0.117)	(0.143)
GENDER (1=female)	0.10	0.17	0.18	0.11	-0.00	-0.03	0.09	0.22	0.19**	0.07	-0.05	-0.00
	(0.062)	(0.120)	(0.114)	(0.083)	(0.104)	(0.092)	(0.065)	(0.146)	(0.070)	(0.071)	(0.107)	(0.160)
SES	0.08*	0.01	0.12	0.10	0.09	0.10	0.07	0.01	0.12	0.08	0.10	0.10
	(0.040)	(0.086)	(0.064)	(0.061)	(0.052)	(0.075)	(0.043)	(0.122)	(0.086)	(0.074)	(0.053)	(0.078)
SCHOOL TYPE (1=private)	0.09	0.02	0.13	0.12	0.06	0.03	0.08	-0.01	0.13	0.15*	0.11	-0.01
	(0.063)	(0.091)	(0.084)	(0.109)	(0.085)	(0.148)	(0.066)	(0.108)	(0.069)	(0.063)	(0.085)	(0.113)
SCHOOL TRACK (1=general)	0.66***	0.70***	0.98***	0.86***	0.51**	0.40	0.71***	0.76***	0.96***	0.87***	0.65***	0.54*
	(0.110)	(0.128)	(0.133)	(0.115)	(0.165)	(0.265)	(0.121)	(0.225)	(0.193)	(0.239)	(0.190)	(0.233)
STU-TEA RATIO	-0.03*	-0.04	-0.03	-0.05**	-0.03	-0.02	-0.03*	-0.04	-0.02	-0.05**	-0.04	-0.04*
	(0.014)	(0.023)	(0.021)	(0.015)	(0.024)	(0.020)	(0.014)	(0.032)	(0.024)	(0.017)	(0.024)	(0.020)
SCHOOL CHOICE	0.02	0.18	0.04	-0.02	0.10	-0.08	0.02	0.10	0.05	0.03	0.12	-0.12
	(0.094)	(0.160)	(0.129)	(0.128)	(0.144)	(0.283)	(0.099)	(0.190)	(0.146)	(0.089)	(0.113)	(0.140)
PRESCORE (G9VEM_Z)	0.72***	0.87***	0.67***	0.75***	0.71***	0.76***	0.72***	0.77***	0.67***	0.77***	0.72***	0.77***
	(0.041)	(0.066)	(0.054)	(0.036)	(0.052)	(0.070)	(0.044)	(0.067)	(0.054)	(0.050)	(0.070)	(0.077)
STUDY HOURS	0.17*	0.15	0.09	0.10	0.20	0.30**	0.18*	0.09	0.13	0.07	0.24	0.35**
(1= >10hrs /week)	(0.068)	(0.101)	(0.102)	(0.065)	(0.107)	(0.097)	(0.072)	(0.157)	(0.092)	(0.089)	(0.150)	(0.113)
SELF ESTEEM	0.34***	0.35**	0.42***	0.35***	0.28***	0.24**	0.38***	0.45**	0.48***	0.40***	0.30**	0.26**
	(0.051)	(0.134)	(0.059)	(0.075)	(0.071)	(0.088)	(0.054)	(0.138)	(0.081)	(0.114)	(0.104)	(0.084)
VERBAL PT in middle school	-0.08**	-0.04	-0.09*	-0.05	-0.13**	-0.11**	-0.08**	-0.06	-0.07	-0.06	-0.12**	-0.09*
	(0.028)	(0.035)	(0.039)	(0.033)	(0.039)	(0.042)	(0.030)	(0.044)	(0.041)	(0.039)	(0.043)	(0.047)
VERBAL PT in G10	0.00	0.07	0.00	-0.02	0.00	-0.16	-0.00	0.07	-0.02	-0.01	-0.04	-0.14
	(0.064)	(0.110)	(0.081)	(0.058)	(0.072)	(0.116)	(0.068)	(0.142)	(0.112)	(0.100)	(0.101)	(0.109)
VERBAL PT in G11	0.13	0.25	0.04	0.10	0.14	0.20*	0.15	0.19	0.12	0.14	0.14	0.37
	(0.075)	(0.128)	(0.114)	(0.086)	(0.073)	(0.086)	(0.094)	(0.151)	(0.144)	(0.155)	(0.160)	(0.190)
Constant	5.27***	3.15***	3.99***	5.47***	6.47***	7.52***	5.31***	3.24***	3.89***	5.48***	6.56***	7.79***
	(0.296)	(0.524)	(0.418)	(0.300)	(0.437)	(0.718)	(0.311)	(0.784)	(0.501)	(0.420)	(0.430)	(0.622)
Observations	2,070	2,070	2,070	2,070	2,070	2,070	1,870	1,870	1,870	1,870	1,870	1,870
R-squared	0.269						0.272					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_V (verbal score on the CSAT)

Table Q.7. Effects of English tutoring in grade 10 on the CSAT English achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
ENGLISH PT in G10	0.03	0.16	0.14	0.03	-0.00	0.07	0.26	0.72	0.62	0.37	-0.08	0.45
	(0.067)	(0.129)	(0.105)	(0.097)	(0.080)	(0.143)	(0.267)	(0.638)	(0.367)	(0.420)	(0.358)	(0.366)
URBANICITY	-0.02	0.01	-0.17	-0.11	0.07	0.14	-0.05	-0.03	-0.17	-0.12	0.05	0.21
	(0.083)	(0.175)	(0.100)	(0.093)	(0.112)	(0.126)	(0.091)	(0.139)	(0.095)	(0.114)	(0.091)	(0.158)
GENDER (1=female)	0.07	0.17	0.19**	0.06	0.00	-0.10	0.05	0.16	0.17**	0.05	-0.04	-0.15
	(0.058)	(0.131)	(0.067)	(0.078)	(0.076)	(0.091)	(0.063)	(0.130)	(0.067)	(0.072)	(0.072)	(0.105)
SES	0.24***	0.14	0.18***	0.25***	0.31***	0.35***	0.25***	0.15	0.21***	0.25***	0.32***	0.31***
	(0.039)	(0.075)	(0.042)	(0.046)	(0.065)	(0.051)	(0.044)	(0.115)	(0.050)	(0.047)	(0.036)	(0.082)
SCHOOL TYPE (1=private)	0.14*	0.25	0.12	0.10	0.18*	0.18	0.19**	0.33**	0.14	0.10	0.22*	0.24**
	(0.059)	(0.151)	(0.078)	(0.080)	(0.072)	(0.095)	(0.064)	(0.117)	(0.083)	(0.118)	(0.102)	(0.088)
SCHOOL TRACK (1=general)	0.63***	0.77***	0.75***	0.62***	0.72***	0.68***	0.67***	0.73***	0.82***	0.58***	0.75***	0.85***
	(0.106)	(0.222)	(0.181)	(0.137)	(0.163)	(0.206)	(0.122)	(0.179)	(0.174)	(0.160)	(0.179)	(0.217)
STU-TEA RATIO	-0.03*	-0.02	-0.02	-0.05**	-0.03*	-0.05*	-0.04**	-0.04	-0.02	-0.05*	-0.04	-0.05**
	(0.013)	(0.016)	(0.020)	(0.018)	(0.015)	(0.022)	(0.015)	(0.026)	(0.021)	(0.023)	(0.019)	(0.017)
SCHOOL CHOICE	-0.15	-0.07	-0.22*	-0.24**	-0.07	-0.06	-0.18	-0.11	-0.23	-0.27*	-0.13	-0.04
	(0.088)	(0.198)	(0.100)	(0.086)	(0.107)	(0.139)	(0.095)	(0.125)	(0.140)	(0.123)	(0.114)	(0.162)
PRESCORE (G9VEM_Z)	0.73***	0.96***	0.80***	0.74***	0.69***	0.60***	0.72***	0.95***	0.78***	0.72***	0.70***	0.55***
	(0.039)	(0.079)	(0.066)	(0.048)	(0.057)	(0.082)	(0.042)	(0.106)	(0.083)	(0.062)	(0.070)	(0.065)
STUDY HOURS (1= >10hrs /week)	0.38***	0.40***	0.34***	0.42***	0.33***	0.26	0.36***	0.31***	0.30***	0.39***	0.35***	0.21
	(0.063)	(0.103)	(0.078)	(0.063)	(0.074)	(0.145)	(0.068)	(0.093)	(0.069)	(0.090)	(0.095)	(0.150)
SELF ESTEEM	0.43***	0.47***	0.48***	0.42***	0.39***	0.49***	0.42***	0.37***	0.43***	0.42***	0.37***	0.44***
	(0.048)	(0.081)	(0.047)	(0.054)	(0.076)	(0.079)	(0.053)	(0.110)	(0.053)	(0.064)	(0.088)	(0.075)
ENGLISH PT in middle school	0.02	0.08	0.03	0.01	-0.01	-0.05	0.01	0.03	0.04	-0.03	-0.02	-0.06
	(0.034)	(0.089)	(0.047)	(0.052)	(0.046)	(0.048)	(0.043)	(0.093)	(0.070)	(0.092)	(0.063)	(0.060)
ENGLISH PT in G11	0.18**	0.30	0.19**	0.14	0.10	0.02	0.13	0.28	0.04	0.06	0.11	-0.07
	(0.065)	(0.169)	(0.059)	(0.078)	(0.060)	(0.102)	(0.093)	(0.191)	(0.111)	(0.117)	(0.111)	(0.173)
ENGLISH PT in G12	0.19**	0.09	0.25*	0.29**	0.09	0.03	0.17*	0.11	0.21*	0.21**	0.09	-0.00
	(0.068)	(0.114)	(0.110)	(0.094)	(0.085)	(0.135)	(0.075)	(0.177)	(0.096)	(0.073)	(0.122)	(0.118)
Constant	4.95***	2.24***	3.68***	5.43***	5.91***	7.29***	4.99***	2.45***	3.37***	5.54***	6.12***	7.04***
	(0.284)	(0.595)	(0.457)	(0.344)	(0.439)	(0.436)	(0.314)	(0.566)	(0.516)	(0.505)	(0.316)	(0.405)
Observations	2,344	2,344	2,344	2,344	2,344	2,344	2,032	2,049	2,049	2,049	2,049	2,049
R-squared	0.348						0.336					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table Q.8. Effects of English tutoring in grade 11 on the CSAT English achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
ENGLISH PT in G11	0.18**	0.30	0.19*	0.14	0.10	0.02	0.33	2.45	1.11	0.57	0.13	0.25
	(0.065)	(0.173)	(0.093)	(0.124)	(0.089)	(0.108)	(0.212)	(1.566)	(0.588)	(0.947)	(0.691)	(1.346)
URBANICITY	-0.02	0.01	-0.17	-0.11	0.07	0.14	-0.02	0.11	-0.17	-0.11	0.04	0.22**
	(0.083)	(0.213)	(0.094)	(0.128)	(0.147)	(0.197)	(0.086)	(0.196)	(0.158)	(0.110)	(0.090)	(0.083)
GENDER (1=female)	0.07	0.17	0.19***	0.06	0.00	-0.10	0.07	0.22	0.22*	0.07	0.05	-0.15
	(0.058)	(0.112)	(0.047)	(0.070)	(0.086)	(0.079)	(0.060)	(0.131)	(0.089)	(0.083)	(0.094)	(0.086)
SES	0.24***	0.14	0.18***	0.25***	0.31***	0.35***	0.21***	0.05	0.14*	0.23***	0.32***	0.31*
	(0.039)	(0.084)	(0.048)	(0.053)	(0.060)	(0.073)	(0.041)	(0.133)	(0.064)	(0.065)	(0.078)	(0.122)
SCHOOL TYPE (1=private)	0.14*	0.25*	0.12	0.10	0.18*	0.18	0.16**	0.27	0.18*	0.10	0.18	0.17
	(0.059)	(0.106)	(0.071)	(0.082)	(0.090)	(0.109)	(0.061)	(0.146)	(0.080)	(0.088)	(0.103)	(0.107)
SCHOOL TRACK (1=general)	0.63***	0.77***	0.75***	0.62***	0.72***	0.68***	0.64***	0.87***	0.73***	0.58***	0.67***	0.69**
	(0.106)	(0.202)	(0.191)	(0.150)	(0.124)	(0.166)	(0.110)	(0.208)	(0.155)	(0.144)	(0.161)	(0.231)
STU-TEA RATIO	-0.03*	-0.02	-0.02	-0.05**	-0.03	-0.05*	-0.03*	-0.03	-0.02	-0.05*	-0.04**	-0.05
	(0.013)	(0.020)	(0.015)	(0.018)	(0.020)	(0.024)	(0.014)	(0.022)	(0.017)	(0.020)	(0.015)	(0.028)
SCHOOL CHOICE	-0.15	-0.07	-0.22	-0.24*	-0.07	-0.06	-0.14	-0.00	-0.20	-0.22*	-0.06	-0.04
	(0.088)	(0.211)	(0.134)	(0.116)	(0.102)	(0.149)	(0.091)	(0.201)	(0.137)	(0.113)	(0.092)	(0.125)
PRESCORE (G9VEM_Z)	0.73***	0.96***	0.80***	0.74***	0.69***	0.60***	0.71***	0.94***	0.79***	0.76***	0.67***	0.59***
	(0.039)	(0.086)	(0.056)	(0.059)	(0.053)	(0.068)	(0.041)	(0.072)	(0.059)	(0.053)	(0.067)	(0.070)
STUDY HOURS (1= >10hrs /week)	0.38***	0.40***	0.34***	0.42***	0.33***	0.26*	0.34***	0.20	0.27***	0.35***	0.32***	0.19
	(0.063)	(0.121)	(0.094)	(0.079)	(0.097)	(0.108)	(0.065)	(0.140)	(0.065)	(0.087)	(0.067)	(0.109)
SELF ESTEEM	0.43***	0.47***	0.48***	0.42***	0.39***	0.49***	0.45***	0.47***	0.47***	0.45***	0.42***	0.47***
	(0.048)	(0.096)	(0.065)	(0.065)	(0.057)	(0.075)	(0.050)	(0.099)	(0.059)	(0.050)	(0.061)	(0.085)
ENGLISH PT in middle school	0.02	0.08	0.03	0.01	-0.01	-0.05	0.01	-0.01	0.01	0.02	-0.00	-0.05
	(0.034)	(0.066)	(0.061)	(0.054)	(0.046)	(0.057)	(0.037)	(0.103)	(0.060)	(0.072)	(0.042)	(0.074)
ENGLISH PT in G10	0.03	0.16	0.14	0.03	-0.00	0.07	0.01	-0.36	-0.08	-0.06	0.01	0.09
	(0.067)	(0.175)	(0.100)	(0.099)	(0.091)	(0.168)	(0.086)	(0.426)	(0.188)	(0.228)	(0.184)	(0.344)
ENGLISH PT in G12	0.19**	0.09	0.25**	0.29**	0.09	0.03	0.14	-0.61	-0.04	0.12	0.07	-0.03
	(0.068)	(0.147)	(0.080)	(0.110)	(0.081)	(0.088)	(0.094)	(0.490)	(0.204)	(0.323)	(0.231)	(0.442)
Constant	4.95***	2.24***	3.68***	5.43***	5.91***	7.29***	4.91***	1.87***	3.40***	5.40***	5.98***	7.28***
	(0.284)	(0.653)	(0.520)	(0.316)	(0.388)	(0.517)	(0.296)	(0.453)	(0.351)	(0.418)	(0.465)	(0.696)
Observations	2,344	2,344	2,344	2,344	2,344	2,344	2,212	2,273	2,273	2,273	2,273	2,273
R-squared	0.348						0.335					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table Q.9. Effects of English tutoring in grade 12 on the CSAT English achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
ENGLISH PT in G12	0.19**	0.09	0.25*	0.29***	0.09	0.03	0.14	0.39*	0.18	-0.04	0.14	-0.24
	(0.068)	(0.120)	(0.114)	(0.087)	(0.068)	(0.085)	(0.144)	(0.178)	(0.241)	(0.193)	(0.208)	(0.243)
URBANICITY	-0.02	0.01	-0.17	-0.11	0.07	0.14	-0.03	-0.05	-0.17	-0.08	0.05	0.22
	(0.083)	(0.200)	(0.121)	(0.109)	(0.088)	(0.134)	(0.088)	(0.175)	(0.125)	(0.084)	(0.119)	(0.122)
GENDER (1=female)	0.07	0.17	0.19*	0.06	0.00	-0.10	0.07	0.20*	0.16*	0.08	-0.03	-0.08
	(0.058)	(0.153)	(0.081)	(0.067)	(0.093)	(0.089)	(0.061)	(0.088)	(0.076)	(0.067)	(0.056)	(0.108)
SES	0.24***	0.14	0.18***	0.25***	0.31***	0.35***	0.23***	0.15	0.17**	0.29***	0.31***	0.33***
	(0.039)	(0.107)	(0.047)	(0.055)	(0.054)	(0.067)	(0.042)	(0.092)	(0.054)	(0.078)	(0.043)	(0.072)
SCHOOL TYPE (1=private)	0.14*	0.25**	0.12	0.10	0.18*	0.18*	0.14*	0.26*	0.12*	0.07	0.17*	0.19*
	(0.059)	(0.096)	(0.089)	(0.119)	(0.076)	(0.090)	(0.062)	(0.127)	(0.061)	(0.087)	(0.066)	(0.091)
SCHOOL TRACK (1=general)	0.63***	0.77***	0.75***	0.62***	0.72***	0.68***	0.69***	1.07***	0.80***	0.60***	0.80***	0.87**
	(0.106)	(0.197)	(0.165)	(0.116)	(0.135)	(0.191)	(0.116)	(0.159)	(0.186)	(0.131)	(0.117)	(0.283)
STU-TEA RATIO	-0.03*	-0.02	-0.02	-0.05**	-0.03	-0.05	-0.03*	-0.02	-0.02	-0.04	-0.04	-0.05
	(0.013)	(0.020)	(0.016)	(0.015)	(0.018)	(0.025)	(0.014)	(0.016)	(0.023)	(0.023)	(0.022)	(0.026)
SCHOOL CHOICE	-0.15	-0.07	-0.22	-0.24*	-0.07	-0.06	-0.19*	-0.23	-0.26	-0.27*	-0.10	-0.02
	(0.088)	(0.205)	(0.139)	(0.109)	(0.097)	(0.126)	(0.093)	(0.209)	(0.140)	(0.114)	(0.111)	(0.107)
PRESCORE (G9VEM_Z)	0.73***	0.96***	0.80***	0.74***	0.69***	0.60***	0.72***	0.89***	0.82***	0.73***	0.71***	0.57***
	(0.039)	(0.087)	(0.054)	(0.058)	(0.059)	(0.076)	(0.041)	(0.100)	(0.074)	(0.050)	(0.049)	(0.062)
STUDY HOURS (1= >10hrs /week)	0.38***	0.40**	0.34***	0.42***	0.33**	0.26	0.38***	0.34**	0.35***	0.45***	0.35***	0.26*
	(0.063)	(0.153)	(0.100)	(0.095)	(0.104)	(0.133)	(0.066)	(0.129)	(0.089)	(0.075)	(0.078)	(0.112)
SELF ESTEEM	0.43***	0.47***	0.48***	0.42***	0.39***	0.49***	0.45***	0.53***	0.50***	0.44***	0.36***	0.42***
	(0.048)	(0.125)	(0.072)	(0.062)	(0.068)	(0.088)	(0.051)	(0.106)	(0.069)	(0.077)	(0.074)	(0.118)
ENGLISH PT in middle school	0.02	0.08	0.03	0.01	-0.01	-0.05	0.02	0.05	0.03	0.02	-0.04	-0.02
	(0.034)	(0.081)	(0.049)	(0.062)	(0.056)	(0.055)	(0.037)	(0.071)	(0.061)	(0.057)	(0.057)	(0.063)
ENGLISH PT in G10	0.03	0.16	0.14*	0.03	-0.00	0.07	0.03	0.12	0.18	-0.05	-0.01	0.06
	(0.067)	(0.162)	(0.062)	(0.115)	(0.080)	(0.124)	(0.071)	(0.124)	(0.111)	(0.084)	(0.072)	(0.103)
ENGLISH PT in G11	0.18**	0.30*	0.19*	0.14	0.10	0.02	0.20*	0.14	0.22*	0.29**	0.08	0.09
	(0.065)	(0.150)	(0.083)	(0.093)	(0.064)	(0.112)	(0.077)	(0.164)	(0.093)	(0.113)	(0.105)	(0.131)
Constant	4.95***	2.24**	3.68***	5.43***	5.91***	7.29***	4.96***	2.27***	3.68***	5.32***	6.16***	7.07***
	(0.284)	(0.696)	(0.347)	(0.311)	(0.465)	(0.603)	(0.300)	(0.624)	(0.521)	(0.553)	(0.414)	(0.551)
Observations	2,344	2,344	2,344	2,344	2,344	2,344	2,114	2,114	2,114	2,114	2,114	2,114
R-squared	0.348						0.349					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_E (English score on the CSAT)

Table Q.10. Effects of math tutoring in grade 10 on the CSAT math achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
MATH PT in G10	0.14	0.29	0.33**	0.14	-0.04	-0.07	0.14	-0.23	0.47	0.80	0.01	0.26
	(0.082)	(0.162)	(0.112)	(0.125)	(0.093)	(0.126)	(0.322)	(0.718)	(0.423)	(0.501)	(0.309)	(0.694)
URBANICITY	-0.08	-0.21	-0.04	-0.01	-0.05	-0.04	-0.10	-0.18	-0.05	-0.05	-0.03	-0.13
	(0.089)	(0.180)	(0.130)	(0.080)	(0.114)	(0.179)	(0.096)	(0.138)	(0.108)	(0.123)	(0.100)	(0.265)
GENDER (1=female)	-0.35***	-0.16	-0.23*	-0.43***	-0.44***	-0.45***	-0.39***	-0.25	-0.28**	-0.49***	-0.49***	-0.48***
	(0.063)	(0.155)	(0.115)	(0.099)	(0.085)	(0.097)	(0.069)	(0.159)	(0.102)	(0.107)	(0.079)	(0.118)
SES	0.04	-0.03	-0.02	0.05	0.11**	0.17**	0.04	-0.03	-0.03	0.00	0.11	0.12
	(0.042)	(0.082)	(0.048)	(0.071)	(0.039)	(0.061)	(0.047)	(0.097)	(0.076)	(0.090)	(0.063)	(0.066)
SCHOOL TYPE (1=private)	0.17**	0.05	0.19	0.17	0.17*	0.31***	0.16*	0.12	0.21	0.14	0.17*	0.26**
	(0.064)	(0.128)	(0.098)	(0.093)	(0.082)	(0.092)	(0.068)	(0.174)	(0.114)	(0.085)	(0.076)	(0.084)
SCHOOL TRACK (1=general)	0.41***	0.52*	0.37*	0.49*	0.47***	0.35	0.41**	0.89***	0.23	0.34	0.44*	0.23
	(0.116)	(0.206)	(0.154)	(0.199)	(0.133)	(0.218)	(0.139)	(0.199)	(0.150)	(0.182)	(0.191)	(0.295)
STU-TEA RATIO	-0.04*	-0.04	-0.03	-0.03	-0.05***	-0.03	-0.04**	-0.06*	-0.03	-0.04	-0.06**	-0.02
	(0.014)	(0.025)	(0.020)	(0.022)	(0.013)	(0.020)	(0.016)	(0.028)	(0.023)	(0.023)	(0.017)	(0.020)
SCHOOL CHOICE	-0.13	-0.35	-0.08	0.03	-0.18	-0.20	-0.21*	-0.50***	-0.10	-0.07	-0.23*	-0.30
	(0.094)	(0.208)	(0.155)	(0.149)	(0.145)	(0.169)	(0.101)	(0.149)	(0.101)	(0.149)	(0.117)	(0.293)
PRESCORE (G9VEM_Z)	0.75***	0.75***	0.80***	0.83***	0.76***	0.63***	0.71***	0.69***	0.74***	0.75***	0.72***	0.63***
	(0.043)	(0.087)	(0.067)	(0.074)	(0.062)	(0.076)	(0.046)	(0.077)	(0.072)	(0.050)	(0.068)	(0.061)
STUDY HOURS	0.50***	0.37*	0.44***	0.54***	0.50***	0.55***	0.49***	0.28	0.43**	0.50***	0.50***	0.48***
(1= >10hrs /week)	(0.068)	(0.170)	(0.088)	(0.071)	(0.111)	(0.073)	(0.074)	(0.166)	(0.136)	(0.103)	(0.130)	(0.135)
SELF ESTEEM	0.26***	0.31**	0.24*	0.27***	0.24***	0.30***	0.26***	0.34**	0.22*	0.25***	0.23**	0.31***
	(0.052)	(0.097)	(0.120)	(0.064)	(0.065)	(0.075)	(0.056)	(0.113)	(0.087)	(0.063)	(0.089)	(0.076)
MATH PT in middle school	-0.05	0.05	0.02	-0.08	-0.08	-0.02	-0.05	0.15	-0.00	-0.13**	-0.12*	-0.09
	(0.037)	(0.075)	(0.076)	(0.060)	(0.051)	(0.079)	(0.047)	(0.092)	(0.050)	(0.050)	(0.051)	(0.076)
MATH PT in G11	0.55***	0.53***	0.50***	0.55***	0.58***	0.52***	0.58***	0.71***	0.53***	0.41**	0.57***	0.47*
	(0.076)	(0.123)	(0.058)	(0.102)	(0.091)	(0.134)	(0.105)	(0.149)	(0.099)	(0.142)	(0.100)	(0.240)
MATH PT in G12	0.43***	0.57***	0.49***	0.39***	0.37***	0.27**	0.45***	0.67***	0.51***	0.44***	0.40***	0.28*
	(0.072)	(0.141)	(0.076)	(0.097)	(0.077)	(0.098)	(0.080)	(0.161)	(0.091)	(0.119)	(0.111)	(0.133)
Constant	5.40***	3.23***	3.75***	5.28***	6.96***	7.57***	5.67***	3.44***	3.95***	5.41***	7.31***	7.77***
	(0.305)	(0.472)	(0.457)	(0.528)	(0.348)	(0.479)	(0.336)	(0.672)	(0.446)	(0.493)	(0.465)	(0.791)
Observations	2,338	2,338	2,338	2,338	2,338	2,338	2,033	2,053	2,053	2,053	2,053	2,053
R-squared	0.345						0.334					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table Q.11. Effects of math tutoring in grade 11 on the CSAT math achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
MATH PT in G11	0.55***	0.53***	0.50***	0.55***	0.58***	0.52**	0.63**	1.02*	1.32	1.92***	1.30	0.51
	(0.076)	(0.143)	(0.095)	(0.091)	(0.111)	(0.166)	(0.241)	(0.476)	(0.701)	(0.545)	(0.795)	(1.029)
URBANICITY	-0.08	-0.21	-0.04	-0.01	-0.05	-0.04	-0.09	-0.22	0.01	-0.02	-0.10	-0.10
	(0.089)	(0.125)	(0.114)	(0.117)	(0.153)	(0.200)	(0.092)	(0.149)	(0.119)	(0.126)	(0.110)	(0.137)
GENDER (1=female)	-0.35***	-0.16	-0.23*	-0.43***	-0.44***	-0.45***	-0.38***	-0.26*	-0.28*	-0.34***	-0.41***	-0.47***
	(0.063)	(0.134)	(0.108)	(0.084)	(0.073)	(0.117)	(0.065)	(0.117)	(0.116)	(0.085)	(0.115)	(0.122)
SES	0.04	-0.03	-0.02	0.05	0.11	0.17*	0.04	-0.14	-0.02	0.04	0.12*	0.18
	(0.042)	(0.093)	(0.070)	(0.064)	(0.072)	(0.082)	(0.044)	(0.100)	(0.073)	(0.059)	(0.057)	(0.098)
SCHOOL TYPE (1=private)	0.17**	0.05	0.19*	0.17*	0.17	0.31**	0.18**	0.11	0.16	0.10	0.22*	0.21*
	(0.064)	(0.116)	(0.087)	(0.075)	(0.088)	(0.102)	(0.065)	(0.148)	(0.088)	(0.093)	(0.090)	(0.095)
SCHOOL TRACK (1=general)	0.41***	0.52	0.37**	0.49*	0.47***	0.35	0.39**	0.43*	0.29	0.32	0.42	0.49**
	(0.116)	(0.289)	(0.125)	(0.212)	(0.114)	(0.191)	(0.121)	(0.177)	(0.243)	(0.259)	(0.239)	(0.185)
STU-TEA RATIO	-0.04*	-0.04	-0.03	-0.03	-0.05**	-0.03	-0.04*	-0.03	-0.02	-0.03	-0.04	-0.04
	(0.014)	(0.027)	(0.015)	(0.021)	(0.017)	(0.026)	(0.015)	(0.041)	(0.028)	(0.020)	(0.019)	(0.022)
SCHOOL CHOICE	-0.13	-0.35	-0.08	0.03	-0.18	-0.20	-0.17	-0.39*	-0.02	-0.03	-0.19	-0.22
	(0.094)	(0.177)	(0.134)	(0.124)	(0.159)	(0.218)	(0.098)	(0.185)	(0.110)	(0.113)	(0.116)	(0.183)
PRESCORE (G9VEM_Z)	0.75***	0.75***	0.80***	0.83***	0.76***	0.63***	0.75***	0.75***	0.79***	0.78***	0.75***	0.66***
	(0.043)	(0.084)	(0.072)	(0.085)	(0.081)	(0.097)	(0.045)	(0.097)	(0.074)	(0.065)	(0.071)	(0.075)
STUDY HOURS	0.50***	0.37**	0.44***	0.54***	0.50***	0.55***	0.48***	0.33*	0.48***	0.40***	0.39***	0.53***
(1= >10hrs /week)	(0.068)	(0.138)	(0.070)	(0.066)	(0.077)	(0.069)	(0.071)	(0.141)	(0.107)	(0.081)	(0.112)	(0.115)
SELF ESTEEM	0.26***	0.31***	0.24**	0.27***	0.24***	0.30***	0.28***	0.40***	0.22**	0.30***	0.21**	0.27**
	(0.052)	(0.069)	(0.088)	(0.075)	(0.068)	(0.056)	(0.054)	(0.099)	(0.068)	(0.078)	(0.064)	(0.097)
MATH PT in middle school	-0.05	0.05	0.02	-0.08	-0.08	-0.02	-0.07	-0.01	-0.10	-0.15*	-0.14	-0.06
	(0.037)	(0.084)	(0.058)	(0.056)	(0.048)	(0.066)	(0.042)	(0.079)	(0.085)	(0.059)	(0.082)	(0.110)
MATH PT in G10	0.14	0.29	0.33**	0.14	-0.04	-0.07	0.12	0.08	0.08	-0.24	-0.28	-0.03
	(0.082)	(0.152)	(0.111)	(0.084)	(0.129)	(0.157)	(0.103)	(0.176)	(0.261)	(0.168)	(0.246)	(0.315)
MATH PT in G12	0.43***	0.57***	0.49***	0.39***	0.37***	0.27*	0.40***	0.53*	0.19	-0.01	0.15	0.26
	(0.072)	(0.157)	(0.100)	(0.095)	(0.094)	(0.104)	(0.097)	(0.256)	(0.239)	(0.153)	(0.203)	(0.314)
Constant	5.40***	3.23***	3.75***	5.28***	6.96***	7.57***	5.56***	3.31***	3.68***	5.16***	6.79***	7.83***
	(0.305)	(0.700)	(0.482)	(0.488)	(0.540)	(0.495)	(0.319)	(0.713)	(0.359)	(0.275)	(0.428)	(0.552)
Observations	2,338	2,338	2,338	2,338	2,338	2,338	2,209	2,271	2,271	2,271	2,271	2,271
R-squared	0.345						0.341					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)

Table Q.12. Effects of math tutoring in grade 12 on the CSAT math achievement

	OLS						IV					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Average	q10	q25	q50	q75	q90	Average	q10	q25	q50	q75	q90
MATH PT in G12	0.43***	0.57***	0.49***	0.39**	0.37***	0.27*	0.42**	0.40	0.73**	0.48**	0.61*	0.45
	(0.072)	(0.140)	(0.109)	(0.129)	(0.103)	(0.108)	(0.157)	(0.456)	(0.271)	(0.161)	(0.290)	(0.387)
URBANICITY	-0.08	-0.21	-0.04	-0.01	-0.05	-0.04	-0.07	-0.21	-0.06	0.00	-0.15	-0.10
	(0.089)	(0.136)	(0.122)	(0.111)	(0.099)	(0.165)	(0.095)	(0.162)	(0.147)	(0.142)	(0.127)	(0.134)
GENDER (1=female)	-0.35***	-0.16	-0.23**	-0.43***	-0.44***	-0.45***	-0.34***	-0.19	-0.23	-0.38**	-0.44***	-0.50***
	(0.063)	(0.136)	(0.089)	(0.081)	(0.087)	(0.107)	(0.066)	(0.114)	(0.119)	(0.115)	(0.095)	(0.101)
SES	0.04	-0.03	-0.02	0.05	0.11*	0.17**	0.04	-0.03	-0.06	0.02	0.09	0.15*
	(0.042)	(0.078)	(0.062)	(0.069)	(0.051)	(0.060)	(0.045)	(0.083)	(0.063)	(0.071)	(0.059)	(0.067)
SCHOOL TYPE (1=private)	0.17**	0.05	0.19	0.17	0.17	0.31*	0.19**	0.07	0.17	0.24**	0.22*	0.25*
	(0.064)	(0.139)	(0.117)	(0.093)	(0.115)	(0.126)	(0.067)	(0.156)	(0.099)	(0.085)	(0.090)	(0.127)
SCHOOL TRACK (1=general)	0.41***	0.52*	0.37*	0.49**	0.47***	0.35	0.45***	0.67*	0.37**	0.53***	0.54***	0.40*
	(0.116)	(0.215)	(0.167)	(0.169)	(0.123)	(0.212)	(0.127)	(0.288)	(0.127)	(0.140)	(0.120)	(0.186)
STU-TEA RATIO	-0.04*	-0.04	-0.03	-0.03	-0.05**	-0.03	-0.04*	-0.07	-0.03	-0.04*	-0.05*	-0.03
	(0.014)	(0.029)	(0.026)	(0.020)	(0.016)	(0.020)	(0.015)	(0.041)	(0.026)	(0.017)	(0.023)	(0.018)
SCHOOL CHOICE	-0.13	-0.35*	-0.08	0.03	-0.18	-0.20	-0.16	-0.44*	-0.09	0.02	-0.22	-0.19
	(0.094)	(0.142)	(0.101)	(0.131)	(0.123)	(0.150)	(0.100)	(0.209)	(0.192)	(0.165)	(0.174)	(0.137)
PRESCORE (G9VEM_Z)	0.75***	0.75***	0.80***	0.83***	0.76***	0.63***	0.75***	0.81***	0.79***	0.87***	0.77***	0.68***
	(0.043)	(0.082)	(0.086)	(0.096)	(0.078)	(0.100)	(0.045)	(0.084)	(0.089)	(0.063)	(0.062)	(0.080)
STUDY HOURS	0.50***	0.37*	0.44***	0.54***	0.50***	0.55***	0.47***	0.42**	0.35***	0.47***	0.44***	0.51***
(1= >10hrs /week)	(0.068)	(0.158)	(0.117)	(0.079)	(0.104)	(0.098)	(0.072)	(0.156)	(0.093)	(0.108)	(0.096)	(0.107)
SELF ESTEEM	0.26***	0.31***	0.24**	0.27***	0.24**	0.30***	0.29***	0.31***	0.28**	0.27***	0.27**	0.28**
	(0.052)	(0.071)	(0.091)	(0.062)	(0.078)	(0.082)	(0.055)	(0.076)	(0.091)	(0.063)	(0.093)	(0.109)
MATH PT in middle school	-0.05	0.05	0.02	-0.08	-0.08	-0.02	-0.06	0.01	-0.03	-0.08	-0.11	-0.08
	(0.037)	(0.080)	(0.059)	(0.049)	(0.059)	(0.079)	(0.040)	(0.075)	(0.059)	(0.061)	(0.072)	(0.091)
MATH PT in G10	0.14	0.29*	0.33**	0.14	-0.04	-0.07	0.11	0.45**	0.33**	0.07	-0.08	-0.17
	(0.082)	(0.135)	(0.106)	(0.121)	(0.109)	(0.153)	(0.088)	(0.143)	(0.110)	(0.110)	(0.148)	(0.147)
MATH PT in G11	0.55***	0.53***	0.50***	0.55***	0.58***	0.52**	0.60***	0.53*	0.54***	0.67***	0.58***	0.54***
	(0.076)	(0.152)	(0.119)	(0.096)	(0.088)	(0.161)	(0.094)	(0.228)	(0.134)	(0.127)	(0.165)	(0.162)
Constant	5.40***	3.23***	3.75***	5.28***	6.96***	7.57***	5.43***	3.64***	3.97***	5.17***	7.06***	7.76***
	(0.305)	(0.674)	(0.548)	(0.552)	(0.348)	(0.487)	(0.323)	(0.711)	(0.632)	(0.438)	(0.576)	(0.652)
Observations	2,338	2,338	2,338	2,338	2,338	2,338	2,117	2,117	2,117	2,117	2,117	2,117
R-squared	0.345						0.343					

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Dependent variable: CSAT_M (math score on the CSAT)