The Relationship Between Private Tutoring And Mathematics Achievement

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Abstract. This study aims to shed light on the association between private tutoring and academic achievement in mathematics among primary school students in Qatar. Utilizing data from the Trends in International Mathematics and Science Study (TIMSS) 2019, we employ a propensity score technique to elucidate the disparities in mathematics achievement levels between two distinct groups: students who receive private tutoring and those who do not. Our findings indicate that students who engage in private tutoring have lower odds of attaining higher achievement scores in mathematics.

1.   Introduction

Over the past few decades, there has been an increase in the rate of engagement in private tutoring services across the world with specific prominence in East Asian countries (Bray and Lykins, 2012). Nevertheless, scholarship on the topic of private tutoring is still rather limited (Bray, Kwo and Jokic, 2015). In Qatar, there is very little research done on the growing private tutoring business. The Qatar Education Study 2012 (SESRI 2012) and the Qatar Education Study 2015 (QES 2016), both conducted by the Social and Economic Survey Research Institute (SESRI), are the only studies known to have covered the topic of private tutoring in the nation, although only briefly. Despite its direct relevance to educational planning and decision-making in Qatar, the fact of the matter remains that private tutoring is a phenomenon least investigated. Indeed, very little is known about its scale, its scope and its effects on students' achievement .

This paper aims to bridge this gap by investigating the impact of private tutoring on students' academic performance in Qatar. Children receive private tuition in academic subjects outside regular school hours, effectively extending their learning time. This form of structured support, following the school curriculum, has been termed "shadow education". It has the potential to substantially enhance students' performance in tests and represents a significant financial investment by families in their children's education. However, there is no conclusive evidence that private tutoring enhances overall student achievement (Mori and Baker, 2010).

The inconsistent findings of these studies may be attributed to cultural and institutional variations across countries as well as methodological differences (Lambert and Spinath, 2014).

Qatar presents a unique context due to the substantial proportion of expatriate residents. Non-Arab expatriates bring their cultural backgrounds and often enroll their children in schools following the curricula of their home countries, which are frequently supported by shadow education. This research aims to elucidate the disparities in academic achievements between two groups of students: those who receive private tutoring and those who do not. Specifically, we aim to provide empirical evidence on the relationship between private tutoring and academic performance, as measured by the TIMSS 2019 standardized tests.

This study contributes to the existing empirical literature on the association between academic performance and private tutoring. It has two main objectives. Firstly, it expands the research on the relationship between private tutoring at an early age and academic achievement. Secondly, it seeks to provide insights for the formulation of effective policies regarding private tutoring in Qatar. By addressing these objectives, this research aims to contribute to a better understanding of the complex dynamics surrounding private tutoring and its impact on academic outcomes among young children.

2.   Context of the Research Study

The State of Qatar is a small, but wealthy state in the Arabian Gulf. Over the last 20 years, the country has witnessed some extraordinary transformations. One sector that has possibly undergone the most radical changes and development is Qatar's education sector. Prior to the 1950s, when modern education first emerged in Qatar, the only educational system available to girls and boys was traditional instruction taught by a single teacher to groups of students. This method primarily emphasized memorization of the Quran along with rudimentary math and Arabic spelling (Al-Maadheed, 2017). In 1952, Qatar had just one elementary school for boys. Yet, by 1980 it had 141 schools; 71 for boys and 70 for girls.

Recently, Qatar's education system consists of four types of schools: community schools, foreign schools, government schools, and private Arabic schools. This is due to the country's diverse population. Students of Qatari nationality often attend publicly sponsored, gender-segregated government schools, with separate buildings designated for boys and girls. Additionally, a sizable immigrant population from Arab nations attends these schools. The Ministry of Development Planning and numbers (2017) released official numbers showing that 83% of Qatari nationals were enrolled in government schools in 2014–2015, indicating that government schools are the chosen choice for the majority of their education. On the other hand, children of expatriates typically attend international schools, which are frequented by foreign families residing in Qatar. The curricula employed at these schools are worldwide, similar to those in the UK, Canada, and the USA. Conversely, community schools employ the curricula of the nations whose embassies are located in Qatar and receive funding from them. They are therefore meant to assist those who have emigrated from that nation (such as French, Filipino, Indian, and Pakistani nationals). Lastly, the curriculum of a foreign Arab nation (such as Egypt, Tunisia, Sudan, etc.) is followed by private Arabic schools.

Private tutoring is a thriving industry in Qatar, as it is in other nearby states. A variety of options are available, such as one-on-one, small-group, or large-class tutoring. Because of this, both private organizations and individuals are pushing their way into the shadow education industry by establishing courses to satisfy the nation's growing demand for private tutoring. According to a 2015 National Survey that involved 1803 students from 38 secondary schools private tutoring was common among students. Private tutoring was received by 46% of Qatari

students and 28% of foreign students. The percentages were significantly higher in international schools, where 39% of foreign pupils and 55% of Qatari students received private coaching (Alemadi et al., 2016). A follow-up poll conducted in 2018 with 1639 students from 34 schools showed that the percentages stayed largely unchanged, with 34% of students at foreign schools and 45% of students in government schools using private tutoring (Sellami, 2019). The Qatar Education Study (2018) reveals that nearly one-third of Qatari parents pay Dh1,400 (about $400 USD) on average each month for private tutoring sessions.

In Qatar, private tutoring is banned by law. According to the Vice-President of the Qatari Bar Association Article 19 in Chapter 4 of the 1994 penal code prohibited teachers from providing out-of-school tutoring. Unlicensed tutors are now considered criminals according to Law No. 18 of 2010. Nonetheless, under specific guidelines, educators were allowed to offer tutoring while the student was at school (Abdurrahman, 2018).

Nevertheless, despite all of the government's efforts to control education outside of the mainstream in Qatar, the industry for private tuition is still booming and seeing growth in demand. Parents would continue to employ a private tutor regardless of the expense as long as they believe it will improve their child's academic performance (Rao, 2017).

3.   Theoretical Background

Private tutoring has emerged as an academic support system outside of traditional school settings, aiming to enhance students' learning and improve their performance. The underlying assumption is that additional time devoted to subject matter learning through private tutoring would lead to increased knowledge acquisition and better performance in examinations. However, the impact of private tutoring on student achievement for all school levels and in particular for primary level remains a topic of debate and research, with inconclusive findings reported in the literature (Mori and Baker, 2010).

Some studies have shown positive associations between private tutoring and primary academic outcomes. For instance, Banerjee et al (2007) reported the results of two randomized experiments conducted in schools in urban India over two years for students in grade 3 and 4. Results showed that remedial education increased average test scores of all children in treatment schools in basic literacy and numeracy skills by 0.28 standard deviation. Moreover and using the Vietnam Living Standards Surveys (VLSS) 1997–1998 and 1992–1993 for analysis, Dang (2007) found evidence that private tutoring is an essential expense for households in Vietnam for both primary and lower secondary children. Conversely, other studies have presented a more nuanced perspective, indicating limited or insignificant effects of private tutoring on primary students' achievements. These findings suggest that private tutoring may not consistently lead to significant improvements in academic achievement or may have marginal impacts that do not align with initial expectations. For instance, in a study of Indonesian fourth graders, Suryadarma et al. (2006), did not find any significant effect of tutoring on mathematics or dictation results. Similarly, 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. Furthermore, certain studies have even indicated a negative impact of private tutoring on academic achievement. Fang and Zhang (2018) conducted an analysis using the data of evaluation of basic education from the National Collaboration and Innovation Center in China to analyze the relationship between the study time after class and primary pupils achievements. They found that tutoring has a significant negative impact on the academic performance of primary pupils. The longer the pupils work, the lower the pupil achievements.

Another aspect explored in the literature is the impact of private tutoring across different subject areas. For instance, Ha and Harpham (2005) reported that private tutoring has a positive impact on reading, but an insignificant effect on writing and numeracy for eight-year-old children in Vietnam.

It is worth noting that the empirical evidence on the impact of private tutoring varies depending on the methodological approaches adopted. One key methodological distinction in the literature is the consideration of endogeneity controls. Recent studies have increasingly incorporated strategies to address endogeneity concerns, with a notable emphasis on controls in articles published after 2005. For example, Suryadarma et al. (2006) employed an instrumental variables approach to control for endogeneity in their study of Indonesian fourth graders, ultimately finding no significant effect of tutoring on mathematics or dictation results as mentioned above. In contrast, Keuren (2016) utilized propensity score matching to infer a causal impact of private tutoring on the numeracy, literacy, and total outcomes for fourth grade public school students in Cambodia. Using the World Bank Public Expenditure Tracking Survey (PETS) 2004 data, author found that pupils who receive private tutoring outperform their peers who never receive it in terms of reading, numeracy, and overall scores. Moreover, Kang (2007) utilized a combination of Ordinary Least Squares (OLS) and Propensity Score Matching to examine the impact of private tutoring on CSAT results in the Korean context, revealing a slight positive effect on achievement.

In summary, the literature on the impacts of private tutoring for primary students presents a complex picture, with conflicting findings. While some studies suggest positive effects on academic performance, others report neutral or even negative associations. Furthermore, the influence of private tutoring may vary across different subject areas.

4. TIMSS Data and Methods

4.1. TIMSS Data

The primary aim of the TIMSS (Trends in International Mathematics and Science Study) assessments is to establish a reliable and valid measure of knowledge and skills in mathematics and science. These assessments hold significant value within the global education community and are designed to align with the curricula of participating countries. Introduced in 1994/1995, the initial implementation of TIMSS involved 45 countries, with Kuwait being the only Arab participant at that time. However, as time has progressed, the participation of Arab nations in TIMSS evaluations has increased, encompassing both fourth and eighth-grade levels.

In the latest TIMSS survey conducted in 2019, a total of 64 countries and 8 benchmarking participants took part. Notably, 9 Arab countries participated at the fourth-grade level, while 11 Arab countries participated at the eighth-grade level. The TIMSS 2019 assessment witnessed the involvement of 6 Gulf countries, namely Bahrain, Oman, Qatar, the United Arab Emirates, Saudi Arabia, and Kuwait. In addition, Dubai played a role as a benchmarking participant.

To ensure meaningful comparisons across countries, the TIMSS assessments are strategically scheduled to take place at the end of the academic year. This timing allows for greater cross-country comparability by minimizing potential variations in the content and timing of instruction across different educational systems.

The choice to use Qatar as a sample for our study investigating the impact of private tutoring on mathematics' achievement for primary students is justified for multiple reasons. Firstly, Qatar has demonstrated a strong commitment to education and have made significant

investments in their educational systems. In 2001, the Qatari government appointed the Rand Corporation to analyse and offer recommendations to modernize the local K-12 system in order to improve their education system. Moreover, few Gulf countries have specific regulations for shadow education. The most prominent exception is Qatar, the government of which issued a pair of documents (Qatar, 2015, 2017) with detailed specifications on licensing tutoring. Furthefmore, and based on TIMSS data (2019), Qatar has a fairly high rate of private tutoring for primary students compared to other gulf countries (Bahrain, Oman, Qatar and the United Arab Emirates)[1] and especially in mathematics.
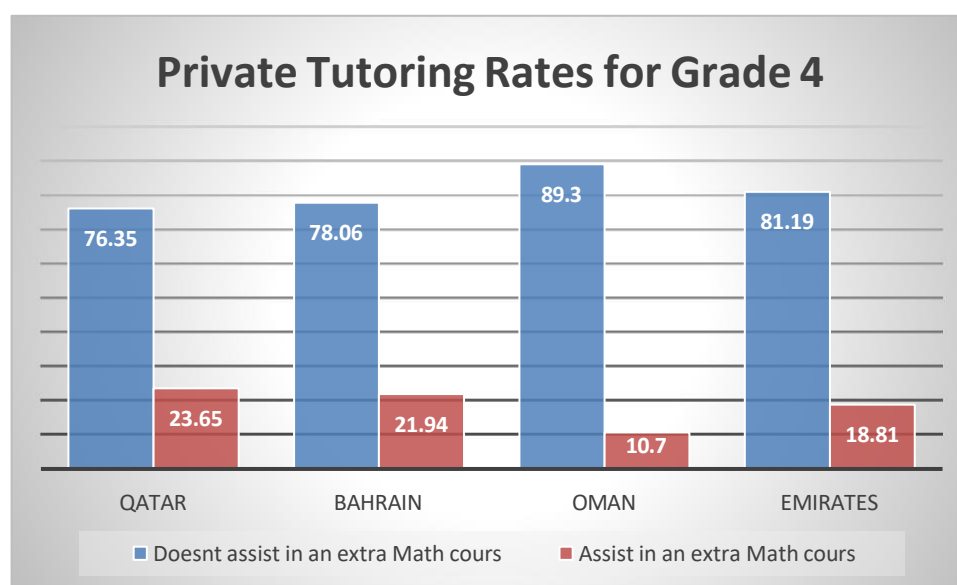
Source: TIMSS (2019)

4.2. Sample Design and Exclusion

TIMSS is a globally recognized assessment program that employs meticulous sampling procedures to ensure the accuracy and reliability of its estimates, striving to provide an accurate representation of the larger population. In order to maintain consistency and fairness across different cycles of TIMSS, stringent exclusion criteria have been established at both the school and student levels, as documented by Martin et al. (2020). At the school level, certain criteria are employed to exclude specific schools from the dataset. Schools located in remote areas or with an extremely small student population, such as four or fewer students in the target grade, are excluded. Additionally, schools that deviate significantly from the mainstream educational system or exclusively cater to children with special needs are also excluded. These exclusion criteria ensure that the dataset primarily consists of schools that align with the typical educational context. Moreover, international guidelines are implemented to determine within-school exclusions. These guidelines take into account students with functional disabilities, students with intellectual disabilities, and students who are non-native language speakers. By excluding these specific student groups, the aim is to maintain a standardized assessment environment and ensure that the results accurately reflect the abilities of the target population.

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[1] Saudi Arabia and Kuwait were excluded from our sample due to the problem of missing data.

It is important to note that these exclusion criteria are designed to enhance the validity and reliability of the assessment outcomes. In our specific sample, the overall exclusion rate is 2,2%, demonstrating the adherence to these exclusion guidelines while still maintaining a robust and representative dataset for analysis (**Table A-1**).

For our study, we have utilized the Qatari dataset derived from TIMSS 2019, with a specific focus on fourth-grade students. The choice to include fourth-grade students is significant as this age group represents a formative period where educational interventions, including private tutoring, can exert a substantial influence on students' academic performance and learning outcomes. Our sample is composed of 1822 students. We then divided the dataset into two groups: the treatment group, consisting of students who received private tutoring in mathematics, and the control group, comprising students who did not. The proportion of students who received private tutoring amounts to 23,38%.

4.3. Methods

4.3.1. Empirical Model and Technique

OLS regression is first used to estimate the average treatment effect of private tutoring. The variable treatment is introduced in **Equation (1)** as a dummy variable.

$$P_{i,c,s} = \alpha_0 + \alpha_1 F_{i,c,s} + \alpha_2 T_{i,c,s} + \varepsilon_{i,c,s} \quad (1)$$

Where P_{ics} is the score of student i in class c at school s. F_{ics} is a vector of individual and family background characteristics. T_{ics} is the treatment variable which is a binary variable that takes the value 1 for treated observations and 0 for control observations. To draw valid inferences, we use the students' sampling weights. The aim of OLS regression is to examine if there are any significant differences in performance between the treatment and control groups. However private tutoring is endogenous, in that these unobserved factors affect both investment in private tutoring, on the one hand, and the student's performance at school, on the other. If not properly controlled for in regression analysis, all these unobserved characteristics will end up in the error term ε, and due to their correlation with the private tutoring variable, they will make estimation results inconsistent and unreliable. In other words, estimation results suffer from selection bias if analyses do not properly address the fact that students attending private tutoring are different from those who do not. This identification problem is analogous to others in the education literature, such as the difficulty of estimating whether religious and other private schools yield better student outcomes than public schools do (Bedi and Garg, 2000 and Newhouse and Beegle, 2005) . One of econometric techniques that have been used in the literature to deal with the endogeneity of private tutoring is propensity score matching. The propensity score matching (PSM) is a quasi-experimental method in which the researcher creates an artificial control group by matching each treated unit with a non-treated unit with similar characteristics. PSM, in particular, computes the probability of a unit enrolling in a program based on observed characteristics. Then, based on the propensity score, PSM assigns treated units to untreated units. PSM is based on the assumption that untreated units can be compared to treated units based on some observable characteristics, as if the treatment had been fully randomized (Rubin, 2001). To control for the potential confounding influence of pretreatment variables (individual and family variables), we utilize a logit model to predict children's propensity for the treatment group. Following that, we use the Nearest Neighbor Matching to pair cases in both groups based on their likelihood of experiencing a treatment. We use matching with replacement to identify neighbor cases (Frisco et al., 2007).

4.3.2. Variables

This section describes the outcome variables used for the purpose of this study as well as the covariates and the treatment variable**.**

Outcome Variables : The dependent variables are overall performance in mathematics. In TIMSS, student achievement is represented by sets of five plausible values : Math1,Math2, Math3, Math4 and Math5. Plausible values are imputed values drawn from the estimated ability distributions (Martin et al., 2016; Mislevy, 1991). Plausible values are generated by making use of all available background data of the students. Plausible values are not intended to be estimates of individual student scores, but rather are imputed scores for like students- students with similar response patterns and background characteristics in the sampled population- that may be used to estimate population characteristics correctly (Martin et al., 2020). A detailed review of the plausible values methodology is given in Mislevy (1991).

Covariates : The core explanatory variables are individual and family background characteristics. Individual factors include the students' age, gender, language's instruction and students' status. Family factors include parents' education and occupation, children's books and some educational resources such as possessing computers and internet.

In the model, all nominal variables were incorporated as dummy variables. Specifically, the variable "Gender" was coded as 1 for females and 0 for males. The variable "Language" took a value of 1 for students receiving instruction in English and 0 for those receiving instruction in classical Arabic. Regarding parental education, the variable "parents' higher education" took a value of 1 if parents had a university degree or higher and 0 if no. Variables associated with possessing educational resources, take the value 1 if response is yes and zero if no. For occupation, and students' status, certain categories were designated as reference points, including "never worked for pay" for parental occupation, and "any parent born in the country" for students' status.

Treatment Variable: The treatment variable "Treat" is a binary variable that takes the value 1 if student had attended tutoring lessons not provided by the school during the last 12 months in mathematics and 0 if not[2].

4.3.3. Descriptive Statistics

In what follows, we provide a comprehensive overview of the descriptive statistics pertaining to the outcome variables **(Table 1)** and covariates employed **(Table 2).** For continuous variables, , we compute the means to summarize the central tendency of the data. On the other hand, categorical variables, such as gender or socioeconomic status, are characterized by distinct categories or groups. In order to depict the distribution of these variables, we calculate proportions.

Table 1: Descriptive statistics for Mathematics Achievements

Variables	Mean of Total sample	Mean of Control Group	Mean of Treatment Group	Effect Size (Cohen's d)

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[2] Covariates and treatment variable are listed in **Table A-2** with their codings.

Math1	484.155	497.380	440.817	-0.658
Math 2	484.825	497.595	442.975	-0.652
Math 3	486.690	498.843	446.864	-0.615
Math 4	484.035	497.514	439.865	-0.700
Math 5	484.342	497.437	441.432	-0.668
Observations	1822	1396	426	

Within both the treated and control groups, the mean values of the outcome variables hover around the global average of approximately 500 points. The effect size of private tutoring on mathematics performance is relatively important (for further insights on the range of variation, refer to Borenstein, 2009. The negative sign associated with the effect size signifies that engaging in private tutoring yields less favorable results compared to not receiving such additional support.

Table 2: Descriptive statistics of covariates for all students

Variables	Mean/Proportion	Min	Max
Age	9.913	8	11
Gender	0.564	0	1
Possess Computer	0.930	0	1
Possess Internet	0.918	0	1
Students' Status			
Any parent was born in the country	0.511	0	1
Only one parent was born in the country	0.108	0	1
Both of parents were born in the country.	0.381	0	1
Language test	0.589	0	1
Parents' Higher Education	0.790	0	1
Parents' occupation			
Never worked for pay	0.0509	0	1
General laborer	0.00548	0	1
Skilled worker	0.0263	0	1
Clerical	0.109	0	1
Small business owner	0.0455	0	1
Professional	0.7628	0	1

Children's books			
0-10	0.328	0	1
11-25	0.273	0	1
26-50	0.213	0	1
51-100	0.133	0	1
More than 100	0.0526	0	1
Observations	1822		

The students included in the sample exhibit an average age of 9.91 years. In addition, the sample is approximately evenly divided between boys and girls, ensuring a balanced representation of both sexes in the analysis. Furthermore, a variable called "students' status" is utilized to discern between native and expatriate students. By considering whether both parents were born in the country or only one parent was born in the country, this variable helps capture the students' demographic background and immigration status. Analyzing the composition of the sample, it is observed that more than 50% of the students don't hold national citizenship, indicating a significant presence of expatriate students within the dataset. Additionally, when examining the language used during the testing process, it is revealed that 59% of the students took the tests in English.

Regarding the characteristics of Qatari parents, it is observed that a significant proportion possess a high level of education. Specifically, 79 percent of parents hold a university degree or higher, indicating a high educational attainment within these households. Moreover, a considerable portion of parents, specifically 76.2 percent, are employed in professional occupations. In terms of the home environment and available resources, the TIMSS data provides insights into the presence of children's books and other essential learning materials. The findings reveal that more than half of the students have fewer than 25 books available at home. This indicates a lower emphasis on reading and book access for Qatari children. However, it is noteworthy that parents in Qatar demonstrate the ability to afford basic resources for their children's education, as evidenced by the high percentage (over 91 percent) of students who possess computers and internet connections.

5. **Results and Discussion**

The following section provides a comprehensive analysis of the results obtained from both Ordinary Least Squares (OLS) regression and propensity score matching techniques. OLS regression analysis was conducted independently five times for each evaluation. To derive the final parameter of interest, Rubin's rules (Rubin, 1987) were applied, which enable the combination of results from multiple regression analyses to generate a comprehensive and reliable estimate. The findings from the OLS regression analysis are presented in **Table 3,** while **Table 4** presents the results obtained from propensity score matching.

The OLS results reveal a significant negative association between receiving private tutoring and achievement in mathematics. Students who received private tutoring exhibit lower levels of achievement compared to their peers who did not receive such additional academic support.

Consistent with previous research (Ammermüller et al., 2005; Chiu & Khoo, 2005), the analysis reveals that family variables have a significant positive impact on students' performance. These findings emphasize the influential role of family factors in shaping academic outcomes. Moreover, when examining individual student characteristics, the coefficient of gender

demonstrates a significant influence in evaluations ; Boys outperform girls in mathematics. This gender disparity aligns with established patterns observed in educational research. Additionally, an interesting observation specific to Gulf countries and specially in Qatar is the influence of students' status as native or expatriate. The results indicate that native students tend to achieve comparatively lower performance levels than their expatriate counterparts. Lastly, the findings presented in **Table 3** indicate that students who took the tests in English, which is the first language of most expatriate students, outperformed those who took the tests in Arabic. This finding aligns with prior investigations (Bouhlila and Hentati, 2022) and underscores the significance of language of instruction in relation to academic achievement.

Table3: OLS Results

Variables	Mathematics Achievement
Treat	-35,520***
	(5,015)
Age	23,335***
	(4,259)
Sex	-8,217**
	(3,561)
Possess Computers	19,261**
	(7,652)
Possess Internet	27,538***
	(6,960)
Test's Language	25,296***
	(5,689)
Students' Status	
Only one parent was born in the country	-15,785***
	(6,141)
Both of parents were born in the country.	-37,605***
	(4,618)
Parents' Higher Education	
	20,484***
	(4,941)
Parents' occupation	
General laborer	-24,479
	(18,943)
Skilled worker	25,135
	(15,854)
Clerical	12,262

	(10,205)
Small business owner	3,917
	(11,628)
Professional	26,213***
	(8,843)
Children's books	
11-25	19,899***
	(4,653)
26-50	29,439***
	(5,458)
51-100	35,438***
	(5,480)
More than 100	55,0018***
	(8,0189)
Constant	166,745***
	(41,563)

Notes: Standard errors are in parentheses.
*** p<.01, ** p<.05, * p<.1

To further substantiate the finding between private tutoring and academic achievement, we employ a propensity score model. The results of this analysis are presented in **Table 4.**

Table 4: ATET Nearest Neighbor Results

	ATE TREAT (1 vs. 0)	**Mathematics**
Overall Performance		-34,417***
		(5,181)

Notes: Standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

In the context of our study, the analysis reveals compelling evidence regarding the impact of private tutoring on Qatari student performance in mathematics. The results indicate that students who received private tutoring in mathematics (Treatment group) experienced a noteworthy reduction of 34.4 points in their overall scores compared to their counterparts who did not receive such tutoring (Control group). These findings strongly suggest that students who have received private tutoring face significant challenges in achieving better academic outcomes in mathematics. The observed differences in scores between the treatment and control groups are statistically significant at the 1% level, emphasizing the robustness and reliability of these findings. Importantly, these results align with prior research conducted which underscores the potential detrimental effects of private tutoring on primary student performance (Ha and Harpham, 2005 and Suryadarma and al, 2006). The primary school stage is a crucial period characterized by rapid individual development. It is essential to respect the laws governing children's physical and mental development and align education with their developmental

timetable. Play serves as a vital component of children's holistic development, allowing them to explore their surroundings, develop social skills, and engage in imaginative and creative experiences (Stone, 1993). Outdoor recess, in particular, offers children unique opportunities for physical activities that enhance cognitive, social, physical, and emotional skills (Burriss & Foulks Boyd, 2005). By fostering a balanced approach that includes academic instruction, play, and social engagement, we can create an environment that supports children's overall development and maximizes their academic potential.

6. Conclusion and Recommendations

In this study, we explore the impact of private tutoring on academic achievement in mathematics among primary school students in Qatar. By employing propensity score matching and using TIMSS 2019 Data, we investigate whether private tutoring significantly improves students' academic outcomes in mathematics. The findings reveal that , contrary to parents' expectations, private tutoring does not yield a significant improvement in academic achievement for primary school children.

The findings of the current study evoke important implications of the issue of private tutoring for education policy and practice, and raise questions that require attention at the level of policy interventions. In 2001 and in order to improve their education system, Qatar's K-12 public schooling system underwent comprehensive reforms. The Rand Corporation was tasked by the Qatari government with analyzing the local K–12 system and making recommendations for its modernization. However, these efforts are undermined by the thriving private tutoring industry. Despite all of the government's efforts to control education outside of the mainstream in Qatar, private tuition is still very much in demand and is growing. Therefore, Qatari government may come up with better policies to help manage this phenomenon so as to lower the chances of its drawbacks. Moreover, it is evident that more serious interventions by parents and educators are needed to create an optimal learning environment for primary school children. Schools and school leaders should play a more active role to reduce the phenomenon. This could be achieved by drafting a code of ethics to guide teachers on ethical standards and the negatives implications of engaging in private tutoring for primary students. In addition, schools must work closely with parents to make them aware of some of the negative consequences of private tutoring for primary students by organizing awareness campaigns and establishing better communication mechanisms. For parents, and instead of relying solely on private tutoring, parents should focus on providing children with ample opportunities for creative play and social interaction, as these experiences contribute to their overall well-being and academic performance (Stone, 2005). Providing advanced tutoring at this stage may inadvertently increase the pressure on children and then reduce their academic performance (Shi et al., 2022). It is important to recognize that children's academic achievement is influenced by a multitude of factors, and fostering an environment that supports their overall development is crucial. One aspect often overlooked in the pursuit of academic excellence is the importance of play and social activity. Furthermore, exercise and outdoor activities have positive effects on children's mental functioning, particularly on tasks involving executive functions such as working memory, mental flexibility, and self-control (Tomporowski et al., 2007).

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8. Appendix

Table A-1: Coverage and Exclusion Rates in Qatar

Coverage	Overall exclusion	Schools	Students
100%	2.2%	1.2%	1%

Source: TIMSS (2019)

Table A2. Variables' List, coding and meaning

List of Variables	Coding	Meaning
Overall Performance Math1-Math5	asmmat 01–05	The 1st to 5th plausible value of Overall Performance in Mathematics
TreatM	asbh08aa/b	Dummy variable which takes the value 1 if student had attended tutoring lessons not provided by the school during the last 12 months in mathematics and 0 if not.
Age	asdage	Quantitative variable which indicates student's age.
Sex	asbg01	Dummy variable which takes the value 1 for female and 0 for male.
Education	asdhedup	Dummy variable hich takes the value of 1 if parents had a university degree or higher and 0 if no
Occupation	asdhoccp	Categorical variable which reflects parents' occupation as follows ; never worked for pay, general laborer, skilled worker, clerical, small business owner, professional. The category never worked for pay is considered as reference category.
Internet	asbg05d	Dummy variable which takes the value 1 for « Yes » and 0 for « No ».
Computer	asbg05a	Dummy variable which takes the value 1 for « Yes » and 0 for « No ».
Children books	asbh11	Quantitative variable which indicates the number of children's books.
Country	asbg06a+ asbg06b	Categorical variable which reflects parents' origin as follows; any parent born in country, only one parent born in country, both of parents born in country. The category any parent born in country is considered as reference category.

Langage Test	lang_sa	Dummy variable which takes the value of 1 for students receiving instruction in English and 0 for those receiving instruction in classical Arabic

Source: TIMSS (2019)