

Research Article

Determinants of Primary School Achievement: An International Comparison Using TIMSS 2011 DATA

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Abstract

Measuring educational performance and understanding its determinants are crucial factors in helping the educational community to better understand student output and to guide policy makers in drafting educational policies. Despite the growing number of studies interested in educational output and its determinants in many countries, there are few comparative surveys assessing both developed and developing countries. This article attempts to assess the impact of home environment, school resources and teacher quality on students' educational achievement at fourth grade across developed and developing countries. In sum up we suggest for developing countries to invest in school resources and teacher quality for exemple ensure that primary school are well equipped with necessary resources and focus on improving teacher quality through better training and adequate compensation. According to developed countries findings suggest that home environment factors like having a computer, desk, personal room, and books—play a crucial role in student performance also consider the impact of parental outcomes and involvement in their children's education we suggest to implement programs that support parental engagement and address socioeconomic disparities that impact the home learning environment.

Keywords

Academic Achievement, Home Environment, School Resources, Teacher Quality, Primary Education, OLS, Quantile Regression, TIMSS 2011

1. Introduction

Education is the most important component of human capital which is considered by the UNESCO [28] as a social elevator and an important means to achieve sustainable development. Indeed primary education holds a central position in the whole educational system, its role is to allow all pupils to develop their cognitive, social, emotional cultural and physical skills to the best of their abilities, preparing them for their further school career. Therefore, achieving universal primary education is crucial, especially when educational attainment has been noted as a key aspect to overall econom-

ic growth [21]. Recent economic literature shows a large interest in the analysis of the determinants of school attainment (Engin-Demir [15]), Sayed-Forooq, S., Safdar-Rehman, G., Saqib, S. and Irfan, U. [27]). Despite the important value of this first step, TIMSS reveals that pupils from developing and even from developed or high per capita income countries suffer from low achievement in mathematics. Therefore, this study attempts to fill the gap with an empirical comparative study of developed and developing countries.

In the last decades, many developing countries witnessed

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an increase in the primary education enrollment ratio. Countries such as Yemen, Morocco and Iran reported a rise from 76.8%, 96.54%, and 100.46% in 2001 to 94.43%, 116.51% and 105.4% in 2011, respectively. In contrast, some developed countries marked a slight decrease like Romania and Croatia from 97.8% and 97.09% in 2011 to 96.59% and 93.40% in 2011 respectively. Despite the important rates of primary enrollment, data from TIMSS 2011 indicate that eight developing and four developed countries suffer from low quality of primary education in mathematics.

Table 1. TIMSS 2011 distribution of mathematics.

| Developed countries | Mathematics |
|----------------------|-------------|
| Average scale | 500 |
| Spain | 482 |
| Romania | 482 |
| Norway | 495 |
| Poland | 481 |
| Croatia | 492 |
| Malta | 496 |
| Developing countries | Mathematics |
| Morocco | 335 |
| Iran | 431 |
| Oman | 385 |
| Qatar | 413 |
| Saudi Arabia | 410 |
| United Arab Emirates | 434 |
| Bahrain | 436 |
| Tunisia | 359 |
| Turkey | 469 |
| Yemen | 248 |
| Kuwait | 342 |

2. Determinants of Educational Quality: Literature Review

There is a range of factors that affect on the quality of performance of students (Waters and Marzano [46]). Walberg [47] determined three groups of nine factors based on affective, cognitive and behavioral skills for optimization of learning that affect the quality of academic performance: Aptitude (ability, development and motivation), instruction (amount and quality), environment (home, classroom, peers and television) (Roberts, [44]).

There is a large debates concerning the most factors contribute to the low achievement. According to Hanushek [20] family background and socioeconomic factors are important determinants of student achievement than school resources. The following section reviews the literature of the impact of home environment, school resources, and teacher resources on academic achievement.

2.1. Home Environment: Definition, Measures and Effects on Achievement

The term “Home environment” refers to all the objects, forces and conditions in the home, which influence the child physically, intellectually, and emotionally ([31]).

Home environment is related to many different aspects such as Parents’ education, Parents’ occupation, Parental structure, Number of children’s books in the home and Economic status, and Family size.

There have been some challenges to which input indicators influence the students’ outcomes. Kellaghan, [34] detect a link between home environment and pupils’ academic achievement. Parental education and family SES level have positive correlations with the student’s quality of achievement (Mitchell and Collom, [41]).

Lockheed et al [40] prove that family background affects not only the probability that children enroll in, attend, and complete school, but also the learning of children in school. In the same line, Brunello and Checchi [2] make a point that family’s education is an important and strong element in the determination of student achievement. Fuller [18] provided a study review that shows a positive relationship between pupil’s achievement and the availability of textbooks and other instructional materials. Mayer [32] concluded that family socioeconomic status is positively correlated with student learning.

Spiegel [29] emphasizes that parents play a crucial role in the literacy development of their children; what parents do in their homes significantly affects the development of literacy skills and abilities. According to Spiegel, home literacy environment have several components, two of which are artifacts of reading (books, news papers, pencils, paper, letters, junk mail and another print –related material especially children’s materials) and events (reading to and with children). Spiegel concludes that parents of successful readers impact a love of reading and a sense of the value of reading to their children through creating rich literacy environments.

The achievement of students is negatively correlated with the low SES level of parents because it hinders the individual in gaining access to sources and resources of learning (Duke [13]).

Krashen [36] concludes that students whose parents are educated score higher on standardized tests than those parents were not educated. Similarly Willms [48] shows that children whose parents had primary school education or less were more than three times as likely to have low test scores

or grade repetition than children whose parents had at least some secondary schooling.

Chiu [10] studies the effect of the family socioeconomic status on 15 year- old students' academic achievement in science based on data from 41 countries. He finds that the socioeconomic status of the family and the educational sources (cultural composition of the family, level of education of the parents, educational situation of sibling) have an important effect on the student academic achievement in science.

Parental education especially for the mother when she has a high level education and knowledge is considered a fortune for their child. According to Duplooy ([14] mother's education is most influential on the child's intellectual development. Similarly in a survey of literature Kellaghan [34] find that if the mother was herself successful at school and achieve a higher level of formal education, the transmission of knowledge can be possible. In [38], Jubber examine the effect of the level of mothers' education on academic achievement in South Africa. Their results suggest that over 60% of the children rated as good performers came from graduate mothers. In the same line Farooq, Chaudhry, shafiq and Berhanu [16] in their study using standard t-test and ANOVA to investigate the effect of different factors on students' achievement, show a significant effect of parents' education on students' overall academic achievement as well as achievement in the subject of Mathematics and English. In addition, when parents are educated they can be a good supervisor for their children to enhance academic performance. Cassidy and Lynn [7] stress the importance of parental supervisor and assistance of the child's reading in his study he finds that reading and parental supervision are positively correlated with academic achievement.

Using the ex-post facto correlation method Muola [30] studies the effect of home environment factors on academic achievement motivation. His study is carried out on 235 Standard eight Kenyan pupils from six urban and rural primary school. Taking six measures of home environment which are parental encouragement, parents' occupation, mothers' education, fathers' education, family size and learning facilities at home, their results show a significant effect for all factors on academic achievement motivation except parental encouragement.

Dahl & Lochen, [11] find that family income have been shown to have a powerful influence on student's in reading, also Harmon and Walker [24], Chevalier and Lanot [9] point out that student academic achievement is closely related to family income but that family's education is the most important factors. De brouecker and Underwood [12] point out that those parents with high education provide the most conducive environment for their children to study, thus providing the necessary motivation for them to proceed to higher education.

2.2. School Resources

Hanushek [23] conclude that there is no systematic relationship between student performance and commonly measured attributes of schools and teachers. In [24], Hanushek's review of 400 studies of student achievement found no stronger relationship between student performance and school resources. In contrast Card and Krueger [4], Altonji and Dunn [1] argue from U. S data that there is a strong positive relation between school resources and student outcomes. Similarly Heyneman, Layne- Farrar and Todd, [26] conclude that unobserved variables that affect student learning may lead to underestimates of school resource effects.

Hanushek's [22] note that 71% of the estimated effects of school spending on student test scores are statically insignificant or negative and conclude that there is no strong or systematic relationship between spending and student performance. Dissimilarly Hedges and Green wald, [25]; believe that the same research literature provides support for the idea that additional spending will, on average increase student test scores.

Tiebout [37] assume that omitted variables will produce an upward bias in the estimated effects of school resources on student outcomes because more affluent families are likely to choose higher spending districts.

Besides that another indicator which is strongly related to educational outcome was the geographic location of school (i.e urban, rural, city, town, etc.). The definition of school location is based upon size and density of the population in area. TIMSS¹ describes three different population size of the city, town or area in which their schools were located: cities of more than 100.000, cities or town of 15.001 to 100.000 medium and small towns, villages or rural areas of 15.000 or fewer people.

According to analysis made by the National Assessment of education Progress in 1992, the average proficiency of student from extreme rural communities at ages 9, 13, and 17 in writing, mathematics, and science was above that of student from disadvantaged urban area.

Mullis et al [42] showed that the student in extreme rural areas outperformed students in disadvantaged urban areas in reading at grades 4, 8, and 11. Lippman et al proved two different results; in 1988 they show that grade 8 achievement of rural students enrolled in high-poverty schools was higher than that of their urban counterparts. However, before two years, in grade 10 the performance of rural students became similar to the performance of urban students.

Campbell, Donahue, Reese, Phillips [6] revealed that fourth graders in rural areas and small towns exhibited higher reading proficiency than did students in urban and large town areas outperformed their counterparts in both areas.

Greenberg and Teixeira [19] found that 17 years old student in central cities and in rural communities adjacent to metropolitan areas have performed on the National Assess-

¹ TIMSS 2011: The International Results in Mathematics, p206-207.

ment of Education Progress at level lower than the national average.

To sum up, there is no clearly evidence about the effects of school location on educational outcomes.

2.3. Teacher Quality

The literature on teacher resources and student outcomes can be categorized into many areas of research like teacher experience and teacher education. The importance of these teachers characteristics highlights the need to understand whether it contribute to teacher effectiveness and improvement student achievement.

2.3.1. Teacher Experience

During the last two decades, a body of research of conflicting findings have emerged from the literature on teacher experience and student outcomes. Coleman and al [8] find that teacher resources are not consistently or positively linked to student achievement. Hanushek [21] review several studies using teacher experience in production function models common to economic research, which examine the connection between educational input and student outputs. The review proved that teacher experience is not an important indicator of teacher quality, so an unlikely contributor to student achievement. In other words, Murnane and Phillips' [33] prove that, early years of teaching (up to 7 years) may be associated with a gradual increase in student outcomes, middle years of 8 to 14 correspond to a weak negative effect and then a positive effect on achievement among teachers with 15 or more years. Moreover, using Alabama data Ferguson and Ladd [17] examine the combination between teacher experience of 5 or more years and student achievement in the third, fourth, eighth and ninth grades. They find that teacher experience between beginning and up 5 years had a statically significant positive effect on math and reading attainment, while teachers' experience of 5 more years is associated with no significant influence on reading and math scores.

2.3.2. Teacher Education

The link between teacher education and student outcomes is a high priority policy issue. Several studies show that teacher's quality has a strong impact on student's achievement Card and Krueger [5].

Previous research provided contradictory relationships between teachers' academic degrees (bachelor's, Master's, Doctorate, and others) and student attainment. Using a sample of third, fourth, eighth and ninth grades in Alabama, Ferguson and Ladd [17] find a positive relationship between

teacher holding advanced degrees and student mathematics scores but not reading scores. In contrast Rowan and al [45] prove that teacher holding advanced degree correlated positively with reading scores but negatively with elementary student achievement on math scores. In this case some research mention the importance of the area in which the degree was awarded, this idea is stressed by Goldhaber and Brewer [43], using data from NELS: 88 to examine the effects of teachers' holding masters degrees on high school students' mathematics achievement. Their findings suggest that student achievement gains in mathematics are positively associated with those assigned to teachers who earned their masters degree in mathematics.

3. Methodology

3.1. TIMSS Survey Data

The sample design of the TIMSS is based on two stages random sample design, with a sample of school is chosen as a first stage and one or more intact classes of students from each of the sampled schools as a second stage.

TIMSS is a survey data and in survey data there are three features that must be taken into account when doing regressions: the sampling weights, the cluster sampling and stratification.

We use data from TIMSS 2011 for pupils in the fourth grade with an average age not less than 9.5 years at the time of testing. Table 2 provides sample sizes and target populations assessed mathematics.

Descriptive statistics about students assessed in TIMSS 2011 are summarized in table 2. All developed countries named the fourth year of formal schooling "primary 4"; but for developed countries, we notice some differences as all countries name the fourth year of formal schooling "primary 4" except Spain which names it "primary education year 4" and Poland which names it "grade 3 of primary school". According to the average age at the time of testing, all countries have nearly the same average ranges from 9.7 in Norway to 10.9 in Romania. As we can see, Poland has the largest sample size with 5027 students, followed by Romania and Croatia, while Norway features the lowest number of sampled students. According to developing countries, the average age of tested students ranges from 9.7 in Kuwait to 11.2 in Yemen. As can be noted, the United Arab Emirates has the largest sample size with 14720 students, followed by Oman and Yemen, while Malta features the lowest number of sampled students.

Table 2. Summary data from TIMSS 2011.

| Developing Countries | Countries name for fourth year of formal schooling | Average age at time of testing | Total number of school that participated | Student participation | Number of student assessed | Coverage |
|----------------------|--|--------------------------------|--|-----------------------|----------------------------|----------|
| Bahrain | Grade5 | 10.4 | 159 | 98% | 4083 | 100% |
| Iran | Grade 4 | 10.2 | 244 | 99% | 5760 | 100% |
| Kuwait | Grade 4 | 9.7 | 148 | 94% | 4142 | 78% |
| Morocco | Grade 4 | 10.5 | 286 | 97% | 7841 | 100% |
| Oman | Grade 4 | 9.9 | 327 | 98% | 10411 | 100% |
| Qatar | Grade 4 | 10 | 166 | 99% | 4117 | 100% |
| Saudi Arabia | Grade 4 | 10 | 171 | 99% | 4515 | 100% |
| Tunisia | Years 4 of primary education | 10 | 222 | 99% | 4912 | 100% |
| Turkey | Grade 4 | 10.1 | 257 | 98% | 7479 | 100% |
| United Arab Emirates | Grade 4 | 9.8 | 459 | 97% | 14720 | 100% |
| Yemen | Grade 4 | 11.2 | 216 | 97% | 8058 | 100% |
| Malta | Grade 5 | 9.8 | 96 | 95% | 3607 | 100% |
| Spain | Primary education year4 | 9.8 | 151 | 97% | 4183 | 100% |
| Croatia | Grade 4 | 10.7 | 152 | 95% | 4584 | 100% |
| Norway | Grade 4 | 9.7 | 119 | 85% | 3121 | 100% |
| Romania | Grade 4 | 10.9 | 148 | 98% | 4673 | |
| Poland | Grade 3 of primary school | 9.9 | 150 | 96% | 5027 | 100% |

Source: IEA's - TIMSS 2011

3.2. Description of Variables

TIMSS survey various factors that contribute on the quality of academic performance of student at fourth grade. Table 3 displays the independent factors:

1. Age and Girl reflect the individual characteristics of the pupil.
2. Possessing computer, Possessing study desk, Possessing books, possessing own room, possessing internet connection, amount of book at home: indicators of home environment indicators.
3. Parent check homework and parent ask for learning

measure of parental support

4. Index of School resources math was created by TIMSS and based on the average response to questions about shortages that affect the capacity to provide instruction (instructional materials, budget for supplies, school building and grounds, heating/ cooling/ lighting systems, buildings, space (size of classroom) and, teaching (computer, software, audio visual resources..).
5. Indicators of teacher quality: Teachers' formal education and teachers' years of experience.

All this qualitative variables are considered as dummy variable in the regression model.

Table 3. Descriptive statistics.

| Variables | Type of variable | Description |
|----------------|------------------|----------------------------|
| Age | continuous | |
| Sex of student | Binary | 2categories: 1female 0male |

| Variables | Type of variable | Description |
|--|------------------|---|
| Possessing computer | Binary | 2 categories: 1 yes, 0 otherwise |
| Possessing own rooms | Binary | 2 categories: 1 yes, 0 otherwise |
| Possessing internet connection | Binary | 2 categories: 1 yes, 0 otherwise |
| Possessing study desk | Binary | 2 categories: 1 yes, 0 otherwise |
| Amount of books at home | Ordinal | 5 categories: 1 none or very few (0-10 books), 2: one shelf (11-25 books), 3: one bookcases (26-100books), 4: two bookcases (101-200 BOOKS), 5: three or more bookcases (over 200books) |
| Index of School resources math (acdgmsr) | Ordinal | 3 categories: 1 well, 2 medium, 3bad |
| School location | Ordinal | 6 categories: 1: more than 500000 people, 2: 100.001 to 500.000 people, 3: 50.001 to 100.000 people, 4: 15.001 to 50.000 people, 5: 3001 to 15000 people, 6: 300 people or fewer |
| Parent ask learning | Binary | 5 categories: 1 every day, 2: once or twice a week, 3: once or twice a month, 4: never |
| Parent check homework | Ordinal | 5 categories: 1 every day, 2: once or twice a week, 3: once or twice a month, 4: never |
| teachers' years of experience | Ordinal | 4categories: 1: 20years or more, 2: At least 10 but less than 20 years, 3: At least 5 but less than 10 years, 4: Less than 5 years |
| Average mean for 5 plausible value in MATH | continuous | |

3.3. Regression Models and Technique

Using the education production function model proposed by Hanushek [22] to evaluate the relationship between home environment, school resource, teacher quality and pupils' outcomes (test score), conceptually the model is defined as the cumulative influence of input given by:

$$Y_i = \beta_0 + \sum_{j=1}^m \beta_j X_{ij} + \mu_i$$

where Y_i is a test score of student ($i = 1, \dots, N$), X_{ij} are the score determinants which influence students' educational achievements, β_j are the estimated coefficients and μ_i is the residual term.

The education production function was estimated by the OLS technique at the first step, however this estimation method does not inform about the heterogeneity of educational determinants effects a long score distribution. Koenker and Basset [39] have extended the OLS estimation to a robust regression technique notably the Quantile regression. Contrary to the OLS estimation which evaluates the impact of explanatory variables on the mean of the outcome variable, the Quantile regression technique allows to estimate the impact of explanatory variables on educational attainment at different parts of the conditional distribution of output variable.

Quantile regression seeks to evaluate if a given explanato-

ry variable affects more or less student at the r th quantile of conditional score distribution than student at $(1-r)$ th quantile.

Instead the quantile regression provides some robustness to heteroscedastic problem since estimated marginal effects of exogenous variables differ across the different parts of conditional outcome distribution. Moreover the quantile regression is more efficient than the OLS technique in the case when the error terms are not normally distributed.

Conceptually the quantile regression model is defined as a linear function of covariates given by:

$$y_i = x_i' \beta_\theta + \mu_{\theta i}$$

$$Quant_\theta(y_i | x_i) = x_i' \beta_\theta, i = 1, \dots, n, \theta \in (0,1)$$

Where $Quant_\theta(\frac{y_i}{x_i})$ is a given quantile θ of the dependent variable y_i conditional on the explanatory vector x_i . For the distribution of the error term $\mu_{\theta i}$, it is only assumed satisfying the follows restriction $Quant_\theta(\mu_{\theta i} | x_i)$. Similarly to the OLS estimation where the sample mean is defined as the solution to the minimization of the sum of squared residuals, the median is defined as the solution of this minimization of the sum of absolute residual for the quantile (Koenker and Hallak [35]). Buchinsky [3] have proposed the following optimization problem to be solved to obtain coefficient vector β_θ .

$$\min_{\beta} \frac{1}{n} = \{ \sum_{i: y_i \geq x'_i \beta} \theta |y_i - x'_i \beta| + \sum_{i: y_i < x'_i \beta} (1 - \theta) |y_i - x'_i \beta| \}$$

By varying weights among residuals the ERF is estimated at different quantiles ($\theta = 10\%, 25\%, 50\%, 75\%, 90\%$) of achievement distribution. It follows that for estimating the 25th percentile positive residuals are weight by 25% and the negative residuals are weighted by 75%. Where all residuals receive the same weight, we obtain the median of the score distribution.

4. Results

In this section, we present OLS and Quantile regression estimates of the impact of home environment, school resources and teacher quality on mathematical outcomes. Due to the missing variables, our sample will include only eight developing countries and four developed ones. The results are presented in tables 4 and 5 for some DEVELOPPING AND DEVELOPED country respectively. (see Appendix II). We report OLS estimations in column 1 and the lower (10th), median (50th) and the upper (90th) quantile in the next column.

Regarding OLS and quantile regression pupils' characteristics (gender and age) in developing countries, results were mixed; sometimes girls do better than boys and sometimes the opposite compared to developed countries where boys always perform better in all sampled countries.

OLS regression suggests that pupils' age has a negative significant or insignificant impact on both developed and developing countries except for Qatar, the United Arab Emirates, Malta and Norway, the coefficient was positive which means that the older pupils are the better they perform.

The quantile regression results were similar to OLS estimation for lower quantile and for median pupils but there is a substantial result in upper quantile.

OLS results

Possessing computer is a good determinant for educational outcome in mathematics for all developing countries except in Bahrain doesn't have any effect and it is seemingly decreasing students' score since its coefficient is estimated at (-9.54) in United Arab Emirates. In contrast, in developed countries possessing computer is significant relation to mathematics achievement only in Romania.

Regarding the amount of book in developed pupils home, all categories are statically significant and have the expected signs. However in developing countries when pupils have over 200 books, there is not a significant determinant of school performance in mathematics, except in Iran.

The effect of possessing own room is whether insignificant or have a negative effect on pupils performance for both developing and developed countries except in Poland is a good determinant.

Also possessing study desk has a positive impact on

school performance only for developing countries which are Bahrain, Iran, Qatar, Tunis, and United Arab Emirates and for all developed countries except Romania.

According to having internet connection has a significant positive impact for the majority.

Turning now to parental involvement with has been quite intense in the literature are in our case approached by parents ask learning and parent check homework. OLS results show that parent ask their children is not a significant determinant of school achievement for all different countries except for morocco and Qatar when parents ask learning once or twice a month improves the quality of primary education while in Romania when parents ask their children to learn once or twice a week has more significant and positive effect on mathematics performance (52.32) than asking their children to learn once or twice a month (43.8). According to parent checking homework, OLS regression suggests that there is no relation between performance and parent check homework for Bahrain, Iran, Tunis (developing countries) and Romania (developed countries) and it has a negative effect in Kuwait, Morocco and Norway.

While parent checking homework every day and once or twice a week are positively related to mathematics achievement only in Oman, Qatar, United Arab Emirates and Malta.

Turning now to the effect of school resources. It seems that school resources don't have any effect on pupil's performance from developed countries. Although in developing countries OLS results was mixed, well school resources are strongly positively related to mathematics achievement only in Bahrain, nevertheless it affects negatively Moroccan's and Oman's pupils performance.

Focusing on teacher quality which is measured by teacher year experience and teacher formal education. There is a significant relation between teacher formal educations to achievement only in one developed country which is Norway. According developing countries results show most countries performance are highly related to teacher formal education especially in Oman, more teacher has high grade more the mathematics performance of pupils improved (coefficient is estimated at 52.6 to 66.11).

Another teacher quality indicators which is teachers' years experience which is a good determinant on the primary education only in Oman and Qatar while in developed countries it is a deteriorate determinant to maltase and Norway's pupils performance when teacher has at least 10 but less than 20 years experience.

Quantile regression results

Quantile regression suggests that having a computer seemingly increases the performance of pupils; as we can note, in developed countries only Romanian pupils' performance is positively related to having a computer along the quantile distribution especially for pupils at the lower quantile (10%) which coefficients estimated at 30.08. In Poland, only at

upper regression (90%) having a computer is statistically significant. However, in developing countries, possessing a computer has the expected signs for all countries along all the distribution except for Bahrain which does not show any effect and for the United Arab Emirates where median and upper students are those who have a score less than that of those who do not have a computer by -9.73 points. This may be explained by using computers to play rather than to acquire knowledge.

Possessing a study desk remains a good determinant for students at lower quantile than median and upper quantile for developed countries; nevertheless, in developing countries, students at median or upper quantile scored more than those at lower quantile.

Having books at home increases student scores along the whole distribution conditional in all developed countries, similar to some developing countries which are the United Arab Emirates, Oman and Kuwait.

As to owning a room, quantile regression results are similar to OLS regression, only in Poland this determinant has an important value as to student performance.

Another variable, which is having internet connection, quantile regression suggests similar results to OLS indicating that having internet connection is positively linked to pupils achievement for all countries. The exception was in Tunis, OLS results are not significant so it became a good determinant only at lower quantile, its coefficient is estimated at 14.28.

Home environment has been also approached by the amount of books at home, If the amount of books at home is between 101 and 200 books, pupils' mathematical scores in developed countries increase compared to OLS results. In fact, median students are those who benefit the most as the coefficient is estimated at 72.18 in Malta. Nevertheless, results were mixed in developing countries, they were balanced between one bookcase (26-100books) and two bookcases (101-200).

Parental support is the factor we are most interested in. Quantile regression results suggest that parents asking children to study is weakly related to educational achievement because it seems beneficial only in few countries while in others it is insignificant (Poland) or has a negative effect (United Arab Emirates, Oman, Tunis). We can also notice some similarities between developed and developing countries. At lower quantile, pupils whose parents ask them to study once or twice a week increase their scores by 21.44, 26.20 and 30.20 in Morocco, Malta and Romania respectively.

Parents checking homework reveal almost the same results to OLS, all parent check homework categories are unfavorable to mathematics performance in developed countries,

while in developing countries when parents check home work every day, otherwise, once or twice a week were statistically significant only in Oman, Qatar and United Arab emirates.

Focusing on school characteristics, well school resources tend to decrease pupils' performance in developed countries. However, in some developing countries like Bahrain, Qatar, and United Arab emirates, median and at upper quantile pupils seem to do better by 16.40 21.64 and 33.3 respectively.

According to teacher quality, teacher formal education did not turn out a significant determinant of student score for developing countries. Yet for some developing countries (Morocco, Oman, Qatar) student with a teacher with tertiary level education have the highest score in mathematics. On the other hand, teachers' years of experience effects were contradictory along the quantile regression as in developed as developing countries.

5. Conclusions

This paper examines whether home environment, school resources and teacher quality do affect educational mathematical performance in some developed and developing countries.

Results show that home environment, i.e. possessing a computer, a desk, one's own room and books, is largely related to educational outcome in developing and developed countries.

However, school resources and teacher quality are good determinants for the quality of primary education only in developing countries. So we suggest that a developed country has another factor which can predict pupils' performance such as parents' outcomes.

Abbreviations

| | |
|-------|---|
| OLS | Ordinary Least Squard |
| TIMSS | Trends in Mathematics and Science Study |

Author Contributions

Kaouther Soudani is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

Appendix

Table 4. Developing Countries Ordinary Least Square and Quantile Regression Within Each Country. Dependent Variable: Average Mean of the 5 Plausible Values in Mathematics. Standard Errors in Parentheses. Significant Levels *1%; **5%; ***10%.

Bahrian.

| VARIABLES | OLS | Q10 | Q50 | Q90 |
|---------------------|----------------------|----------------------|----------------------|----------------------|
| gender1 | -1.418 (7.859) | 21.32*** (4.194) | 7.216 (4.408) | -8.821 (6.031) |
| Age | -2.608 (4.567) | -21.32*** (4.349) | -7.680*** (2.869) | 14.69*** (5.285) |
| possesscomputer1 | 9.250 (10.36) | 22.56 (13.84) | 10.73 (12.91) | 16.52 (14.26) |
| possessstudydesk1 | 19.67*** (4.591) | 16.71*** (5.452) | 17.67*** (5.933) | 9.874 (7.488) |
| possessbooks1 | 17.73*** (4.481) | 11.52** (4.898) | 16.07*** (4.242) | 9.718 (6.232) |
| possessownrom1 | -20.59*** (3.948) | -13.54** (5.964) | -23.36*** (4.178) | -25.78*** (5.795) |
| internetconnection1 | 41.50*** (5.937) | 28.96*** (10.51) | 36.13*** (7.261) | 43.22*** (6.658) |
| amountofbook2 | 19.06*** (4.601) | 15.20* (8.890) | 20.47*** (6.416) | 22.46** (10.23) |
| amountofbook3 | 23.75*** (4.557) | 16.92* (10.26) | 28.37*** (5.346) | 29.48*** (10.15) |
| amountofbook4 | 31.92*** (8.531) | 12.50 (13.36) | 32.35*** (7.529) | 52.44*** (12.66) |
| amountofbook5 | 6.555 (6.510) | -0.459 (13.47) | 3.174 (7.793) | 24.73** (12.28) |
| parentasklearning1 | -15.56* (8.645) | -6.217 (10.64) | -8.919 (10.58) | -11.24 (14.59) |
| parentasklearning2 | -1.957 (9.852) | 2.652 (9.496) | 1.919 (11.17) | -8.671 (12.48) |
| parentasklearning3 | 2.345 (12.85) | 16.70 (13.05) | 12.38 (15.31) | -22.28 (14.95) |
| checkhomework1 | -2.892 (6.475) | -0.917 (9.174) | -1.809 (7.795) | 0.285 (11.76) |
| checkhomework2 | -0.0381 (7.185) | -7.584 (10.56) | -3.793 (9.138) | 5.835 (14.20) |
| checkhomework3 | -18.13 | -21.84* | -8.839 | 10.83 |

| VARIABLES | OLS | Q10 | Q50 | Q90 |
|-------------------------|----------|-----------|-----------|-----------|
| | (11.21) | (12.35) | (10.45) | (20.86) |
| mathschoolresource1 | 25.43* | 6.680 | 16.40** | 24.90* |
| | (15.08) | (7.516) | (6.947) | (12.96) |
| mathschoolresource2 | -13.06 | -19.96*** | -5.530 | 5.698 |
| | (9.190) | (6.768) | (5.209) | (9.433) |
| teacherformaleducation2 | -31.19 | -0.320 | -45.68*** | -50.09*** |
| | (21.61) | (19.86) | (12.20) | (14.82) |
| teacherformaleducation3 | -7.138 | 17.21 | -23.31 | -13.94 |
| | (25.37) | (19.27) | (14.39) | (21.31) |
| teacherexperience1 | 3.527 | 12.80 | 5.481 | 9.967 |
| | (13.74) | (13.78) | (8.443) | (14.50) |
| teacherexperience2 | -7.179 | -1.075 | -1.348 | -0.0191 |
| | (11.45) | (12.97) | (7.913) | (14.41) |
| teacherexperience3 | -8.971 | 0.494 | -4.365 | -10.44 |
| | (11.62) | (8.992) | (8.110) | (14.81) |
| Constant | 445.4*** | 502.4*** | 497.2*** | 360.4*** |
| | (60.43) | (44.67) | (36.82) | (67.80) |
| Observations | 2,391 | 2,391 | 2,391 | 2,391 |
| R-squared | 0.158 | | | |

Tunis

| VARIABLES | OLS | Q10 | Q50 | Q90 |
|--------------------|-----------|-----------|-----------|-----------|
| gender1 | -3.309 | -2.479 | -8.807*** | -12.99*** |
| | (3.625) | (5.521) | (2.920) | (3.839) |
| age | -32.75*** | -33.50*** | -36.96*** | -34.90*** |
| | (3.044) | (2.641) | (3.960) | (5.180) |
| possesscomputer1 | 28.07*** | 17.22** | 31.10*** | 27.83*** |
| | (4.896) | (7.273) | (4.536) | (7.797) |
| possessstudydesk1 | 18.25*** | 21.87** | 20.44*** | 25.72*** |
| | (5.458) | (10.17) | (5.286) | (7.516) |
| possessbooks1 | 12.16** | 9.156 | 15.46*** | 16.53* |
| | (5.376) | (7.301) | (5.007) | (9.014) |
| possessownrom1 | -4.481 | 3.968 | -4.539 | -6.891* |
| | (4.197) | (5.090) | (4.645) | (4.176) |
| internetconection1 | -1.358 | 14.28** | 0.782 | 3.839 |
| | (5.145) | (6.396) | (4.023) | (6.609) |
| amountofbook2 | 17.34*** | 7.806 | 15.27** | 16.02** |
| | (5.979) | (5.288) | (6.648) | (8.077) |

| VARIABLES | OLS | Q10 | Q50 | Q90 |
|---------------------------|---------------------|---------------------|----------------------|----------------------|
| amountofbook3 | 31.24*** (7.120) | 29.10*** (7.814) | 45.84*** (5.632) | 32.49*** (7.557) |
| amountofbook4 | 27.82*** (8.529) | 28.56*** (10.21) | 44.54*** (8.180) | 34.98*** (11.63) |
| amountofbook5 | 4.264 (9.415) | 3.537 (17.40) | 23.24*** (8.447) | 23.39* (12.97) |
| parentasklearning1 | -17.43** (8.581) | 0.0446 (20.62) | -32.44** (14.69) | -33.91*** (10.16) |
| parentasklearning2 | 5.982 (10.58) | 14.26 (24.51) | -12.00 (14.29) | -13.08 (11.91) |
| parentasklearning3 | -6.771 (13.21) | 16.60 (26.09) | -10.68 (16.42) | -5.227 (23.98) |
| checkhomework1 | 3.454 (7.935) | -0.0930 (13.29) | -4.650 (7.870) | 4.054 (7.742) |
| checkhomework2 | -2.221 (8.143) | 1.736 (12.91) | -11.74 (9.297) | -3.428 (8.903) |
| checkhomework3 | -15.62 (13.40) | -17.92 (12.35) | -26.38** (11.20) | 0.579 (14.79) |
| mathschoolresource1 | -4.619 (28.64) | -5.974 (11.27) | 3.221 (7.592) | 8.099 (14.21) |
| mathschoolresource2 | -16.35 (27.50) | -20.49* (11.66) | -14.41** (7.306) | 0.454 (13.66) |
| teacherformaleducation2 | 20.10* (10.65) | -37.82 (32.33) | -42.05* (24.05) | -2.894 (26.63) |
| o.teacherformaleducation3 | - | -56.09* (34.03) | -65.82*** (24.49) | -19.75 (25.19) |
| teacherformaleducation4 | 2.849 (11.98) | -50.98* (30.80) | -51.19** (23.42) | -11.36 (24.02) |
| teacherformaleducation5 | 6.871 (14.62) | -30.11 (28.87) | -42.24** (20.82) | -12.81 (24.07) |
| teacherformaleducation6 | 62.90*** (19.09) | - | - | - |
| teacherexperience1 | 0.949 (15.56) | 20.65* (10.70) | 14.19 (9.000) | 4.477 (12.71) |
| teacherexperience2 | -3.760 (13.92) | 18.45* (9.590) | 7.209 (8.787) | 2.585 (13.72) |
| teacherexperience3 | 12.56 (17.39) | 30.91** (12.59) | 20.20** (9.917) | 12.74 (11.74) |
| Constant | 674.3*** | 608.0*** | 778.1*** | 800.4*** |

| VARIABLES | OLS | Q10 | Q50 | Q90 |
|--------------|---------|---------|---------|---------|
| | (46.74) | (52.12) | (51.86) | (51.20) |
| Observations | 2,566 | 2,566 | 2,566 | 2,566 |
| R-squared | 0.196 | | | |

Table 5. Developed Countries Ordinary Least Square and Quantile Regression Within Each Country. Dependent Variable: Average Mean of the 5 Plausible Values in Mathematics. Standard Errors in Parentheses. Significant Levels *1%; **5%; ***10%.

Malta.

| VARIABLES | OLS | Q10 | Q50 | Q90 |
|--------------------|----------------------|---------------------|---------------------|---------------------|
| gender1 | -3.445 (5.881) | -7.704 (5.418) | -9.141** (3.969) | -11.50* (5.879) |
| age | 6.331* (3.264) | -6.173 (4.413) | -4.574 (4.567) | 12.28 (8.232) |
| possesscomputer1 | -9.548* (5.659) | 15.12 (22.20) | -5.673 (9.766) | -11.00 (7.085) |
| possessstudydesk1 | 13.14*** (3.412) | 26.20*** (7.424) | 12.75** (6.160) | 13.04** (5.577) |
| possessbooks1 | 24.17*** (3.664) | 37.30*** (9.130) | 27.17*** (6.811) | 28.22*** (9.959) |
| possessownrom1 | -14.28*** (3.055) | -9.824 (6.254) | -4.649 (4.491) | -7.955* (4.129) |
| internetconection1 | 23.84*** (4.691) | 54.09*** (19.14) | 48.76*** (10.97) | 46.55*** (7.847) |
| amountofbook2 | 7.645* (4.301) | 52.26*** (11.19) | 46.36*** (7.990) | 18.43 (11.96) |
| amountofbook3 | 21.90*** (5.166) | 73.07*** (12.10) | 69.01*** (7.172) | 39.33*** (10.85) |
| amountofbook4 | 29.42*** (5.659) | 63.89*** (11.97) | 72.18*** (8.498) | 47.21*** (12.79) |
| amountofbook5 | 10.96 (6.906) | 35.56** (15.75) | 61.95*** (10.11) | 43.86*** (11.49) |
| parentasklearning1 | -14.88** (6.339) | 21.56 (13.34) | 2.937 (8.343) | -9.161 (9.712) |
| parentasklearning2 | -12.44* (6.810) | 26.20* (14.43) | 11.14 (8.279) | 3.023 (10.47) |
| parentasklearning3 | -9.584 (8.370) | 19.95 (15.20) | 16.05 (10.19) | 2.983 (13.70) |
| checkhomework1 | 19.46*** (5.205) | -5.600 (9.999) | -11.28* (6.656) | -9.939 (9.086) |

| VARIABLES | OLS | Q10 | Q50 | Q90 |
|---------------------------|---------------------|---------------------|---------------------|---------------------|
| checkhomework2 | 21.75*** (5.516) | 8.185 (9.121) | 5.447 (8.297) | 3.297 (9.808) |
| checkhomework3 | 1.663 (6.763) | 20.15 (13.94) | 8.412 (12.55) | -10.88 (8.494) |
| mathschoolresource1 | 17.95 (13.42) | 15.14 (20.01) | -4.209 (9.562) | -22.55 (14.99) |
| mathschoolresource2 | -10.55 (12.15) | 5.162 (21.62) | -11.67 (10.41) | -20.89 (15.60) |
| o.teacherformaleducation2 | - | 15.09 (14.93) | 8.091 (11.42) | -10.76 (11.76) |
| teacherformaleducation3 | 9.754 (17.68) | -10.08 (22.64) | -12.06 (26.42) | -34.89* (20.14) |
| teacherformaleducation4 | 6.391 (11.18) | -7.547 (15.35) | 6.203 (11.87) | -2.791 (6.457) |
| teacherformaleducation5 | 22.47 (13.94) | -4.818 (11.91) | 0.823 (10.94) | -6.652 (9.063) |
| teacherexperience1 | -3.518 (12.31) | 2.006 (10.80) | -5.265 (11.16) | 2.592 (9.098) |
| teacherexperience2 | -19.69* (10.39) | 0.481 (5.531) | -3.177 (6.828) | 2.260 (6.122) |
| teacherexperience3 | -15.22 (10.23) | -6.435 (6.117) | -6.569 (6.835) | 0.510 (8.315) |
| Constant | 332.6*** (40.10) | 280.7*** (71.98) | 434.7*** (54.78) | 407.3*** (69.83) |
| Observations | 7,394 | 2,373 | 2,373 | 2,373 |
| R-squared | 0.114 | | | |

Norway.

| VARIABLES | OLS | Q10 | Q50 | Q90 |
|-------------------|---------------------|---------------------|---------------------|----------------------|
| gender1 | -6.240** (2.959) | -0.862 (3.449) | -6.989** (3.055) | -17.66*** (4.492) |
| age | 21.42*** (3.845) | 23.22*** (7.278) | 29.23*** (6.728) | 12.04 (8.093) |
| possesscomputer1 | 12.22 (16.68) | 4.574 (27.46) | 31.23 (22.31) | 1.538 (29.62) |
| possessstudydesk1 | 3.451 (4.546) | 3.996 (5.768) | 6.386 (5.700) | 2.935 (5.616) |
| possessbooks1 | 11.16* (4.546) | 14.30*** (5.768) | 15.90** (5.700) | 14.87* (5.616) |

| VARIABLES | OLS | Q10 | Q50 | Q90 |
|-------------------------|-----------|-----------|----------|----------|
| | (6.143) | (5.263) | (8.011) | (7.890) |
| possessownrom1 | 2.497 | 17.01* | 5.325 | -10.28 |
| | (5.159) | (8.919) | (4.305) | (7.249) |
| internetconection1 | 0.924 | -4.636 | -5.976 | 9.087 |
| | (9.362) | (18.57) | (13.47) | (13.01) |
| amountofbook2 | 28.45*** | 37.72*** | 21.54*** | 20.99 |
| | (10.02) | (7.933) | (8.030) | (13.07) |
| amountofbook3 | 53.75*** | 63.37*** | 60.44*** | 46.66*** |
| | (11.87) | (6.173) | (8.507) | (13.86) |
| amountofbook4 | 61.02*** | 69.91*** | 65.60*** | 44.19*** |
| | (11.11) | (8.150) | (8.992) | (14.66) |
| amountofbook5 | 60.68*** | 72.93*** | 67.48*** | 60.00*** |
| | (12.15) | (6.875) | (8.224) | (15.15) |
| parentasklearning1 | -10.93* | -3.445 | -8.049 | 6.796 |
| | (5.598) | (12.05) | (5.279) | (7.397) |
| parentasklearning2 | 0.181 | 6.089 | 3.981 | 10.51 |
| | (5.765) | (14.54) | (6.821) | (7.235) |
| parentasklearning3 | 13.16 | 22.04* | 20.68** | 36.45** |
| | (8.569) | (12.12) | (8.464) | (17.33) |
| checkhomework1 | -17.93** | -14.86 | -22.39 | -16.05 |
| | (8.422) | (22.19) | (14.44) | (12.56) |
| checkhomework2 | -5.547 | -17.34 | -6.704 | -4.324 |
| | (10.96) | (26.14) | (12.85) | (15.52) |
| checkhomework3 | -46.13*** | -83.65** | -32.08* | -50.01** |
| | (16.04) | (36.98) | (17.43) | (21.17) |
| mathschoolresource2 | 5.591 | 9.769** | 4.117 | 1.101 |
| | (5.794) | (4.544) | (6.884) | (5.367) |
| teacherformaleducation2 | 13.55*** | -3.721 | 6.155 | 28.19*** |
| | (4.418) | (8.008) | (5.216) | (7.603) |
| teacherformaleducation3 | -12.03 | -58.03*** | -12.21 | 0.664 |
| | (8.497) | (18.35) | (13.46) | (12.45) |
| teacherexperience1 | -6.409 | -6.424 | -5.906 | -2.640 |
| | (7.121) | (8.516) | (3.886) | (6.005) |
| teacherexperience2 | -13.14* | -5.721 | -7.532 | -6.061 |
| | (6.619) | (9.296) | (4.908) | (6.588) |
| teacherexperience3 | -18.09* | -7.088 | -3.256 | -2.234 |
| | (10.89) | (8.845) | (6.242) | (7.440) |
| Constant | 228.9*** | 122.8 | 133.9** | 388.8*** |
| | (39.83) | (82.17) | (67.44) | (79.76) |

| VARIABLES | OLS | Q10 | Q50 | Q90 |
|--------------|-------|-------|-------|-------|
| Observations | 2,048 | 2,048 | 2,048 | 2,048 |
| R-squared | 0.129 | | | |

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