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Abstract

Since the controversial finding of the Coleman Report (1966), which was that school resources had little effect on educational outcomes comparing to family background, huge literature has emerged in order to verify the above finding in countries other than the United States. The Heyneman-Loxley work (1983) presented for the first time clear evidence that variation in school resource quality could matter more than variation in family inputs in low and middle-income countries. Following this literature, and using TIMSS 2007 data, we attempt in this study to revisit the Heyneman-Loxely hypothesis and the related debate regarding the overall importance of schools in explaining variations in student achievement across MENA countries. Survey regression techniques and quantile regressions have been used. Results showed that the Heyneman-Loxley effect was not fully supported across the countries. Besides, the Heyneman-Loxley effect is still valid in some middle-income countries at the lower point of the conditional distribution of mathematics and science scores. Yet, some Gulf countries feature a total contradiction with the mentioned effect at the lower tail of the distribution where school resources seem to matter more than Socioeconomic status (SES) in students' performances.

JEL Classification: I2, P3

Keywords: TIMSS, MENA region, Family background, School resources, Quantile regression

ملخص

حيث أن الحقائق المثيرة للجدل فى تقرير كولمان (1966) عن موارد المدرسة لم يكن لها أثر يذكر على النتائج التعليمية مقارنة مع الخلفية العائلية ، فقد برزت أدبيات ضخمة من أجل التحقق من ما سبق من تقريرللحقائق في بلدان أخرى غير الولايات المتحدة. اعمال هاينمان–لوكسلى (1983) قدمت للمرة الأولى دليل واضح على أن الاختلاف في نوعية الموارد المدرسية يمكن أن يهم أكثر من التباين في مدخلات الأسرة في البلدان المنخفضة و المتوسطة الدخل . بعد هذا الأدب ، و باستخدام بيانات TIMSS 2007 ، نحاول في هذه الدراسة إعادة النظر في فرضية هاينمان–لوكسلى والمناقشة ذات الصلة فيما يتعلق بأهمية الإجمالية للمدارس في شرح الاختلافات في التحصيل العلمي للطلاب في جميع أنحاء دول المنطقة . وقد استخدمنا تقنيات الانحدار المسحى و انحدارات دالة التوزيع الكلى. تبين أن تأثير هاينمان–لوكسلى لم يحظ بالدعم الكامل عبر البلدان. الى جانب ذلك، لا يزال تأثير هاينمان–لوكسلى قائما في بعض البلدان المتوسطة الدخل عند نقطة أدنى من التوزيع المشروط لدرجات الرياضيات و العلوم. وحتى الآن ، تتميز بعض دول الخليج بتناقض تام مع التأثير المذكور في ذيل الحد الأدنى من التوزيع حيث تبدو الموارد المدرسية بأهمية أكثر من الحالة الاجتماعية الاقتصادية (SES) في أداء الطلبة.

1. Introduction

In 1983, Heyneman and Loxley challenged the universality of the Coleman report (1966). Family background of the student no longer has a major impact on students' performances in low-income countries; it is rather the school resources that matter more. Besides, the effects of school resources and family background are a function of the national income level. This debate was vividly portrayed in the economic education literature from 1989 until now. The results concerning the relative importance of schools versus family background were mixed. In the present study, I try to revisit the Heyneman-Loxley effect in the Middle East and North African countries (hereafter MENA) as these countries were seldom included in the previous studies mainly because of data scarcity.

We use the TIMSS 2007 database for students in the eighth grade in mathematics and science. Fifteen MENA countries are included in our sample. Two different methodologies are used to assess this effect: the survey regression technique and quantile regressions.

This paper is structured as follows: the next section exposes the review of literature regarding the Heyneman-Loxley effect. Section 3 discusses the methodology. Section 4 highlights the different results. Section 5 provides a discussion and some policy implications and finally section 6 concludes.

2. The Heyneman-Loxley Effect: Review of Literature

The impact of family background or socioeconomic variables (SES) and school factors on students' performances has been a hotly disputed topic in the literature since the release of the Coleman Report in 1966.The report, which was based on data describing US schools, revealed that SES variables were more important than school resources in determining students' educational achievements. Heyneman and Loxley (1983) challenged the previous findings with a study that examined the effects of family background and school resources across a sample of low-income, middle-income and high-income countries. They found that the school variables explained to a greater extent the academic performances of students in low income countries than in high income countries. Indeed, the premises of the minor role of SES on the academic performance of students relative to school resources, jointly with the diminishing association between GDP per capita and the SES influences were discussed earlier in Heyneman (1976b/1980) and Heyneman and Loxley (1982).

More precisely, Heyneman and Loxley (1983) found that SES was more powerful in Qhigh-income countries but not in low-income countries. SES explained 35% of the total variance in these countries whereas in low-income countries it accounted for only 18% of the variance. Besides that, a positive and significant correlation was found between the proportion of variance explained by SES variables and GNP per capita (r= .66).Furthermore, a negative and significant correlation emerged from the proportion of variance explained by school factors and GNP per capita (r=-.72). These findings were vividly portrayed in the literature on economics of education and subsequent investigations have been set in order to check both the universality and stability over time of the Heyneman-Loxley effect. In this respect, different data with different methodologies were employed.

The Heyneman-Loxley (1983) study was not without criticism. Riddell (1989a) pointed to two methodological weaknesses. On one hand, the use of ordinary least squares (OLS) instead of hierarchical linear modeling ignored the multilevel structure of the data used; because students are nested within a class , classes are nested within schools and schools are nested within a country. On the other hand, she questioned the use of the relative proportions of the explained variance as being a correct test of the importance of the different predictors. She argued that much of the variance was not explained (up to 60% or more) "may be entirely due to between school variance but it is not possible to know within the confines of a single level model" (Riddell 1989b, 487). Riddell's criticisms led to a "*scientific quarrel*" showing the importance of this debate. In his response to Riddell, Heyneman (1989) highlighted the fact that though different modeling can be used, the findings from multilevel analysis technique are consistent with the OLS results. In addition, no one knows which SES measures better capture the SES differences; so SES measures may be vitiated by certain misspecification. Lastly, there exists no new technique that has been able to achieve an R-squared of one.

Notwithstanding the above criticisms, the Heyneman-Loxley effect received considerable attention in the literature from 2002 to 2010 particularly with the release of TIMSS results (Heyneman and Lee, forthcoming).

Baker et al. (2002) replicated the Heyneman-Loxley analysis using two modeling strategies, OLS and HLM(hierarchical linear models).The study used TIMSS 1994-95 data for students in the eighth grade belonging to 36 nations with different economic levels. Their results suggested that the Heyneman-Loxley effect had vanished. In all the countries under study, the SES variables predicted more achievement than school variables. A plausible explanation of their findings is that the level of economic development has attenuated this effect.

Hanushek and Luque (2003) re-examined this effect among two different age groups (age 9 and age 13), using TIMSS 1994-95 data. TIMSS data was not employed at the student level but was aggregated at the classroom level instead. They decomposed the total variance as in Heyneman and Loxley (1983). They found no clear evidence that school resources are differentially important in poorer countries. Further, when they investigated the impact of SES variables between the two age cohorts, they found a mixed pattern that the impact of family tends to decline with age.

In an analysis of TIMSS 1999 data from 32 countries, Harris (2007) provided a reinterpretation of the Heyneman-Loxley effect in order to explain the difference between developed and developing countries regarding the impact of school resources. In particular, he focused on the possibility that it may be due to diminishing marginal returns (DMR) to school inputs. Though no solid conclusion was established, the DMR may play some role in the production of education.

Gameron and Long (2007) explained the contrasting findings by the different distribution of income of countries in the sample. They argued that there is a threshold model of school resources, beyond that threshold, school variables account less for students' performances. Hence, the Heyneman-Loxley results continue to be valid in low-income countries.

Chudgar and Luschei (2009) revisited the Heyneman-Loxley effect using 2003 TIMSS data from 25 countries of fourth-grade students. In order to give a new insight to this debate, they introduced the Gini Index to assess the different levels of inequality between countries and they generated a Gini coefficient based on the educational capital in the student's home[1] to assess inequality within a country. Using HLM as a regression technique, their results were consistent with the original Heyneman and Loxley study. It is worthy to note that Chudgar and Luschei replicated first the Heyneman-Loxley work using OLS and taking into account the school fixed effects. They found a relationship between country economic status and the importance of schools.

Llie and Lietz (2010)re-examined this debate for 21 European countries with different economic spectrums (from GDP (PPP) = $1.800 in Maldova to GDP (PPP) = $37.700 in Norway), that participated in TIMSS 2003. Using HLM as a modeling strategy, their results indicated little evidence to support the Heyneman-Loxley effect.

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[1]They constructed an index of educational capital in the home which is based on students' answers regarding family possessions related to learning: dictionary, calculator, computer, desk (1=*yes* and 0=*no*), and books in the home (1 =*no or few books* to 5 =*morethan 200 books*). This variable ranges from a minimum of 1 to a maximumof 9 (p. 637).

Finally, Nonoyama-Tarumi and Willms (2010) used a different methodology inherited from medical[2] studies to revisit this debate. In their study, they used data from the Programme for International Student Assessment (PISA) 2000[3] of 15-year–old students in 43 countries with different economic levels. They found no Heyneman-Loxley effect—there is no association between school effects and national income level. Moreover, the risk associated with being from a low SES family was higher than that associated with attending school with poor resources both in economically developed and low-income countries.

In the myriad of research studies of the Heyneman-Loxley effect, few MENA countries were included in the samples, mainly because of data scarcity. The aim of this present study is to revisit the above debate for this part of the world which is known to be heterogeneous in terms of GDP per capita. Our sample is composed of 15 MENA countries that took part in TIMSS 2007. Unlike the other studies, we will use survey regression technique as a modeling strategy. After that, quantile regressions will be conducted to assess this effect at the lower and upper quantiles.

3. Methodology

3.1 TIMSS survey data

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 (also called the probability weights), the cluster sampling and the stratification (Scheaffer et al. 2012 and STATA 12 documentation).

Sampling weights: in sample surveys, the observations are selected randomly. However, different observations may have different probabilities of selection. The sampling weights are equal to (or proportional to) the inverse of the probability of being sampled. Using weights in the analysis leads to obtaining the right point estimates jointly with the right standard errors (Wooldridge 2001).In TIMSS, sampling weights are used to accommodate the fact that some units such as schools, teachers and students are selected with differing probabilities. According to Rutkowski et al. (2010), it is important to consider the purpose of analysis when selecting the sampling weights to be used. The present study uses total student weight which is appropriate for single-level student level analyses as recommended by Rutkowski et al. (2010).

Clustering: Individuals are first sampled as a group known as cluster. The clusters at the first level of sampling are called primary sampling units. In TIMSS the primary sampling units are the schools and not the students.

Stratification: in surveys, the clusters are grouped in small units. These units are called strata. Sampling is done independently across strata and the stratum divisions are fixed in advance. TIMSS employed school stratification in order to improve the efficiency of the sample design. However, it should be noted that even without any stratification, the TIMSS samples represented the different groups found in the population on average (TIMSS 2007,84).

We use data from TIMSS 2007 for students in the eighth grade with an average age not less than 13.5 years. TIMSS assessment uses a two-stage, clustered sampling design. In stage one, the schools are chosen based on a probability proportional to size sampling approach, whereby larger schools are chosen with higher probability. The second stage consists of choosing randomly one or two intact classes at the eighth grade level. All students in the selected classes are then assessed with the exception of excluded students and students absent

[2]They used concepts of relative risk and population attributable risk to assess the validity of the Heyneman-Loxley hypothesis (see p. 218 for more details about these concepts and about their computations).
[3]PISA is an international study that was launched by the OECD in 1997. It aims to evaluate education systems worldwide every three years by assessing 15-year-olds' competencies in the key subjects: reading, mathematics and science.

on the day of the assessment. Some schools were excluded from the sample and practical reasons were invoked for school exclusions (TIMSS 2007, 80):

- The school is geographically inaccessible.
- The school is of an extremely small size that hosts very few students.
- The school's curriculum or structure was different from the mainstream education system.
- Schools for students with special needs.

For MENA countries, the school level exclusion rate did not exceed 5%. Table 1 provides data on the coverage, overall exclusion, participation of students and the schools. As can be noted, Qatar has the largest sample size with 7184 students, followed by Egypt and Algeria; while Morocco[4]features the lowest number of sampled students.

3.2 Description of variables used

There is no consensus on exactly how socioeconomic status should be measured. While some researchers have used composite measure of SES to conduct their analysis (Baker et al. 2002; Nonoyama-Tarumi 2008/2010; Yang and Gustafsson 2008;Chudgar and Luschei 2009) and recommend the use of composite indices of SES (Mueller and Parcel 1981), others assessed the SES by using a variety of items (Duncan et. al1972; Alexander and Simmons 1975; Heyneman 1976a; Entwisle and Astone 1994; Hanushek and Luque 2002; Wößmann 2003/2004; Ammermüller et al. 2005; Chiu and Khoo 2005; Martins and Veiga 2010) because each item of SES is supposed to be unique and supposed to capture a different aspect of SES (Sirin 2005).

Table 2 displays the different variables used to assess SES. Age and gender reflect the individual characteristics of the student. The variables *number of books, possessing calculator, possessing computer, possessing study desk, possessing dictionary and possessing internet connection* reflect the students' home educational resources. *Parents' highest education level* is also used along with the variable *parents born in country*. The latter assays whether the student is native or expatriate. Additionally, the variable *spend time work on paid jobs* is used in order to reflect the extent to which parents support their children' education. Regarding the school resources, the literature has shown that the link between students' performance and school resources is ambiguous. Furthermore, no conclusive results about but ~~also~~ which specific school resources matter and to which extent they matter were provided (Fuller 1987; Hanushek 1995/2003; Kremer 1995; Ammermüller et al. 2005).

Two indices were provided by TIMSS 2007.The Index of availability of school resources for mathematics instruction and the index of availability of school resources for science Instruction. These indices were constructed in way to reflect the shortages that could affect the school's general capacity to provide mathematics and science instruction. Five areas were considered in the computation of these indices: instructional materials; budget for supplies; school buildings and grounds; heating/cooling and lighting systems; and instructional space. In line with Baker et al.(2002) and Llie and Lietz(2010), these indices were used in the present study.

All the nominal variables[5]were introduced in the regression models as dummy variables. For the *parents highest education level* and *parents born in country* the categories *less than lower-secondary education* and *neither parent born in country* were considered as reference categories respectively. Concerning the variable *spend time work on paid jobs,* we created a dummy variable corresponding to 1 if the student does not spend time at all on doing paid jobs and zero otherwise. The rationale for this, is that time is considered as an important input

[4] It should be noted that Morocco did not satisfy guidelines for sample participation rates.
[5] Binary and ordinal variables are also nominal variables.

in the educational process (Becker 1965; Levin and Tsang 1987). Lastly, the *medium* category for the school resource indices was considered as a reference.

Like any other survey data, TIMSS suffers from missing data. This problem arises when students and school principals fail to answer some questions in their respective questionnaires. Table 3indicates the proportion of missing data in the sample. As can be seen from table 3, Dubai sample suffers most from missing data (57%) whereas Iran has the least proportion of missing data (15%).

3.3 Regression models and techniques

Based on the standard education production function suggested by Alexander and Simmons (1975), and subsequent to the studies of Ammermüller et al. (2005) and Wößmann (2003/2004)the following model was employed first for each student in each country.

Model 1:

$$T_{ics} = \alpha_{0+}\alpha_1 F_{ics} + \varepsilon_{ics}$$

Where T_{ics} is the first plausible value in mathematics (or science) provided by TIMSS 2007.F_{ics}reflects the socioeconomic status of the student i in class c and school s; and ε is the error term. According to Moulton (1986) the hierarchical structure of the data requires that the error term has a school level and a class level element in addition to the individual-student element. Second, and after controlling for the SES variables, the index of availability of school resources for mathematics instruction of class c at school s(index of availability of resources for science instruction) is introduced into the equation (R_{cs}) taking into account the school fixed effects. To implement the school fixed effects, a dummy variable D for each school is included in model 1. Hence, the final model is:

Model 2:

$$T_{ics} = \alpha_0 + \alpha_1 F_{ics} + \alpha_2 R_{cs} + \beta D_s + \varepsilon_{ics}$$

The introduction of school fixed effects in the model constitutes an important departure from the Heyneman-Loxley effect that used specific school variables to study the above relation without eliminating the variation between schools (Chudgar and Luschei 2009). The fixed effects models of schools help address endogenity (Rivkin et al. 2005).

The R-squared from model 1 is the proportion of variance in test score attributable to SES variables; in other words it is the variance explained by SES(let's denote it R_{SES}).Whereas the R-squared from model 2 accounts for the total variance explained by both SES and school resources (R_{total}). The next step consists of calculating the variance attributable to schools which is the amount $R_{sch.} = R_{total} - R_{SES}$. It is the gain in R-squared from model 1 to model2. Besides, the fraction $(R_{total} - R_{SES})/R_{total}$ which is equivalent to $R_{sch.}/R_{total}$ is calculated. The latter indicates the relative importance of family versus school. Within a country, if schools are more important in explaining students' performance then $R_{sch.}/R_{total}$>= 50% (this is known as the first part of Heyneman-Loxley effect) . Furthermore, if schools are more important relative to SES in low-income countries compared to high-income countries, then a negative relationship will be found between the country's economic status as measured by GDP per capita and the relative importance of family versus school. Additionally, a positive relationship will be found between the variance explained by SES and GDP per capita (this is known as the second part of the Heyneman-Loxley effect).

As companion to the above standard regression, and in order to bring a new perspective to this debate, quantile regressions are conducted so as to provide a more complete picture of the Heyneman-Loxley effect mainly at the lower and upper quantiles. Quantile regressions were introduced by Koenker and Bassett (1978). They were initially introduced as a "robust" regression technique which allows for estimation where the typical assumption of normality of the error term is violated (Koenker and Bassett 1978). Quantile regressions are especially useful where extremes are important (Koenker 2005;Koenker and Hallock2001); in our case low performers versus high performers. Recently, quantile regressions have been used simply to get information about points in the distribution of the dependent variable other than the conditional mean (Eide and Showalter 1998).Different illustrations of this methodology can be found in Yu et al. (2003).In the present study, this type of regression addresses the following question: "do school variables (respectively SES variables) predict performance differently for low performers than for high performers within the same country?"

TIMSS survey data uses a two-stage clustered sampling design as mentioned previously. Ignoring the sampling design will underestimate the standard errors leading to results that seem to be statistically significant where in fact they are not (White 1980; Wooldridge 2001). In TIMSS survey data, the primary sampling units are the schools and the problem is that the observations within the cluster of a school are not independent and they can have some common characteristics which cannot be controlled for. To solve this problem, clustering robust linear regression is used in order to require independence of observations across the PSU, i.e. schools. In sum, weighted least squares regression technique is used jointly with the clustering robust linear regression. The rationale behind using sample survey weights is to give each stratum the same relative importance that it has in the population (DuMouchel and Duncan 1983).

Regarding the quantile regressions, the survey structure was not taken into account[6]. However, quantile regressions with robust standard errors were conducted in order to obtain standard errors and t-statistics that are asymptotically valid under heteroskedasticity and misspecification (Machado and Santos Silva 2000; Machado and Santos Silva 2011) .

4. Results

In this section we present the different results of variance decomposition after estimating the models. Following the presentation in Heyneman and Loxley (1983), columns 2 to 5 in tables 4 to 9 present respectively the total variance in student performance attributable to both SES and school variables (R_{total}) as estimated by model 2, the variance explained by SES as estimated by model 1 (R_{SES}), the variance explained by school resources ($R_{sch.}$) and the proportion of variance explained by school resources ($R_{sch.}/R_{total}$).

The last rows in tables 4 to 9 display the correlation coefficients between natural logarithm of GDP per capita (PPP)[7] and the variance explained by SES and the proportion of variance explained by school resources or what Chudgar and Luschei (2009) called the relative importance of schools versus family. Results of survey regression in mathematics and science will be discussed first (tables 4 and 5). After that, quantile regression results will be highlighted (tables 6 to 9).

4.1 Survey regression results

As is evident from the correlation coefficients, the second part of Heyneman-Loxley is still consistent. GDP per capita is positively correlated with the variance explained by SES and negatively correlated with the proportion of variance explained by school resources. Turning to the first part of the Heyneman-Loxley effect, the results indicate slight differences between mathematics performance and science performance in the countries under study.

Regarding mathematics results, in all countries except in Jordan, Lebanon and Syria the family background variables predict more achievement than do school resources indicating a

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[6] There is no module in STATA 12 to implement quantile regressions with complex survey structures. The implementation of quantile regression with complex survey design has been discussed in the literature; see for example Francisco and Fuller (1991).

[7] International Monetary Fund, World Economic Outlook Database, October 2009.

vanished Heyneman-Loxley effect. However, larger family background effects are observed in Gulf-countries (high-income countries) compared to the other middle-income countries. Tunisia is an exception where the proportion of variance explained by SES is about 76%. The above results indicate some presence of the studied effect in Gulf-countries. Another pattern emerged in some countries where the variance is roughly divided between SES and school variables. This pattern is observed in Algeria[8], Jordan, Lebanon and Morocco. Analogously, in Syria the proportion of variance explained by school resources is close to 66%. Hence, the Heyneman-Loxley results are still consistent in this country. In science the picture is somewhat different. Heyneman-Loxley effect tends to be present in Algeria, Morocco and Syria. The case of Qatar features a total contradiction with the Heyneman-Loxley effect since school accounts for about 66% of the total variance.

4.2 Quantile regression results

In this section, we present the quantile regression results (tables 6 to 9). The same models were used at the lower quantile (10^{th}quantile) and at the upper quantile (90^{th}quantile). Comparison is conducted on two levels: within the quantile and between the quantile.

Concerning the second part of the Heyneman-Loxley effect, it is still consistent at the lower and upper ends of the distribution. Across the different countries, SES predicts more achievement at the lower and upper quantiles than school variables in both subjects. Three countries go against this trend: Syria, where schools play an important role in students' achievement in both mathematics and science pointing to the existence of the Heyneman-Loxley gradient; Qatar, where the relative importance of schools versus family prevails over SES in science; and Lebanon, where in mathematics, the variance is equally divided between SES and school resources at the lower quantile.

The comparison of results between the quantiles suggests some important differences. In mathematics evaluation, the relative importance of school versus family at the lower end of the distribution is more important than that at the upper end in Bahrain, Egypt, Iran, Kuwait, Lebanon, Morocco, Oman, Palestine, Dubai and Jordan (with a negligible difference). This means that schools are more important for low-performers than for high-performers regardless of the country's economic status. In Tunisia, high-performers benefit from both SES and school resources. In Qatar and Saudi Arabia, there is no noticeable difference between the quantiles regarding the impact of the mentioned statistic. However, in Syria, the between quantile results corroborate the previous findings. Correspondingly, similar results are obtained for science evaluation where the proportion of variance explained by school resources is more important at the lower quantile than at the higher quantile in Algeria, Bahrain, Egypt, Iran, Jordan (again with a slight difference),Kuwait, Oman (difference negligible), Palestine and Qatar. The different results are summarized in table 10.

5. Conclusion and Policy Implications

In order to continue the debate on whether school resources or family background is more important for student's performance in the MENA region, which is known to be heterogeneous in terms of GDP per capita, I opted to use two different modeling strategies: survey regression technique and quantile regressions. Though, I did not take into account the survey structure when doing quantile regressions, the results obtained are quite similar.

Taken as a whole, the Heyneman-Loxley effect is not fully supported in the MENA region. The sole exception is Syria where school resources have a great impact on students' performance. An important point to highlight, however, is the emergence of a new pattern in some middle-income countries where SES and schools contribute equally to the students'

[8] The results of Algeria may be not comparable with the other countries because in the regression we did not include the variables *spend time work on paid jobs* and*parents born in country* because they are missing for all the students in the sample.

achievement. Furthermore, the results suggest that schools continue to be important for low-performing students in both high and middle-income countries.

From a policy perspective, it is difficult to implement policies that directly assist families or communities aiming at improving students' outcomes. Nonetheless, policy makers should be aware about the fact that "education for All" has overshadowed the problems associated with poverty, employment and poor health that often confront children from low socioeconomic status. Additionally, policy makers must bear in mind that family background differences can deepen inequality in achievement and in educational opportunities despite the free public education and despite the equity in access. Providing support for these children can be done via schools. Though, I only tested the impact of school endowments on students' learning, omitting teacher characteristics, I found evidence that resources matter. A well-endowed school enhances learning and can also motivate children. The quantile regression findings indicate where resources may matter, not just whether or not they matter on average. Besides, I find evidence that schools in some countries may be able to mediate the relationship between students' SES and their achievement.

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Table 1: Coverage and Exclusion Rates

Country	Coverage (%)	Overall Exclusion (%)	Schools	Students
Algeria	100	0.1	149	5447
Bahrain	100	1.5	74	4230
Iran, Islamic Rep.	100	0.5	208	3981
Egypt	100	0.5	233	6582
Jordan	100	2.0	200	5251
Kuwait	100	0.3	158	4091
Lebanon	100	1.4	136	3786
Morocco	100	0.1	131	3060
Oman	100	1.2	146	4752
Palestinian Nat'l Auth.	100	1.0	148	4378
Qatar	100	0.8	66	7184
Saudi Arabia	100	0.5	165	4243
Syrian Republic	100	0.6	150	4650
Tunisia	100	0.0	150	4080
Dubai,U.A.E	100	5.0	88	3195

Source: TIMSS (2007).

Table 2: Description of Variables

Variable	Type of variable	Description
Age	**Continuous**	
Number of books	Ordinal	5 categories : 1Less than one shelf/2 One shelf/3 One bookcase/4 Two bookcases/5 Three or more bookcases
Possessing calculator	Binary	2 categories : 1 yes 0 otherwise
Possessing computer	Binary	2 categories : 1 yes 0 otherwise
Possessing study desk	Binary	2 categories : 1 yes 0 otherwise
Possessing a dictionary	Binary	2 categories : 1 yes 0 otherwise
Possessing internet connection	Binary	2 categories : 1 yes 0 otherwise
Parents highest education level	Ordinal	5 categories : 1 University degree/2 Completed post secondary but not university/3 Completed upper secondary education/4 Completed lower secondary education/5 less than lower-secondary education
Parents born in country	Nominal	3 categories : 1 Both parents born in country /2 Only one parent born in country/3 Neither parent born in country
Sex of student	Binary	2 categories : 1 female 0 male
Spend time work on paid jobs	Ordinal	5 categories : 1No time /2 Less than one hour/3 One to two hours/ 4 More than two hours but less than four/ 5 Four or more hours
Index of availability of math. resources	Ordinal	3 categories : 1 High/2 Medium/3 Low
Index of availability of science resources	Ordinal	3 categories : 1 High/2 Medium/3 Low
1stplausible value in mathematics	Continuous	
1stplausible value in science	Continuous	

Table3: Proportion of Missing Data in the Sample

Algeria	21%	Kuwait	21%	Qatar	22%
Bahrain	28%	Lebanon	36%	Saudi Arabia	24%
Egypt	26%	Morocco	41%	Syria	30%
Iran	15%	Oman	27%	Tunisia	23%
Jordan	18%	Palestinian Nat'l Authority	20%	Dubai	57%

Table 4: Variance Decomposition (mathematics)

Country	Total Variance Explained (%)	Variance Explained By Ses (%)	Variance Explained By School Resources (%)	Proportion of Variance Explained By School Resources (%)	Proportion of Variance Explained By Ses (%)	Effect of Res[9] or Ses
Algeria	22.64	11.35	11.29	49.87	50.13	SES
Bahrain	30.95	24.53	6.42	20.74	79.25	SES
Egypt	38.43	21.14	17.29	44.99	55.01	SES
Iran	49.45	28.73	20.72	41.90	58.10	SES
Jordan	42.79	20.50	22.29	52.09	47.91	RES
Kuwait	30.57	19.11	11.46	37.49	62.51	SES
Lebanon	54.79	25.21	29.58	53.99	46.01	RES
Morocco	37.48	19.49	17.99	47.99	52.00	SES
Oman	37.11	26.07	11.04	29.75	70.25	SES
Palestine	36.34	21.75	14.59	40.15	59.85	SES
Qatar	40.20	28.51	11.69	29.07	70.92	SES
Saudi Arabia	35.34	25.12	10.22	28.91	71.08	SES
Syria	40.96	13.94	27.02	65.96	34.03	RES
Tunisia	36.60	27.89	8.71	23.80	76.20	SES
Dubai	58.75	39.39	19.36	32.95	67.04	SES
Correlations With Log(GDP)	-	**0.56**	-	**-0.67**	-	-

Table 5: Variance Decomposition (Science)

Country	Total Variance Explained (%)	Variance Explained By Ses (%)	Variance Explained By School Resources (%)	Proportion of Variance Explained By School Resources (%)	Proportion of Variance Explained By Ses (%)	Effect of Res Or Ses
Algeria	19.27	8.68	10.59	54.96	45.04	RES
Bahrain	38.74	32.46	6.28	16.21	83.79	SES
Egypt	38.29	21.58	16.71	43.64	56.36	SES
Iran	46.00	28.31	17.96	38.46	61.54	SES
Jordan	44.57	26.28	18.29	41.04	58.96	SES
Kuwait	33.41	22.17	11.24	33.64	66.36	SES
Lebanon	63.98	35.12	28.86	45.11	54.89	SES
Morocco	29.01	13.93	15.08	51.98	48.02	RES
Oman	40.50	29.69	10.81	26.69	73.31	SES
Palestine	37.55	24.78	12.77	34.01	65.99	SES
Qatar	58.78	24.17	34.61	58.88	41.12	RES
Saudi Arabia	38.59	28.78	9.81	25.42	74.58	SES
Syria	32.91	15.99	16.92	51.41	48.59	RES
Tunisia	30.93	21.78	9.15	29.58	70.42	SES
Dubai	49.08	34.64	14.44	29.42	70.58	SES
Correlations With Log (GDP)	-	**r=0.53**	-	**r=-0.34**	-	-

[9] RES stands for resources.

Table 6: Variance Decomposition at the Lower Quantile (mathematics)

Country	Total Variance Explained (%)	Variance Explained By Ses (%)	Variance Explained By School Resources (%)	Proportion of Variance Explained By School Resources (%)	Effect of Res or Ses
Algeria	18.31	11.11	7.20	39.32	SES
Bahrain	28.81	23.21	5.60	19.44	SES
Egypt	39.75	26.19	13.56	34.11	SES
Iran	48.10	30.01	18.09	37.61	SES
Jordan	35.05	19.06	15.99	45.62	SES
Kuwait	25.06	18.03	7.03	28.05	SES
Lebanon	48.63	23.92	24.71	50.81	RES
Morocco	29.95	17.15	12.80	42.74	SES
Oman	31.73	24.34	7.39	23.29	SES
Palestine	31.30	20.49	10.81	34.54	SES
Qatar	37.98	27.66	10.32	27.17	SES
Saudi Arabia	30.17	25.77	4.40	14.58	SES
Syria	35.54	13.02	22.52	63.37	RES
Tunisia	30.24	26.85	3.39	11.21	SES
Dubai	59.98	40.58	19.40	32.34	SES
Correlations With Log(GDP)	-	R=0.50	-	R=-0.53	

Table 7: Variance Decomposition at the Upper Quantile (mathematics)

Country	Total Variance Explained (%)	Variance Explained By Ses (%)	Variance Explained By School Resources (%)	Proportion of Variance Explained By School Resources (%)	Effect of Res or Ses
Algeria	18.50	11.04%	7.46%	40.32%	SES
Bahrain	27.93	22.89%	5.04%	18.05%	SES
Egypt	37.83	25.87%	11.96%	31.62%	SES
Iran	46.61	30.03%	16.58%	35.57%	SES
Jordan	35.06	19.08%	15.98%	45.58%	SES
Kuwait	25.32	18.34%	6.98%	27.57%	SES
Lebanon	47.54	24.13%	23.41%	49.24%	SES
Morocco	30.09	18.28%	11.81%	39.25%	SES
Oman	30.58	23.70%	6.88%	22.50%	SES
Palestine	30.37	20.34%	10.03%	33.03%	SES
Qatar	38.20	27.56%	10.64%	27.85%	SES
Saudi Arabia	29.34	25.18%	4.16%	14.18%	SES
Syria	34.78	12.60%	22.18%	63.77%	RES
Tunisia	30.60	26.58%	4.02%	13.14%	SES
Dubai	59.02	41.02%	18.00%	30.50%	SES
Correlations With Log (GDP)	-	r=0.49	-	r=-0.53	

Table 8: Variance Decomposition at the Lower Quantile (Science)

Country	Total Variance Explained (%)	Variance Explained By Ses (%)	Variance Explained By School Resources (%)	Proportion of Variance Explained By School Resources (%)	Effect of Res or Ses
Algeria	14.87	8.22	6.65	44.72	SES
Bahrain	34.67	30.12	4.55	13.12	SES
Egypt	35.81	22.81	13.00	36.30	SES
Iran	44.47	29.79	14.68	33.01	SES
Jordan	38.40	25.43	12.97	33.78	SES
Kuwait	29.24	21.80	7.44	25.44	SES
Lebanon	55.29	33.22	22.07	39.92	SES
Morocco	21.14	12.64	8.50	40.21	SES
Oman	34.34	28.66	5.68	16.54	SES
Palestine	32.83	24.12	8.71	26.53	SES
Qatar	57.12	22.75	34.37	60.17	RES
Saudi Arabia	31.77	28.66	3.11	9.79	SES
Syria	26.24	14.52	11.72	44.66	SES
Tunisia	25.08	20.99	4.09	16.31	SES
Dubai	47.90	35.64	12.26	25.59	SES
Correlations With Log(GDP)	-	r=0.52	-	r=-0.15	

Table 9: Variance Decomposition at the Upper Quantile (Science)

Country	Total Variance Explained (%)	Variance Explained By Ses (%)	Variance Explained By School Resources (%)	Proportion of Variance Explained By School Resources (%)	Effect of Res or Ses
Algeria	14.94	8.92	6.02	40.29	SES
Bahrain	33.51	29.83	3.68	10.98	SES
Egypt	35.00	22.75	12.25	35.00	SES
Iran	43.84	29.77	14.07	32.09	SES
Jordan	36.81	24.62	12.19	33.12	SES
Kuwait	28.86	22.11	6.75	23.39	SES
Lebanon	55.47	32.56	22.91	41.30	SES
Morocco	21.18	12.19	8.99	42.45	SES
Oman	33.77	28.32	5.45	16.14	SES
Palestine	31.09	23.16	7.93	25.51	SES
Qatar	56.81	22.07	34.74	61.15	RES
Saudi Arabia	31.97	28.44	3.53	11.04	SES
Syria	26.91	14.33	12.58	46.75	SES
Tunisia	24.67	19.91	4.76	19.29	SES
Dubai	49.15	35.24	13.91	28.30	SES
Correlations With Log (GDP)	-	r=0.53	-	r=-0.15	

Table 10: Summary of the Results

	High-income countries	Middle-income countries
Mathematics	• Presence of Heyneman-Loxleyeffect with its 2 parts.	• Vanished part 1 of Heyneman-Loxley effect/ Part 2 is still consistent. • Validity of the Heyneman-Loxley effect in Syria. • New pattern: in Algeria, Jordan, Lebanon and Morocco the variance is roughly divided between SES and school variables.
Science	• Presence of Heyneman-Loxley effect. • Qatar features a contradiction with Heyneman-Loxley effect.	• Vanished part 1 of Heyneman-Loxley effect/ Part 2 is still consistent. • The effect is present in Algeria, Morocco and Syria.
Mathematics		
Lower quantile	• Presence of Heyneman-Loxley effect with its 2 parts.	• Vanished part 1 of Heyneman-Loxley effect/ Part 2 is still consistent. • Validity of the Heyneman-Loxley effect in Syria. • Lebanon: variance is divided between SES and schools.
Upper quantile	• Presence of Heyneman-Loxley effect with its 2 parts.	• Validity of the Heyneman-Loxley effect in Syria.
Between quantiles	• Contradiction with the effect: schools are important in Bahrain, Oman, Oman and Dubai at the lower quantile.	• Presence of the effect: schools are more important at the lower tail of the distribution in Iran, Lebanon,Morocco, Palestine, Jordan and Syria.
Science		
Lower quantile	• Presence of Heyneman-Loxley effect with its 2 parts. • Qatar features a contradiction with Heyneman-Loxley effect.	• Vanished part 1 of Heyneman-Loxley effect/ Part 2 is still consistent.
Upper quantile	• Presence of Heyneman-Loxley effect with its 2 parts. • Qatar features a contradiction with Heyneman-Loxley effect.	• Vanished part 1 of Heyneman-Loxley effect/ Part 2 is still consistent.
Between quantiles	• Contradiction with the effect: schools are important in Bahrain, Kuwait,Oman and Qatar at the lower end.	• Presence of this effect in Algeria, Egypt, Iran, Jordan and Palestine.