Do School Incentives and Accountability Measures Improve Skills in the Middle East and North Africa? The Cases of Jordan and Tunisia

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Abstract: There is general agreement that skill-enhancing school reforms in the Middle East and North Africa (MENA) region are necessary for economic, political and social reasons. Using student-level data from Jordan and Tunisia, this study assesses the relationship between skills and the following school incentive and accountability measures: pedagogical autonomy, school competition, freedom to hire and fire teachers, publicly posting data, and parent involvement in school affairs. Quantile regression analyses of mathematics, science, and reading skills of 15-year-old students suggest that students in schools with incentive and accountability measures do not have higher skills than students in school without the measures; this suggests that schools with incentive and accountability measures are no more efficient than other schools that have not adopted the measures. In terms of equity, the reforms are not associated with higher skills for the less skilled; a notable exception is parent involvement in Tunisia, which is associated with higher science and reading skills among low-skilled students. The main policy implication is that school incentive- and accountability-based reform should not be pursued until researchers have identified the effective design properties of each incentive and accountability measure.

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1. Introduction

A persistent problem in the Middle East and North Africa [MENA] region is that workers lack the skills desired by employers (Shaw, 1981; Henry and Springborg, 2001; Nabil and Veganzones–Varoudakis, 2007; Rauch and Kostyshak, 2009; Salehi-Isfahani, 2001; and Yousef, 2004). This skills crisis persists across workers with various levels of educational attainments and is one reason why MENA youth unemployment rates are the highest in the world; depending on the country, between 30 to 50 percent of 18-24 year olds are unemployed and seeking employment (World Bank, 2004). In addition to suppressing economic development and growth, the skills crisis is related to the surge of youth participation in extremist activities such as violent protests and suicide bombings (Krueger, 2007). As the population share of youth rises in MENA (Assaad and Roudi-Fahimi, 2007), observers are becoming increasingly concerned. Queen Rania of Jordan, for example, refers to the situation as a "ticking time bomb" and stresses the urgency of adopting skill-enhancing policies.[1]

Since schools are a key provider of skills, some observers have called for school reform to ameliorate the skills crisis in MENA (Chapman and Miric, 2009; World Bank, 2008). Despite general agreement about the necessity of school reform, there is disagreement on its direction. The World Bank—a key provider

[1] Source: http://en.trend.az/news/world/wnews/1335476.html. Accessed on 17 October 2009.

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of loans and intellectual guidance to MENA—makes the following recommendation:

> Countries in the Middle East and North Africa need to overhaul their education systems to meet the demands of an increasingly competitive world and realize the potential of their large and growing youth population… Most reforms in the region have attempted to engineer changes in the education system: building schools, hiring teachers, and writing curricula. The success of future reforms will require instead changes in the behavior of key education actors—teachers, administrators, and educational authorities. This is the road not traveled in the education sector.[2] (p. XV, World Bank in *MENA Development Report-- The Road Not Traveled: Education Reform in the Middle East and North Africa*)

The World Bank's recommendation reveals the two possible school reform directions in MENA. The first school reform direction, sometimes referred to "input-based" reform, is favored by teachers and school administrators and emphasizes reducing class size, modifying curricula, and increasing facilities, books, supplies, numbers of teachers, and teacher salaries.

The second school reform direction is sometimes referred to as "incentive- and accountability-based" and is supported by some economists and the World Bank (Bruns et al., 2011; Hanushek, 2003; Pritchett and Filmer, 1999; Wößmann, 2007). According to Figlio and Ladd (2010), incentive- and accountability-based

[2] The first part of the quote has been obtained from the World Bank Press Release No:2008/202/MNA.

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school reform typically emphasizes one or more of the following: pedagogical autonomy, competition from other schools, freedom to hire and fire teachers, publicly available performance data, and parent involvement in school affairs. Among advocates of school incentive- and accountability-based reform, the concept of productive efficiency is central: With school incentive and accountability measures in place, schools are claimed to produce higher skills with the same school inputs, students, and families; these advocates further articulate that, without such improvements in productive efficiency, additional inputs are wasted and therefore do not improve skills. The push for greater school incentives and accountability is accompanied by the larger educational decentralization movement that emphasizes more local control and financing of schools in developing countries (Fiske, 1996). In turn, this educational decentralization movement is a part of the global decentralization movement that emerged in response to the anti-corruption drives against central governments in the 1990s (Bardhan, 2002).

This study examines whether current school incentive and accountability measures in Jordan and Tunisia are associated with higher skills among students after controlling for school input characteristics, student characteristics, and family characteristics. The data source is the Organization for Economic-Cooperation and Development [OECD] initiated *Program for International Student Assessment* [PISA], which contains unusually good proxies for the type of

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mathematics, science, and reading skills that are valued by employers in the new MENA economies, such as knowledge, creativity, real-life problem solving, and life-long learning; for these reasons, PISA is highly regarded among economists (Carnoy, 2006; Hanushek and Wößmann, 2008). In addition to being the only study to address school reform and skills in MENA countries, this study contributes to the scarce empirical research from developing countries on school incentives and accountability (Glewwe and Kremer, 2006). Finally, this study is one of the few that examines school reform using a quantile regression model, which has desirable statistical properties and provides insight into equity by illustrating how school incentive and accountability measures may affect students at various skill levels (Angrist and Pischke, 2009; Ammermüller and Pischke, 2009; Eide and Showalter, 1998); in particular, there is an equity justification for a particular incentive measure if quantile regression results show that the measure is associated with higher skills for low-skilled students.[3]

The nature of the skills crises in Jordan and Tunisia are comparable to the crises in other MENA countries (Cammett, 2007; Miles, 2002). The types of skills desired by the economies of the 1950s were the ability to take orders passively in state-owned industries and to adhere to specific tasks within a confined area of responsibility. In contrast, today's MENA economies have shrinking state

[3] In recent years, there have been rigorous economic studies of Latin American countries, including Gunnarson et al. (2009), Galliani et al. (2008), Faguet and Sánchez (2008), and Parry (1997). In their review of literature from developing countries, Glewwe and Kremer (2006) indicate that there are no studies on the topic in non-Latin American developing countries.

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involvement and a growing share of private businesses that require skills such as the ability to take individual responsibility on less routine tasks and the ability to evaluate organizational practices critically (Heyneman, 1997). Like other MENA countries, Jordan and Tunisia have a youth bulge that is expected to exacerbate the skills crisis. In particular, the 30 percent youth unemployment rate will grow because over a quarter of Jordan's 5.7 million people and Tunisia's 10.3 million people are in the 0-14 age-group (Assaad and Roudi-Fahimi, 2007). Finally, like other MENA countries, the skills crisis has been associated with social and political unrest among the educated but unskilled. The results of this study provide insight into whether incentive- and accountability-based school reform is appropriate for resolving the skills crises in Jordan and Tunisia.[4]

[4] As mentioned earlier, Queen Rania has already expressed her concerns, with particular focus on Jordan. In Tunisia, the case of 26-year-old Tunisian Mohamed Bouazizi caught the world's attention after he set himself on fire in front of a government building in Sidi Bouzidi in January 2011. Bouazizi, a university graduate, had been unable to find meaningful employment and resorted to selling vegetables on the street. His injuries resulted in death and sparked mass protests, culminating in political upheaval in Tunisia that inspired uprisings elsewhere in the Arab world. Of course, the lack of employment and skills is not the only cause of unrest in the region. Rising food prices, official corruption, and freedom to voice political opinions are some of the other causes. For details on the MENA economies, see Abu-Qarn and Abu-Bader (2007), Murshed, (2008), Rauch and Kostyshak (2009) and Yousef (2004). Despite the skills crises, Jordan and Tunisia's economic growth rates of 4 percent have been strong by MENA standards (World Bank, 2004). Other country-level characteristics for Jordan and Tunisia are as follows: Jordan's purchasing power parity (PPP) adjusted per-capita income of $4485 is lower than Tunisia's $6648, though poverty rates (measured as those living below $2 a day) are more comparable at 7.0 percent in Jordan and 6.6 percent in Tunisia. There is a large difference in adult literacy rates between the two countries, with 93.1 percent in Jordan and 77.7 percent in Tunisia. Educational disparities between the two countries are smaller among younger cohorts, with Tunisia having a gross secondary enrollment rate of 84.0 percent compared to Jordan's of 88.6 percent. These enrollment rates are high compared to those in other developing countries and are consistent with a shifting policy focus from mass schooling and nearly-full secondary school enrollment to more specific educational reforms that focus on skill enhancement. The actual relationship between educational attainment and labor market prospects remains unclear because

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2. Conceptual Frameworks and Data

There are two conceptual frameworks in economics that can explain the benefits of school incentive and accountability measures. The education production function framework can be used to focus on the effects of school incentives and accountability on measures of mathematics, science, and reading skills while controlling for school inputs, student, and family characteristics (Levin, 1995). If school incentive and accountability measures improve skills, holding all else constant, it can be asserted that the adoption of such measures improves efficiency.

An alternative conceptual framework is provided by the economists' model of the principal-agent problem. In such a model, school administrators and teachers may underperform because policymakers and parents do not have a good way of monitoring them (Figlio and Ladd, 2010); therefore, skills would improve if policymakers and parents could monitor the administrators and teachers effectively, holding all student, family, and other school characteristics constant.

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of a lack of microeconomic research; for example, no studies have examined the rates of return to education in Jordan and Tunisia for at least thirty years (Psacharapoulos and Patrinos, 2004). Nonetheless, anecdotal and descriptive evidence indicates that highly educated youth (especially males) face bleak labor market prospects because of a lack of marketable skills. For evidence on a lack of skills among youth contributing to violence, see the University of Notre Dame report on Jordan (http://merln.ndu.edu/archive/icg/terrorismjordans911.pdf) and the Magherebia brief on Tunisia (http://www.magharebia.com/cocoon/awi/xhtml1/en_GB/features/awi/features/2008/07/08/feature-02).

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Both frameworks suggest that strong incentives and accountability measures must be in place in order for additional school inputs and resources to improve skills (Bishop and Wößmann, 2004). Despite the conceptual appeal of the production function and principal-agent frameworks, the empirical evidence from industrialized and developing countries indicate that very few school incentive and accountability measures are associated with higher skills (Glewwe and Kremer, 2006; Kane and Staiger, 2002).

The data source, PISA, is a triennial world-wide test of 15-year old students. The OECD coordinates PISA with country-level partners, such as ministries of education. The first PISA assessment focused on reading literacy, followed by the inclusion of mathematics literacy in 2003, and science literacy in 2006. Unlike the other international assessment tests such as the *Trends in International Mathematics and Science Study* [TIMSS] and the *Progress in International Reading Literacy Study* [PIRLS], PISA asks students to apply mathematics, science, and language to solve real world problems. PISA tests students between the ages of 15 years and 3 months, and 16 years and 2 months. Tests are not conducted for home schooled children and children no longer attending school. Schools report student results in mathematics, science, reading, and attitudes toward the environment. The 2006 PISA marks the first time that

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low-income MENA countries have been included in an international assessment test.[5]

PISA uses a two stage sampling procedure. Once the population is defined, a school is selected with a probability proportional to its enrollment. Next, 35 students are randomly selected from each school. Since the target population is selected for age, the sample includes students from different grades. Students answer questions on personal and family characteristics, and school directors answer questions on school characteristics.[6]

2.1 Dependent Variables

The dependent variables for this study are achievement scores in mathematics, science, and reading. For the mathematics problems in PISA, students identify features of a problem to which mathematics is relevant; in turn they use their knowledge of mathematics to solve the particular problem. The science component includes the application of scientific knowledge and skills to

[5] The number of countries included in PISA has steadily increased from 32 to 57, with a growing number of developing countries being included. Jordan, Tunisia, Turkey and Qatar participated in PISA 2006, but this study concentrates on Jordan and Tunisia because oil-rich Qatar is developed and scores higher. Moreover, the skills crisis persists only in low-income MENA countries such as Jordan and Tunisia.

[6] The regular method of standard errors is biased for two reasons. First, there is intra-cluster correlation among schools. Second, there is no single estimate for the dependent variable, but five (called plausible values). Thus, the standard error has to take into account the sampling variance in the estimate of the dependent variable. To correct for intra-cluster correlation, PISA provides a series of weights for Balanced Repeated Replicates (this is like bootstrapping except the resamples are pre-defined). When calculating standard errors of variables except for those derived from the plausible values, the Balanced Repeated Replicates methodology is adopted.

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real-life situations that are set in a variety of contexts relevant to life and health, technology, the Earth, and environment. Finally, the reading components involve written information provided in a real-life context; the texts are set in a variety of reading situations, including reading for private, occupational, educational and public purposes.

2.2 School Incentives Variables

The three school incentive characteristics that are examined here are (1) whether the school has pedagogical autonomy, (2) whether the school competes with other schools for students, and (3) whether the school has the authority to hire and fire teachers. Schools are said to have pedagogical autonomy if school administrators and teachers have flexibility in teaching methods and course design. Research from industrialized countries indicates that teachers with pedagogical autonomy are able to cater to the specific needs of their students, which leads to improved skills (Archibald and Porter, 1994). Regarding competition, it is argued that schools can produce more skills when faced with greater competition from other public and private schools (Chubb and Moe, 1990). Schools that do not make improvements will risk losing students to other schools. The ability of schools to hire and fire teachers is seen as a possible mechanism to reduce shirking, such as absenteeism and the withholding of class

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instruction to ensure student demand for after-hours private tutoring (Banerjee and Duflo, 2006; Choudhury et al. 1996).

2.3 School Accountability Variables

The two school accountability variables that are considered here are (1) whether the school makes its data publicly available, and (2) whether parents have a say over school affairs. By making the data on student achievement publicly available, schools may become accountable to parents and bureaucrats (Banerjee et al., 2007). For example, informed or involved parents hold schools accountable by complaining about poor performance and threatening to withdraw their children from school. Sometimes, these data are used to construct school rankings, which serve the accountability purpose and also the incentive purpose because schools may be concerned about reputation and competition. Regarding parental involvement, principal-agent theory on teachers and parents predicts that there is a tendency for school employees to be self-serving and to use funds for things that most benefit them, such as increased teacher and staff pay and smaller class size (Pritchett and Filmer, 1999). Thus, parents having a say over staffing, budgeting, instructional content, and assessment practices may encourage schools to pursue approaches that are most beneficial to students.

2.4 Controls

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PISA also collects data on a range of school, student, and family characteristics. The choice of variables used as controls follows the rich empirical literature on the determinants of educational outcomes in developing countries (for a review, see Glewwe and Kremer, 2006). At the school level, there are controls for school inputs such as the proportion of certified teachers, the proportion of minimally qualified teachers, student-teacher ratio, student-teacher ratio squared, whether the school is public or private, and whether the school is in an urban or rural area. Student control variables include the student's gender, age, and grade. Family control variables include paternal education, maternal education, and the number of books in the household.

3. Empirical Models

3.1 OLS Model

Education production functions are typically estimated using ordinary least squares (OLS), which reveal the effect of a school characteristic on the average achievements of students (Todd and Wolpin, 2003). The OLS model for this study is:

$$skill_i = x_i'\beta_\theta + u_{\theta_i}$$

where $skill_i$ is a student *i*'s skill in a given subject, and x_i is a vector of explanatory variables that include the key variables for incentive and accountability measures; u_i is a mean zero error term. The OLS estimation results

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indicate whether the average student in schools with certain incentive and accountability measures have higher skills compared to a student at a school without those incentive and accountability measures holding school input, student, and family characteristics constant. Thus, the OLS results reveal whether schools with incentive and accountability measures are more efficient at producing skills. Positive and statistically significant coefficients for the school incentive and accountability variables would suggest that there is an efficiency argument in favor of existing school incentive and accountability measures.

3.2 Quantile Regression Model

A shortcoming of the OLS model is that it cannot provide insight into whether the associations vary across students of different skill levels. In contrast, the quantile regression model, developed by Koenkar and Basset (1978), can reveal the effect of school incentive and accountability measures on very low, low, median, high and very high skilled students. In other words, a quantile regression model provides insight about equity by determining whether school incentives and accountability characteristics matter, and for whom they matter. If the coefficient for low achieving students is positive, statistically significant, and larger than the coefficient for high achieving students, then there is an equity basis for the wide adoption of existing types of school incentive and accountability measures.

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The quantile regression model also has desirable statistical properties. In particular, the estimated median (rather than the mean) is less sensitive to extreme outliers because the weighted sum of absolute deviations gives a robust measure of location on the distribution scale. In addition, the quantile regression model produces better estimates than the OLS model by assuming an error term of non-normal distribution, which is suitable for heteroskedastic data such as achievement scores.

The quantile regression model for this study is:

$$skill_i = x_i'\beta_\theta + u_{\theta_i}, Quant_\theta(skill \mid x_i) = x_i'\beta_\theta$$

where *i* is a student. $Quant_\theta(skill \mid x_i)$ refers to the conditional quantile of $skill_i$, conditional on the vector of explanatory variables x_i and $\theta \in (0,1)$. It is assumed that $Quant_\theta(u_i \mid x_i) = 0$. The quantile regression estimates are obtained by minimizing the weighted sum of the absolute values of the errors. Specifically, the θ^{th} conditional quantile regression estimator for β is obtained by minimizing the following objective function with respect to β:

$$\sum_{i:skill_i \geq x_i\beta} \theta \mid skill_i - x_i\beta \mid + \sum_{i:skill < x_i\beta} (1-\theta) \mid skill_i - x_i\beta \mid$$

There are several caveats when using the described data and methodology. First, PISA does not measure other student outcomes relevant to student social and political development, such as civic knowledge and engagement (Mazawi, 2010). Second, PISA tests only students who are enrolled in school, not those who

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have dropped out. The fact that children who have dropped out may have different academic ability than students who have remained raises the problem of sample selection bias in the estimates. For policy purposes, it means that reforms may affect unenrolled and enrolled children differently. Jordan and Tunisia have gross secondary enrollment rates of 89 percent and 86 percent (World Bank, 2008), suggesting that sample selection bias exists to a small extent. Third, as with most education production function studies, there is omitted variable bias because of the unavailability of data on students' innate abilities. Fourth, the findings in this study may not hold for students younger or older than the age of fifteen or for students in other MENA countries. Fifth, simple cross-sectional identification is not ideal for establishing a causal relationship between skills and school incentives and accountability measures. Finally, as recent panel studies from industrialized countries have shown, some school reforms may not affect students until much later in life. For example, evidence from Project STAR in Tennessee, USA, found that smaller class size during kindergarten was highly correlated with future outcomes such as earnings at age 27, college attendance, home ownership, and retirement savings (Chetty el al., 2010).

Some of the mentioned caveats can be better addressed once more detailed cross-sectional and panel data from MENA become available. Nonetheless, a basic empirical assessment using cross-sectional data can provide a starting point for policy discussions and future research.

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4. Results

4.1 Descriptive Statistics

Table 1 shows the descriptions, means, and standard deviations for the dependent variables and the school incentives and accountability variables. The invalid or missing responses are dropped, and the resulting sample sizes are 5125 students in Jordan and 3037 students in Tunisia. The descriptive statistics suggest that school competition and publicly available data are common in both Jordan and Tunisia, such that over half of all students are in schools that compete, and more than three-quarter are in schools that post data. Far less common are pedagogical autonomy (especially in Tunisia), the ability of schools to hire and fire teachers, and parents having influence over school staffing, budgeting, instructional content, and assessment practices.

[Table 1 about here]

4.2 OLS Results

Table 2 presents the OLS regression results for Jordan and Tunisia; because of space constraints, the coefficients for the control variables are not presented. According to Panel 1, mathematics skills in Jordan are lower if the average student attends a school with pedagogical autonomy, holding all other characteristics constant. Panel 2 indicates that none of the school incentive and

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accountability measures have a positive and statistically significant association with science skills in Jordan. Panel 3 shows that pedagogical autonomy is associated with lower reading skills in Jordan. The OLS results therefore provide no evidence that school accountability and incentive measures are associated with better mathematics, science, and reading skills for the average student in Jordan. In other words, the OLS analysis shows no evidence that such measures are associated with productive efficiency in Jordan.

[Table 2 about here]

For Tunisia' Panel 1 shows that the coefficient for hiring and firing teachers and pedagogical autonomy are statistically significant but negatively associated with mathematics skills. Panel 2 indicates that pedagogical autonomy has a large negative and statistically significant relationship with science skills in Tunisia. Finally, the positive and statistically significant coefficient for parental influence in Panel 3 shows that students have higher reading skills in schools with parental influence. The findings from Panels 2 and 3 raise questions about the nature of parental influence in Tunisia because of higher reading scores but lower mathematics skills for the average student.

4.3 Quantile Regression Results

The quantile regression results report the association between the five school incentive and accountability measures across different skill quantiles after

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controlling for school input characteristics, student characteristics, and family characteristics. It is worth noting that the statistical significance and magnitudes of coefficients do not affect the quantile of a student (p. 281, Angrist and Pischke, 2009). For example, a positive and statistically significant coefficient on pedagogical autonomy at the 0.75 quantile reveals that a student attending a school with pedagogical autonomy has higher skills than another student at the 0.75 quantile whose school does not have pedagogical autonomy, holding all else constant. It does not mean that having pedagogical autonomy pushes a student from the 0.75 quantile to a higher quantile. Likewise, a negative and statistically significant coefficient does not indicate that a student in the 0.75 achievement quantile pushes the student to a lower quantile.

[Table 3 about here]

Table 3 presents the quantile regression estimation results for Jordan. Panel 1 indicates that pedagogical autonomy is associated with lower mathematics skills at the 0.25 quantile after controlling for all other characteristics. According to Panel 2, science skills are higher at the 0.75 and 0.90 quantiles if there is parental influence over school staffing, budgeting, instructional content, and assessment practices. Panel 3 indicates that none of the existing incentive and accountability measures have a statistically significant relationship with reading skills across all quantiles in Jordan.

[Table 4 about here]

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Table 4 presents the quantile regression estimation results for Tunisia. Panel 1 indicates that school incentives in the form of autonomy over teacher hiring and firing decisions is associated with lower mathematics skills at the 0.25, 0.75, and 0.90 quantiles. The accountability measure of parental involvement in school is associated with lower mathematics achievement at the 0.75 quantile. Panel 2 indicates that there is a negative association between pedagogical autonomy and science skills at the 0.25, median, and 0.75 quantiles. Panel 3 shows that at the 0.10 quantile, parental influence has a large, positive and statistically significant association with reading skills in Tunisia; since the coefficients for parental influence are not statistically significant across the 0.25, median, 0.75, and 0.90 quantiles, parental influence is associated with greater equity. None of the other coefficients for school incentive and accountability measures in Panel 3 have a statistically significant relationship with reading skills in Tunisia.

There is some evidence that the quantile regression model provides more information than the OLS model. For example, the OLS results show that parental influence has no statistically significant association with skills for the student with average skills but the quantile regression results show that parental influence has a positive and statistically significant relationship with science and reading skills in Tunisia. In other example, the quantile regression results reveal that the negative association between lower mathematics skills and pedagogical autonomy exists

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only for low-skilled students. Last, though undetected by OLS, the quantile regression results reveal that parental influence is associated with lower mathematics skills among highly skilled students.

4.4 Robustness Checks

Given the policy relevance of the research question, further checks for robustness are useful. The first robustness check involves the construction of school incentive and accountability indexes because the previous dummy variables are likely to be highly correlated. The coding for the school incentive index is such that it takes a value 0 if the student's school has adopted none of the incentive measures, 1 if the school has adopted one incentive measure, 2 if the school has adopted two incentive measures, and 3 if the school has adopted all three incentive measures. Similarly, the school accountability index is 0 if the student's school has not adopted any of the accountability measures, 1 if the school has adopted one accountability measure, and 2 if the school has adopted both accountability measures. According to the quantile regression results in Appendix Table 1, however, there is no positive and statistically significant association between the indexes and greater skills in Jordan. Similarly, in the case of quantile regression results for Tunisia in Appendix Table 2, none of the index coefficients are statistically significant.

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A second set of robustness checks involves school-level rather than student-level analyses. For each school, the student and family characteristics are averaged. The quantile regression results for Jordan, presented in Appendix Table 3, show several cases of incentive and accountability measures being negatively associated with skills; by contrast, for the first time in this study, the ability to hire and fire teachers has positive and statistically significant associations among low quantiles for science and reading skills. The quantile regression results for Tunisia are presented in Appendix Table 4, which also shows several negative and statistically significant coefficients; the only positive and statistically significant association is between parental influence and reading skills in low quantiles.

To address the possibility that school incentive and accountability measures may work differently for private and public schools, another set of robustness checks attempted to separately analyze private and public school students. Of the 5125 students in the Jordanian sample, 14.1 percent attend private schools. In the Tunisian sample of 3037 students, just 1.4 percent attends private schools. The results of the analysis of private and public school students for both countries do not contradict the findings presented above.

5. Discussion

The OLS and quantile regression analyses and robustness tests indicate that the adoption of existing school incentive and accountability measures may

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not improve mathematics, science, and reading skills in Jordan and Tunisia. The quantile regression analyses show that such measures are not associated with better skills across the skills distribution (that is, from very low to very high skills) in Jordan; this lack of association suggests that the gap in skills within Jordan may not improve if more schools adopt existing types of school incentive and accountability measures. In Tunisia, however, there is some evidence that school accountability in the form of parental influence is associated with higher science and reading skills among low-skilled students; thus, the adoption of parental involvement measures may reduce the gap between less-skilled and highly skilled workers in Tunisia. The other coefficients for school incentive and accountability measures in Tunisia are either negative and statistically significant or statistically insignificant.

The lack of statistical evidence raises the question: Why is it that most existing school incentives and accountability measures are not contributing to better skills in Jordan and Tunisia? One possible explanation is that mostly ineffective schools are adopting school incentive and accountability measures. Another set of possible explanations is related to the design properties of the current school incentive and accountability measures in Jordan and Tunisia. The remainder of this section lists problematic design properties of pedagogical autonomy, school competition, freedom to hire and fire teachers, data posting, and

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parental influence, all of which may be contributing to ineffective skills development.

Problematic design properties with the incentive measure pedagogical autonomy include teachers not being extended autonomy (King and Özler, 1998; King, Özler, and Rawlings, 1999), and teachers being unable to obtain appropriate teaching materials (Heyneman, 1997). Furthermore, teachers and administrators may be confused about the extent of pedagogical autonomy, which in turn may compromise skills development. Further research on the existing design properties of pedagogical autonomy in Jordan and Tunisia is necessary to understand which, if any, of these reasons explain the lack of positive and statistically significant associations. Figlio and Ladd (2010) suggest that the lack of necessary resources, skills, and knowledge among administrators and teachers are perhaps the most important causes of ineffective school accountability and incentive systems.

A problematic design property of school competition depends on its connection with government funding (Belfield and Levin, 2003). If government funding for schools is unrelated or weakly related to enrollment, then schools facing competition may not enhance skills even if they lose students to competing schools. In contrast, if government funds follow students, schools have an incentive to develop skills. Further research on the nature of government funding for students in Jordan and Tunisia may explain why school competition is presently unrelated to higher skills.

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A problematic design property with schools being able to hire and fire teachers is that schools may have difficulty observing the activities of teachers behind closed classroom doors (Levin, 1995). Even if accurate monitoring methods were used, schools may be reluctant to hire or fire teachers because doing so hurts the morale and efforts of other teachers (Farrell, 1993).

Making performance data public may not improve skills if it causes schools and teachers to "teach to the test" and to deemphasize the skills valued by employers. Consequently, students may perform well on national exams but poorly on a test for which preparation is not possible, such as PISA. Other problematic design properties with making data publicly available are related to difficulties that parents may have with accessing and interpreting the data. For example, if data are made available over the internet and most parents do not have access to the internet, parents may be unable to take action to improve the manner in which schools impart skills. In addition, some parents may be illiterate and unable to read the data. Similarly, if data are posted in schools, some parents may be too busy or poor to visit schools. Moreover, parents may be aware of the data but feel that they are powerless to change schools. Finally, parents may be unable to rank schools meaningfully because the school performance data are volatile from year to year (Mizala et al., 2007).

A problematic design property with parental influence in schools is related to parental knowledge of school affairs. In particular, having parents engaged in

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decisions about school affairs may not improve skills if parents have little or no idea of what practices actually benefit students. Worse, parents may be a disruptive force and encourage schools to teach to the national test and not focus on the skills desired by employers. Nonetheless, this study provides modest evidence from Jordan and Tunisia that some schools have developed fruitful collaborations with parents.

6. Conclusion

This paper assessed a conceptually attractive but unproven school reform direction for Jordan and Tunisia: The establishment of school incentive and accountability measures. The results indicate that students in schools with incentive and accountability measures are on average no more skilled than students in schools without measures. Thus, schools with incentive and accountability measures are no more efficient than those without. In terms of equity, only parental influence in schools in Tunisia is associated with higher skills among low-skilled students. So can school incentives and accountability improve skills in Jordan and Tunisia? According to this study, not if existing types of school incentive and accountability measures are adopted.

This study does not imply, however, that school incentives and accountability measures cannot improve skills in Jordan and Tunisia. Rather, the findings of this study are consistent with the argument that only well-designed

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school incentives and accountability measures can improve skills (Carnoy and Loeb, 2002; Kane and Staiger, 2002; Ladd, 1999; Lockheed and Levin, 1993). As Deaton (2009) and Heckman (1992) have suggested, researchers have a valuable role to play by not only understanding *whether* school incentives and accountability work, but *how* they work.

A three-stage approach may be used for understanding how school incentives and accountability work and ensuring that they contribute to skills development in Jordan, Tunisia, and other MENA countries. In the first stage of school incentive- and accountability-based reform, fieldwork is required to understand the different design properties of pedagogical autonomy, school competition, teacher hiring and firing, data sharing, and parental influence measures in Jordan and Tunisia. In the second stage, researchers must conduct evaluations to identify effective design properties of incentive and accountability measures. The final stage of incentive- and accountability-based reform involves the implementation of the effective school incentive and accountability measures. Moreover, in the final stage, school input-based reform can be simultaneously pursued because effective incentive and accountability measures can ensure that additional inputs—such as facilities, books, supplies, and teachers—will not be wasted. The emerging literature from the U.S provides guidance on the design, evaluation, and implementation of efficient and equitable school incentive and accountability measures in MENA (for a review, see Figlio and Ladd, 2010).

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Table 1: Variable descriptions and descriptive statistics for student samples in Jordan and Tunisia

		Jordan	Tunisia
		Mean (SD)	Mean (SD)
Dependent variables			
Mathematics skills	Mathematics skills reflect understanding of space and shape; change and relationships; quantity; and uncertainty	395.1 (73.1)	372.0 (86.2)
Science skills	Science skills reflect the recognition and explanation of scientific phenomena, the understanding of scientific investigation and the interpretation of scientific evidence	432.8 (81.0)	391.5 (78.2)
Reading skills	Reading scores reflect the ability to retrieve, interpret, reflect, and evaluate different kinds of written text, ranging from prose to lists, graphs and diagrams	412.1 (81.7)	388.7 (89.7)
Incentive variables			
Pedagogical autonomy	=1 if school principal and teachers have "considerably responsibility" over its textbooks, course content, and the offered courses; =0 if the school governing board, central education authority, or both determine pedagogy	0.138 (0.345)	0.038 (0.192)
Faces competition	=1 if schools respond that there are one or more schools that compete for their students; =0 if there are no schools competing	0.559 (0.497)	0.494 (0.500)
Hire and fire teachers	=1 if principals, teachers, or the governing board has the ability to hire and fire teachers; =0 if the immediate education authority or central education authority makes these decisions	0.096 (0.294)	0.033 (0.180)
Accountability variables			

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Data for public	=1 if school publicly posts student achievement data; =0 if data is not publicly posted.	0.802 (0.398)	0.871 (0.336)
Parental influence	=1 if parents exert a direct influence on decision making about staffing, budgeting, instructional content, and assessment practices; =0 if parents are not directly involved.	0.056 (0.230)	0.009 (0.094)
N		5125	3037

Source: PISA 2006.
Notes: (i) Weighted means and standard deviations in parentheses.

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Table 2: OLS estimation results for students in Jordan and Tunisia

	Jordan	Tunisia
	Coef.	Coef.
	(SE)	(SE)
PANEL 1. Mathematics skills		
Pedagogical autonomy	-14.0**	-24.7
	(7.1)	(16.5)
Faces competition	-7.5	3.2
	(6.0)	(5.6)
Hire and fire teachers	17.6	-32.4**
	(15.2)	(8.2)
Data for public	9.9	4.2
	(6.8)	(7.2)
Parental influence	7.9	-19.3*
	(13.1)	(11.2)
Student, family, school controls	Yes	Yes
R-squared	0.233	0.491
N	5125	3037
PANEL 2. Science skills		
Pedagogical autonomy	-9.8	-34.6**
	(6.6)	(12.4)
Faces competition	-6.0	1.9
	(5.1)	(4.4)
Hire and fire teachers	13.8	-9.9*
	(13.9)	(5.3)
Data for public	2.5	-1.7
	(5.8)	(5.9)
Parental influence	12.9	5.0
	(10.0)	(11.5)
Student, family, school controls	Yes	Yes
R-squared	0.238	0.442
N	5125	3037
PANEL 3. Reading skills		
Pedagogical autonomy	-13.7*	-52.1
	(7.8)	(33.8)
Faces competition	0.5	7.0
	(5.6)	(5.6)
Hire and fire teachers	20.7	-4.4
	(20.1)	(11.7)
Data for public	3.7	0.5
	(7.0)	(6.7)
Parental influence	-1.2	25.6**
	(11.1)	(12.6)

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Student, family, school controls	Yes	Yes
R-squared	0.292	0.460
N	5125	3037

Source: PISA 2006.

Notes: (1) Standard errors in parentheses are obtained from Balanced Repeated Replicates (this is like bootstrapping except the resamples are pre-defined). (2) ** and * refer to statistical significance at the 5% level and 10% level respectively.

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Table 3: Quantile regression estimation results for students in Jordan

	Quantile				
	0.10 coef. (SE)	0.25 coef. (SE)	0.50 coef. (SE)	0.75 coef. (SE)	0.90 coef. (SE)
PANEL 1. Mathematics skills					
Pedagogical autonomy	-15.5	-14.8*	-11.8	-13.5	-12.7
	(12.9)	(8.5)	(8.6)	(9.5)	(9.8)
Faces competition	-4.1	-5.6	-5.7	-8.2	-8.7
	(7.6)	(6.0)	(6.5)	(7.8)	(7.8)
Hire and fire teachers	21.9	20.8	21.6	15.1	7.9
	(20.1)	(19.3)	(18.0)	(17.5)	(17.6)
Data for public	9.4	10.6	8.3	8.6	10.1
	(9.6)	(8.2)	(8.4)	(7.7)	(9.3)
Parental influence	-5.6	-2.9	4.2	8.6	18.4
	(15.3)	(15.7)	(16.0)	(7.7)	(13.4)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes
N	5125	5125	5125	5125	5125
PANEL 2. Science skills					
Pedagogical autonomy	-8.6	-6.7	-10.1	-11.7	-9.1
	(11.2)	(7.2)	(7.6)	(8.8)	(9.6)
Faces competition	-1.6	-2.8	-5.8	-5.9	-9.2
	(7.5)	(5.5)	(6.0)	(6.2)	(7.3)
Hire and fire teachers	13.2	13.8	18.6	9.2	2.1
	(19.9)	(16.0)	(19.4)	(16.6)	(15.2)
Data for public	1.2	-1.2	0.3	3.2	5.2
	(11.4)	(6.5)	(6.9)	(7.3)	(7.4)
Parental influence	-9.3	6.1	16.2	20.6**	20.0*
	(20.7)	(14.8)	(11.4)	(9.8)	(12.2)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes
N	5125	5125	5125	5125	5125
PANEL 3. Reading skills					
Pedagogical autonomy	-14.5	-12.9	-13.6	-12.5	-12.3
	(14.4)	(10.6)	(9.6)	(9.6)	(9.0)
Faces competition	0.1	1.9	2.5	1.6	-1.7
	(11.3)	(7.1)	(6.0)	(5.9)	(5.7)
Hire and fire teachers	40.6	25.6	17.2	14.6	10.0
	(27.7)	(26.5)	(21.5)	(18.4)	(19.6)

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Data for public	10.0	4.0	0.6	2.4	3.4
	(10.5)	(10.1)	(7.2)	(7.7)	(6.9)
Parental influence	-18.7	-7.4	0.1	4.8	9.4
	(22.1)	(16.5)	(13.8)	(11.1)	(10.5)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes
N	5125	5125	5125	5125	5125

Source: PISA 2006.

Notes: (1) Standard errors in parentheses are obtained from Balanced Repeated Replicates (this is like bootstrapping except the resamples are pre-defined). (2) ** and * refer to statistical significance at the 5% level and 10% level respectively.

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Table 4: Quantile regression estimation results for students in Tunisia

	Quantile				
	0.10	0.25	0.50	0.75	0.90
	coef.	coef.	coef.	coef.	coef.
	(SE)	(SE)	(SE)	(SE)	(SE)
PANEL 1. Mathematics skills					
Pedagogical autonomy	-20.2	-22.5	-25.2	-18.4	-16.3
	(32.3)	(29.2)	(20.3)	(16.4)	(19.8)
Faces competition	-3.1	1.0	5.0	7.9	5.3
	(8.5)	(6.8)	(6.1)	(7.0)	(7.9)
Hire and fire teachers	-33.9	-30.2**	-19.5	-30.5**	-40.3**
	(17.1)	(13.3)	(16.3)	(15.4)	(10.9)
Data for public	-0.2	0.5	4.3	7.5	-11.9
	(11.3)	(9.9)	(7.5)	(8.1)	(9.3)
Parental influence	2.3	-5.3	-23.5	-32.8**	-46.1**
	(22.2)	(17.1)	(18.1)	(16.2)	(19.3)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes
N	3037	3037	3037	3037	3037
PANEL 2. Science skills					
Pedagogical autonomy	-29.9	-31.7*	-31.6**	-32.3**	-36.0
	(20.0)	(18.2)	(14.7)	(14.2)	(15.7)
Faces competition	-2.1	-0.9	2.2	4.1	5.0
	(6.5)	(5.6)	(5.1)	(5.7)	(6.4)
Hire and fire teachers	-9.1	0.2	-3.8	-12.3	-17.3
	(15.9)	(10.3)	(8.8)	(12.1)	(13.0)
Data for public	-8.6	-3.9	-1.8	2.1	3.0
	(8.2)	(7.6)	(6.3)	(8.9)	(10.5)
Parental influence	30.7*	12.4	3.9	-3.5	-17.4
	(17.0)	(14.4)	(16.9)	(17.2)	(21.6)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes
N	3037	3037	3037	3037	3037
PANEL 3. Reading skills					
Pedagogical autonomy	-33.9	-39.8	-49.5	-42.8	-37.5
	(56.6)	(61.1)	(38.7)	(27.5)	(25.0)
Faces competition	4.9	4.5	5.6	8.0	8.6
	(7.8)	(7.7)	(6.6)	(6.8)	(7.9)
Hire and fire teachers	7.0	0.0	-9.0	-11.8	-11.3
	(33.4)	(13.5)	(18.4)	(14.6)	(10.7)
Data for public	-1.6	-2.1	-0.2	5.5	7.3
	(11.3)	(9.5)	(8.6)	(8.2)	(9.8)
Parental influence	53.6**	40.2	21.3	-4.8	-12.3
	(22.3)	(24.9)	(22.4)	(18.7)	(24.1)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes

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N	3037	3037	3037	3037	3037

Source: PISA 2006.
Notes: (1) Standard errors in parentheses are obtained from Balanced Repeated Replicates (this is like bootstrapping except the resamples are pre-defined). (2) ** and * refer to statistical significance at the 5% level and 10% level respectively.

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Appendix Table 1: Quantile regression and OLS estimation results for schools in Jordan—Index Approach

	Quantile					OLS
	0.10 coef. (SE)	0.25 coef. (SE)	0.50 coef. (SE)	0.75 coef. (SE)	0.90 coef. (SE)	Coef. (SE)
PANEL 1. Mathematics						
Incentives index	-3.33	-4.31	-2.68	-5.90	-7.62	-5.27
	(5.23)	(4.58)	(5.04)	(6.06)	(6.39)	(4.42)
Accountability index	5.77	7.69	7.33	9.71	11.13	9.33
	(9.78)	(8.44)	(8.34)	(7.59)	(8.91)	(7.19)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.230
N	5125	5125	5125	5125	5125	5125
PANEL 2. Science						
Incentives index	-1.81	0.52	-3.36	-4.68	-6.16	-3.74
	(5.16)	(6.39)	(4.85)	(5.34)	(5.57)	(3.95)
Accountability index	-0.98	0.55	4.59	7.15	8.77	4.85
	(9.82)	(6.40)	(6.30)	(7.02)	(6.66)	(5.75)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.235
N	5125	5125	5125	5125	5125	5125
PANEL 3. Reading						
Incentives index	2.50	1.08	0.21	-0.43	-2.13	2.37
	(8.78)	(5.31)	(4.84)	(5.89)	(5.34)	(1.53)
Accountability index	3.39	1.33	0.54	2.21	4.44	4.95**
	(9.77)	(9.40)	(6.81)	(6.61)	(6.41)	(2.10)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.305
N	5125	5125	5125	5125	5125	5125

Source: PISA 2006

Notes: (1) Standard errors in parentheses are obtained from Balanced Repeated Replicates (this is like bootstrapping except the resamples are pre-defined). (2) ** and * refer to statistical significance at the 5% level and 10% level respectively.

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Appendix Table 2: Quantile regression and OLS estimation results for students in Tunisia—Index Approach

	Quantile					OLS
	0.10 coef. (SE)	0.25 coef. (SE)	0.50 coef. (SE)	0.75 coef. (SE)	0.90 coef. (SE)	Coef. (SE)
PANEL 1. Mathematics						
Pedagogical autonomy	-5.61	-2.90	0.40	1.95	1.38	-1.54
	(6.97)	(6.89)	(6.07)	(6.49)	(7.48)	(5.35)
Faces competition	0.05	2.88	4.23	4.76	10.25	5.03
	(10.6)	(9.20)	(6.95)	(8.59)	(9.94)	(6.93)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.487
N	3037	3037	3037	3037	3037	3037
PANEL 2. Science						
Pedagogical autonomy	-6.36	-3.99	-2.45	-0.32	-0.15	-2.46
	(6.29)	(5.36)	(4.75)	(5.56)	(6.41)	(4.43)
Faces competition	-2.39	1.26	3.01	5.54	4.55	2.78
	(7.99)	(7.07)	(6.29)	(9.02)	(10.31)	(5.73)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.437
N	3037	3037	3037	3037	3037	3037
PANEL 3. Reading						
Pedagogical autonomy	1.61	0.42	0.74	3.39	5.62	-2.18
	(11.34)	(9.72)	(7.45)	(6.82)	(7.88)	(2.17)
Faces competition	3.54	6.92	8.94	9.50	12.13	8.90
	(12.21)	(9.90)	(7.79)	(7.05)	(9.69)	(2.99)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.507
N	3037	3037	3037	3037	3037	3037

Source: PISA 2006

Notes: (1) Standard errors in parentheses are obtained from Balanced Repeated Replicates (this is like bootstrapping except the resamples are pre-defined). (2) ** and * refer to statistical significance at the 5% level and 10% level respectively.

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Appendix Table 3: Quantile regression and OLS estimation results for schools in Jordan

	Quantile					OLS
	0.10 coef. (SE)	0.25 coef. (SE)	0.50 coef. (SE)	0.75 coef. (SE)	0.90 coef. (SE)	Coef. (SE)
PANEL 1. Mathematics						
Pedagogical autonomy	1.2	-10.3	-14.4	-10.6	-23.4*	-14.1*
	(12.9)	(7.2)	(10.8)	(7.2)	(13.6)	(8.3)
Faces competition	9.1	5.9	0.1	-11.1**	-31.9**	-8.8
	(11.9)	(5.4)	(6.9)	(5.2)	(10.0)	(5.5)
Fire teachers	5.7	-5.2	11.1	17.5	4.7	9.6
	(28.6)	(8.8)	(20.0)	(12.8)	(17.3)	(14.8)
Data for public	7.4	-5.2	2.2	0.4	-5.5	4.5
	(15.7)	(5.8)	(7.5)	(5.5)	(11.9)	(6.4)
Parental influence	-12.6	-3.6	1.8	0.3	29.8**	-0.1
	(15.3)	(8.9)	(12.4)	(8.0)	(13.2)	(10.9)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.561
N	188	188	188	188	188	188
PANEL 2. Science						
Pedagogical autonomy	-7.4	-8.8**	-10.9	-10.5**	-7.9	-9.7
	(13.1)	(4.4)	(8.0)	(5.3)	(18.7)	(8.4)
Faces competition	-2.4	-0.7	-2.7	-10.3**	-25.3	-8.2
	(9.6)	(3.2)	(6.0)	(4.8)	(15.7)	(5.4)
Fire teachers	18.2	13.8**	10.9	-8.6	-6.3	7.1
	(28.7)	(5.5)	(16.4)	(12.5)	(27.7)	(17.8)
Data for public	-3.2	-13.0**	-6.3	-6.6	1.1	-4.4
	(15.8)	(5.3)	(6.4)	(5.5)	(13.1)	(6.5)
Parental influence	-15.5	6.3	-2.7	11.1	23.2	7.0
	(11.8)	(4.8)	(8.7)	(9.5)	(13.9)	(10.3)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.582
N	188	188	188	188	188	188
PANEL 3. Reading						
Pedagogical autonomy	-20.4	-17.9*	-18.0*	-18.1**	-34.0**	-17.5*
	(26.5)	(10.1)	(9.4)	(6.9)	(10.4)	(9.5)
Faces competition	-20.4	-3.4	1.4	-3.2	-17.2	-5.5
	(16.8)	(5.9)	(6.0)	(6.0)	(10.8)	(6.4)
Fire teachers	65.2**	16.8	14.6	8.7	6.9	9.6

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	(32.1)	(16.6)	(17.8)	(14.3)	(17.0)	(16.4)
Data for public	16.2	6.9	5.6	1.4	11.4*	2.1
	(21.8)	(6.6)	(7.8)	(6.9)	(6.8)	(7.6)
Parental influence	-37.7	-3.9	-2.3	-0.7	12.8	-6.6
	(26.3)	(10.7)	(12.8)	(9.6)	(13.0)	(11.7)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.623
N	188	188	188	188	188	188

Source: PISA 2006

Notes: (1) Standard errors in parentheses are obtained from Balanced Repeated Replicates (this is like bootstrapping except the resamples are pre-defined). (2) ** and * refer to statistical significance at the 5% level and 10% level respectively.

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Appendix Table 4: Quantile regression and OLS estimation results for schools in Tunisia

	Quantile					OLS
	0.10 coef. (SE)	0.25 coef. (SE)	0.50 coef. (SE)	0.75 coef. (SE)	0.90 coef. (SE)	Coef. (SE)
PANEL 1. Mathematics						
Pedagogical autonomy	-17.8	-36.4	-5.9	-27.1	7.8	-23.2
	(63.8)	(40.0)	(25.5)	(28.6)	(42.5)	(14.9)
Faces competition	-6.3	1.1	2.3	1.2	-0.0	-0.6
	(48.8)	(22.2)	(10.3)	(11.2)	(21.9)	(5.9)
Fire teachers	-8.3	-17.8	-37.4**	-59.4**	-76.6*	-37.0
	(66.5)	(31.4)	(15.7)	(15.8)	(46.7)	(26.9)
Data for public	-0.7	3.6	-0.5	4.4	10.9	1.2
	(49.3)	(26.1)	(12.0)	(13.8)	(29.5)	(8.5)
Parental influence	13.0	-9.2	-8.2	-18.6	-28.0	-7.9
	(77.0)	(37.3)	(18.5)	(20.0)	(71.7)	(32.4)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.859
N	127	127	127	127	127	127
PANEL 2. Science						
Pedagogical autonomy	-29.8	-19.1	-36.1**	-29.9**	-26.9	-30.7**
	(27.6)	(12.3)	(9.5)	(11.7)	(27.5)	(11.7)
Faces competition	-3.0	8.6	5.1	1.6	-8.2	2.0
	(18.6)	(6.3)	(3.5)	(7.5)	(16.8)	(4.5)
Fire teachers	17.8	4.0	-11.2**	-27.1**	-40.7*	-9.1
	(22.8)	(9.0)	(4.9)	(7.6)	(23.5)	(20.0)
Data for public	-11.1	-6.2	0.6	-6.7	-8.2	-8.0
	(24.3)	(7.7)	(6.1)	(8.6)	(16.3)	(6.8)
Parental influence	43.5	17.7	16.0	7.7	4.8	14.9
	(32.6)	(13.1)	(10.4)	(12.4)	(25.9)	(25.2)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.880
N	127	127	127	127	127	127
PANEL 3. Reading						
Pedagogical autonomy	-69.5**	-1.7	-26.5**	-39.5*	-33.5	-11.4
	(30.6)	(26.5)	(9.7)	(21.7)	(43.8)	(20.6)
Faces competition	6.8	5.5	2.7	6.6	7.6	10.7
	(24.1)	(11.0)	(5.7)	(10.1)	(35.0)	(8.2)
Fire teachers	5.3	-1.7	-15.6	-34.9**	-44.8	-11.1
	(26.6)	(20.8)	(12.2)	(11.6)	(39.7)	(37.0)
Data for public	-8.6	-10.8	-8.4	1.7	9.2	-10.8
	(29.5)	(14.3)	(6.0)	(11.2)	(32.8	(11.9)
Parental influence	49.8	43.3**	45.4**	21.8	9.7	32.0

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	(34.8)	(19.7)	(9.6)	(17.3)	(75.4)	(45.2)
Student, family, school controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared						0.821
N	127	127	127	127	127	127

Source: PISA 2006

Notes: (1) Standard errors in parentheses are obtained from Balanced Repeated Replicates (this is like bootstrapping except the resamples are pre-defined). (2) ** and * refer to statistical significance at the 5% level and 10% level respectively.

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