



# Student background determinants of reading achievement in Italy. A quantile regression analysis



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## ABSTRACT

In recent years determinants of students' achievement has received much attention. Empirical studies have found that students' characteristics, family background, school attended, and regional residence are major factors affecting student performance. In this paper, we analyze the 2009 OECD-PISA (spell PISA) survey to examine individual background characteristics influencing the reading achievement of Italian 15 years-old students using the quantile regression (QR) approach. The QR approach allows researchers to analyze changes in size and direction of predictor estimates on student performance across the entire distribution of reading achievement scores. Results indicate significant effects of predictors on reading achievement operating differently across quantiles, suggesting different pathways to achievement for low and high performing readers. In particular, some family background predictors (parental education, computer availability at home, and availability of a desk for homework at home), the school program attended and, the region of student residence play important but differing role for low and high performing readers. For example, parental education shows a positive effect on student reading, academic (general) programs perform better than vocational or technical, and Northern regions perform better than Center-Southern ones, with differentiated effects along the distribution of students' reading scores. These findings should be carefully considered by policymakers when outlining strategies to enhance student performance at all levels along the reading continuum of low and high scores.

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## 1. Introduction

Education plays a key role in individuals' life chances and promotes the economic development of countries by enhancing productivity, social development, and reducing social inequality. Higher education is associated with markedly higher earnings, lower unemployment, higher labor force participation and lower criminality; where a high performing educational system is taken to be fundamental in achieving national economic competitiveness (OECD, 2012; Hanushek and Luque, 2003). Due to the technological progress, rising skill demands have made qualifications at the upper secondary level of education (general, technical or vocational) the minimum credential for successful labor market entry (Rangvid, 2003).

The goal of education has shifted its emphasis from the collection and memorization of information only, to the inclusion of a broader concept of knowledge. The meaning of "knowing" has

shifted from being able to remember information, to being able to find and use it (Simon, 2000). The ability to access, understand and reflect on all kinds of information is essential if individuals are able to participate fully in our knowledge-based society. More specifically, reading literacy is considered an essential skill for future literacy and it is about understanding, using, reflecting on and engaging with written texts, in order to achieve one's goals, to develop knowledge needed to participate in society. Reading literacy includes a wide range of cognitive competencies, from basic decoding, to knowledge of words, grammar and larger linguistic and textual structures and features, to knowledge about the world (OECD, 2010, 2011).

Reading achievement is not only a bedrock for achievement in other subject areas within the educational system, but also a prerequisite for successful participation in most areas of adult life (Cunningham and Stanovich, 1998; Smith et al., 2000). Similarly, reading skills are essential to the academic achievement of middle- and high-school students (Holloway, 1999). Furthermore, reading literacy provides access to modern social institutions and has an impact on cognition, or thinking processes as it also shapes the way in which we think (Kern et al., 2008; Olson, 1977; Pretorius, 2000). Assessing the reading literacy of students, therefore, focuses

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on reading literacy skills that include finding, selecting, interpreting and evaluating information from the full range of texts associated with real life situations that reach beyond the classroom (OECD, 2011).

But, what makes a student or a school system successful in terms of literacy or competence? Many studies have analyzed the determinants of students' achievement using the standard regression methods based on the Ordinary Least Squares (OLS) to estimate the effect of predictor variables on the students' achievement measured, usually, as a test score in mathematic, sciences or reading. Since OLS estimators show the effect of predictor variables at one point of the distribution of the dependent variable (the conditional mean) the information gathered by OLS regression is limited to this specific point of the distribution. In terms of achievement this can lead to incomplete findings when the effects of predictors vary at points along the distribution, i.e. at different quantiles.

This analysis identifies individual background determinants of reading success using the last PISA 2009 survey through a quantile regression (QR) approach. QR allows us to describe the effect of predictor variables along the entire students' achievement scores distribution, when educators are interested in assessing the uniformity of changes by predictor influencing the entire range of reading skills. In particular, the investigator aims to identify which variables affect the lower part of the distribution (below the median value) and on the opposite the upper part (above the median). This is done by calculating coefficient estimates at various quantiles of the conditional distributions. The article is divided as it follows: Section 2 contains a review on typical findings in international research including evidence on social background factors predicting achievement especially in Italy. Section 3 describes the QR method, while Section 4 details the data, which is analyzed in Section 5. Section 6 reports conclusions and implications.

## 2. Review

Education affects the individuals' life as it shapes their capabilities, values, aspirations and desires. It allows individuals to think, feel and act in different ways, enables new ways of organizing and supporting social action that depend on numeracy and literacy, technologies of communication and abstract thinking skills and, at the same time, societies use educational access and attainment as a primary mechanism to sort and select future generations into different social and economic roles (Lewin, 2007). These educational experiences in achievement have implications for social policies in more advanced economies, where active social policies focus on integrating people into the labor market through education that ensures disadvantaged regions and students are not left behind in the quest for success (OECD, 2012). The key role of education in the social and economic policies highlights the need to monitor student achievement.

Since the 1990s, major international student achievement surveys have sought to quantify student performances in different fields of knowledge by comparing different educational systems worldwide. These include: (i) the International Adult Literacy Survey (IALS) carried out in three editions (1994, 1996 and 1998) by the Organization for Economic Cooperation and Development (OECD) and Statistics Canada; (ii) the Trends in Maths and Science Study (TIMSS) (1995, 1999, 2003, 2007, 2008 and 2011) and the Progress in International Reading Literacy Study (PIRLS) (2001, 2006 and 2011), both conducted by the International Association for the Evaluation of Educational Achievement (IEA).

Since the year 2000, the OECD carried out the Program for International Student Assessment (PISA). It is administered every three years to provide comparisons of students' achievement among the participating countries; it has completed in 2012 its fourth round. To date, PISA 2009 offers together with the IEA-PIRLS

survey the most comprehensive and rigorous international measurement of student reading skills.

PISA collects information on all three areas of competencies (mathematics, reading and science) in terms of test scores, with a focus on one of the three competencies every three years (in PISA 2009 the focus is on reading literacy for which sub-scores have been provided), unlike the IEA surveys that collect information in reading literacy (PIRLS) and mathematics and science literacy (TIMSS) separately. Both PIRLS and PISA are sample surveys, but their sampling design is quite different. The PIRLS survey is administered to a sample of students formed by one or two whole classes in each school selected, while the PISA test is administered to a group of students who attend the school sampled without taking into account the class group. The choice made by the PIRLS survey allows to focus more attention on the class and, therefore, on the relationship between the taught and learned curriculum. The PISA survey, focuses more attention on the effective level of achievement gained by the students regardless the content of teaching received, as students are randomly selected for each school selected; thereby the classroom effect is got over. Furthermore, although vocational students are not exposed in depth to the kind of formal knowledge taught in academic programs and to a lesser extent in technical and vocational tracks, PISA considers student knowledge in relation to students' ability to reflect on their knowledge and experience and to apply them to real world issues. Both surveys cover a wide range of domains pertaining the assessment of the student reading literacy. To keep to a minimum the assessment burden on each student and in order to avoid that the scaling of achievement would be influenced by the "booklet effect" each student is asked to cope with only part of the assessment following a systematic booklet assembly and rotation procedure. Furthermore, TIMSS assesses mathematics and science achievement at fourth and eighth grade levels, the target population for PIRLS are students enrolled at the fourth grade, while PISA targets 15-year-old students, thus allowing comparisons of competency levels useful in adult life and labor market participation both within and across national education system.

Recently, Hanushek and Woessman (2010) review the economic literature on international differences in educational achievement reporting the main findings of contributions that have analyzed TIMSS and PISA surveys over decades. Because PISA survey cover the most educational systems, its results are reported frequently across a wide range of educational topics. For example, Brunello and Rocco (2013) use aggregate PISA data for 19 countries over the period 2000–2009 to study whether a higher share of immigrant pupils affects the school performance of natives; Bulut et al. (2012), analyzing PISA 2009 data for Turkish students through a structural equation modeling, focus on the relationship between reading scores and the use of technology for reading; Fonseca et al. (2011) compare Portuguese students' performance in PISA 2006 scientific literacy with those of some others OECD countries; Martins and Veiga (2010) using PISA 2003 data evaluate socioeconomic-related inequalities in students' math achievement in 15 EU countries, investigate their main causes and analyze differences between countries; Beese and Liang (2010) use the PISA 2006 data to investigate how school resources indicators (such as teacher qualifications, school facilities, and school type) as well as student level variables (such as socioeconomic status and family resources) affect the literacy in science in United States, Canada and Finland; Bybee et al. (2009) highlight the importance of PISA 2006 about information for the science education community; Suggate (2009) analyses the relationship between reading achievement and the early reading instruction controlling for social and economic differences using PISA 2006.

Worldwide, a broad literature in the field of education and economics is aimed at investigating the determinants of student

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