Using PIRLS Data to Measure Equity in Reading Achievement Across Countries

Kathleen L. Trong, TIMSS & PIRLS International Study Center, trong@bc.edu

Abstract

An approach to measuring equity in reading achievement between student groups is presented, using data from PIRLS 2006. Relative risk ratios are used to compare how likely students with various characteristics were to score in the bottom 20 percent of their country's distribution of achievement. Additionally, to indicate the extent of the problem, these ratios are weighted by the percentage of students possessing the characteristic to provide an estimated size of the group at risk in each country. Results suggest that boys, students attending rural schools, and students whose parents have less than a secondary education are at particular risk for low achievement in a wide range of countries. The results from this study provide countries that participated in PIRLS 2006 information about the equity of their educational systems and can be useful in targeting groups of students that would benefit from special assistance, within and across countries.

Keywords: *equity, reading achievement, relative risk ratios*

Introduction

Inequities in educational resources and outcomes exist, to some degree, in every country around the world. If not addressed, these inequities can exacerbate disparities between social groups, impacting life situations ranging from health to the labor market. As the amount and quality of data on education continues to grow, there are increasing efforts to measure equity in education and monitor efforts toward equity goals.

This research used data from the 2006 cycle of the International Association for the Evaluation of Educational Achievement's (IEA's) Progress in International Reading Literacy Study (PIRLS 2006) to explore an approach to measuring equity in reading achievement across countries, focusing on students with low achievement. The technique utilized was the relative risk ratio. The focus on reading achievement as a basis for a study of inequity was considered particularly appropriate in light of literacy's integral role as a basic skill that is universally valued in education and critical to further success in school and in life.

Historically, education systems have struggled to address the needs of all citizens in an

equitable manner. This problem persists today, with less than 60 percent of adults attaining literacy in many developing countries (World Bank, 2005), and research suggesting that, in some countries, gaps in educational attainment between the most and least advantaged are growing (OECD, 2001).

Importance of Education and Literacy

Inequities related to education and literacy are worth special attention, as these are intrinsically related to individual and societal success. Research has found that educational attainment and reading literacy are related to a range of positive outcomes, including increased earnings (Green & Riddell, 2001) and decreased likelihood of unemployment for individuals (OECD, 2000; Lamb, 1997). Negative outcomes associated with a lack of literacy skills include dropping out of high school and dependence on social welfare programs (Berlin & Sum, 1988). At the societal level, countries with greater literacy skills have higher gross domestic products (GDP) and higher income per capita, and those with lesser inequality in literacy have lesser inequality in the distribution of incomes (OECD & Statistics Canada, 2000). In addition to these economic benefits, research suggests a number of social outcomes are related to literacy and education, including better health for oneself and one's family, increased volunteering, and decreased criminal activity (Wolfe & Haveman, 2001).

IEA's Progress in International Reading Literacy Study (PIRLS)

This research is based on data from PIRLS 2006. Inaugurated in 2001, PIRLS is an international study of trends in fourth-grade student reading achievement that is conducted on a five-year cycle. PIRLS uses nationally representative samples of students to measure reading literacy at the fourth grade, allowing for generalizations at the country level and cross-country comparisons. In addition, PIRLS gathers information about factors that influence reading achievement from students, parents, teachers, schools, and ministries of education. PIRLS 2006 was the second cycle in the PIRLS study, and had 40 participating countries (Mullis, Martin, Kennedy, & Foy, 2007), including the two educational systems of Belgium[1].

Fourth grade students are tested in PIRLS because that is the stage in most educational

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1 In PIRLS 2006, the five Canadian provinces of Alberta, British Columbia, Ontario, Quebec, and Nova Scotia worked with IEA procedurally and financially so that they could be reported separately but not collectively as a country in the *PIRLS 2006 International Report*. However, because these provinces represent 88 percent of the student population in Canada, the data for Canada have been combined for the purposes of this research.

systems when there is a transition from learning to read to reading to learn. Students at this age are expected to apply basic reading skills to texts and use them to accomplish tasks. PIRLS defines reading literacy as:

> the ability to understand and use those written language forms required by society and/or valued by the individual. Young readers can construct meaning from a variety of texts. They read to learn, to participate in communities of readers in school and everyday life, and for enjoyment (Mullis, Kennedy, Martin, & Sainsbury, 2006, p. 3).

Students' progress toward attaining this inclusive definition is measured in an ambitious assessment of reading comprehension, including more than six hours of testing time, and an extensive collection background data.

Purpose of Study

The purpose of this research is to provide an approach to measuring equity between student groups in reading achievement internationally, presented in a manner that is easily interpretable for policymakers and the general public. Ultimately, this research will provide countries that participated in PIRLS 2006 information about the level of equity in their education systems. It may also provide a model for how future IEA studies can provide information about progress toward equity. For the PIRLS 2006 countries, this study addressed the following research questions.

- What is the risk of performing at or below the national 20th percentile associated with student characteristics of interest?
- How many students in each country possess one or more of these characteristics of interest?

Methodology

Relative Risk Ratios

These research questions are addressed using relative risk ratios. Relative risk ratios (RR) are traditionally used in epidemiological research to explore the relationship between background characteristics and a health outcome. It has been considered the "gold standard among measures of association for many years" in this field (Benichou & Palta, 2005, p. 113). A common example is the relationship between receiving a treatment (vs. placebo) and illness (vs. health). When applied to PIRLS data, this becomes the relationship between having a particular background characteristic such as being male (vs. female) and scoring below a

particular threshold on the PIRLS assessment (vs. scoring at or above that threshold). Using these dichotomous factors, RR is calculated in the following way.

$$RR = \frac{P_1}{P_0}$$

In this equation, P_1 is the percentage of students with the characteristic of interest who are low achievers and P_0 is the percentage of students without this characteristic who are low achievers. As explained in a later section, low achievement was defined as scoring at or below the 20th percentile within each country. The resulting ratio expresses the strength of the relationship between these two variables. If there is no relationship, then the RR is 1, indicating that students with the characteristic are equally as likely as their peers to be low achievers. Numbers greater than 1 indicate an increased risk of low achievement, and numbers between 0 and 1 indicate a lesser risk. For example, a RR of 2 means students possessing the characteristic in question are twice as likely as students without the characteristic to be low achievers. Conversely, a RR of .5 indicates that students are 50 percent less likely to be low achievers.

Relative risk ratios were selected because they are a concise representation of the relationship between low achievement and background characteristics, with a meaningful and intuitive interpretation. Since they rely on a dichotomous outcome (e.g., low achievement vs. non-low achievement), they can be applied to achievement scale scores that do not possess an absolute zero, which is the case in PIRLS.

While the relative risk ratio is a useful indicator of the relationship between a student characteristic and low achievement, it does not provide information about the size of the group at risk. With the exception of gender which is approximately 50/50, this is a limitation because the extent or severity of the problem for the country and the policy implications for addressing equity issues may vary greatly depending upon the size of the group in question.

Therefore, to augment the relative risk ratio, the percentage of students with the characteristic of interest was also calculated. To give a general sense of the achievement equity in relation to the size of that group, for relative risks greater than 1 the risk ratios were weighted by the percentage of students possessing the characteristic of interest in the following way, where *P* is the percentage of students in the overall population with the characteristic of interest.

$$WeightedRR = (RR - 1)(P)$$

Weighting the relative risk in this manner allows one to make a rough comparison between situations in which a small proportion of students are at a high risk for low achievement and

those in which a substantial proportion of students have a slightly elevated risk. This weighted number increases as relative risk and the size of the group of interest grows. However, it is not intended to replace the relative risk ratio—it is merely meant to provide some context to aid in interpretation and comparisons.

Defining Low Achievement

For these analyses, low achievement was defined as scoring at or below the 20th percentile within each country. This is useful in helping countries identify equity issues within their national context and to focus on those students at the lower end of their achievement distribution. This definition recognizes that countries have varying levels of resources, and can be useful in identifying risk factors impacting equity in a particular context.

Student Characteristics of Interest

The relative risk of low achievement was calculated for various student characteristics. Characteristics were chosen that have been shown by past research to be related to reading achievement (Mullis, Martin, Kennedy, & Foy, 2007). Additionally, they are often associated with identifiable subpopulations of students who may be more easily targeted by policy reform. Essentially, the purpose of these analyses was to identify student groups impacted by inequity and the extent to which the severity of the problem varies across countries. This provides information about equity for the international community, and is intended to help countries identify where they might focus their efforts in assisting students.

The relative risk of being a low achiever was calculated for the following student characteristics: gender, school location (i.e., urban/rural), parental education, and language spoken at home. For each of these factors, the characteristic generally associated with lower achievement was used as the 'at risk' group, with the exception of school location where both urban and rural schools were examined. Therefore, the relative risk of being a low achiever for boys, students attending an urban or rural school, students with parents with less than secondary education, and students speaking a language other than the language of the test were each examined. The variables used to identify students with these characteristics are described in Exhibit 1, and the relevant response categories as they were analyzed.

(Take in Exhibit 1 about here)

Since these student characteristics are not mutually exclusive (with the exception of attending an urban or rural school), the extent to which students belonged to multiple groups of interest was also examined, as well as the relative risk of low achievement associated with these combinations (e.g., the relative risk for boys attending urban schools). This provides

additional information about the state of equity for a particular population, and would be useful in determining the best way to improve the situations of these students.

However, as more characteristics are considered simultaneously, the number of students can become quite small, resulting in imprecise analyses and large standard errors. Therefore, characteristic combinations were limited to those that pertained to at least 15 percent of students internationally. Using this criterion, the following combinations of student characteristics were examined.

- Boys whose parents have less than a secondary education
- Boys attending rural schools
- Boys attending urban schools
- Students attending rural schools whose parents have less than a secondary education

Findings and Discussion

Students Whose Parents Have Less than a Secondary Education

Exhibit 2 presents the relative risk ratios and weighted relative risk for students whose parents have less than a secondary education. Of the student characteristics examined, those students whose parents lacked a formal education were most consistently at inequitable risk for low achievement. In 39 countries, these students were at a significantly higher risk of being in the bottom 20 percent of their country's achievement distribution. That is, the relative risk was significantly greater than 1 for these students. In 33 countries, students in this situation are at least twice as likely to be low achievers compared to their peers. Students in this situation in Iran (RR=4.18), Indonesia (RR=2.75), and Morocco (RR=2.33) stand out in particular. In these countries, a high relative risk is combined with a large proportion (over 60 percent) of students whose parents have less than secondary education. The extreme inequity related to students' family background provides a strong argument for promoting completion of secondary school in addition to providing additional support for students in this 'at risk' group.

(Take in Exhibit 2 about here)

Boys

Exhibit 3 presents the relative risk ratios for boys, who had a significantly higher risk than girls of low achievement in the majority of countries. The weighted relative risk is not

shown because boys comprise approximately half of the student population in each country. Boys were significantly more likely than girls to be in the bottom 20 percent of their country's achievement in 35 countries, demonstrating pervasive gender differences at the lower end of the achievement distribution. However, there is quite a range of the degree of risk. Boys in Kuwait (RR=2.84), Qatar (RR=1.95), and Trinidad and Tobago (RR=1.68) were at the highest risk of low achievement as compared to girls. Boys in Germany (RR=1.06) and Luxembourg (RR=1.04) were the least likely to be low achievers more frequently than girls. While the risk associated with gender may seem small in many countries compared to some other characteristics, the fact that roughly half the students in every country belong to the 'at risk' group makes this a serious equity concern.

(Take in Exhibit 3 about here)

Students Attending Rural Schools

Exhibit 4 presents the relative risk ratios and weighted relative risk for students attending rural schools. Attending a rural school was associated with a significantly higher risk of low achievement in a large number (21) of PIRLS countries. Those with the highest weighted risk were South Africa (96.8) and Indonesia (95.7). However, there were six additional countries with a relative risk larger than two for students in rural schools (Iran, Romania, Morocco, Israel, the Russian Federation, and Macedonia). In each of these eight countries, at least 30 percent of students attend rural schools.

(Take in Exhibit 4 about here)

Students Attending Urban Schools

Although students in rural schools tend to have the lowest reading achievement in a number of PIRLS 2006 countries, the pattern or achievement in relation to the school location (i.e., rural, urban, suburban) is country specific. In some PIRLS 2006 countries, it is students in the urban schools with the lowest achievement. Exhibit 5 presents the relative risk ratios and weighted relative risk for students attending urban schools. This group had an increased risk of low achievement in six of the PIRLS countries. Of these, England (52.4), Germany (28.2), Austria and French Belgium (15.0) had relatively large weighted risks (11.0 or higher). It is particularly important to note that in each of the six countries, urban students make up a substantial portion of the population, ranging from 25 percent in the United States to nearly half in Canada, England, and French Belgium. The large number of students in the 'at risk' group suggests that this is an important issue for those countries.

(Take in Exhibit 5 about here)

Students Who Do Not Speak the Language of the Test

Exhibit 6 presents the relative risk ratios and weighted relative risk for students who did not speak the language of the test before starting primary school. This characteristic was strongly associated with low achievement in a number of countries—34 PIRLS countries had a relative risk significantly greater than 1. Language is particularly important in Luxembourg (WeightedRR=41.1) and Iran (WeightedRR=38.1), where there is a substantial relative risk and a large number of students with that characteristic. However, there are a number of countries where these students have elevated risk but the percentage of students is fairly small, so that efforts to assist this group could be very focused. Countries with a relative risk of 2 or higher with the at-risk group comprising less than 10 percent of the population include Germany, England, the Slovak Republic, Chinese Taipei, Sweden, Norway, Slovenia, Latvia, and Hungary.

There appears to be less inequity associated with speaking other languages in the home once a child has begun school. Exhibit 7 presents the relative risk ratios and weighted relative risk for students who reported speaking the language of the test at home sometimes or never. These students were more likely to be low achievers in 18 PIRLS countries. Those with the highest weighted risk include Iran (58.9), Germany (37.4), Singapore (33.8), and Austria (32.7). These countries included a range of situations, from Singapore where the relative risk was only 1.43 but pertained to nearly 79 percent of students, to Austria where these students were more than twice as likely to be low achievers, but the group was somewhat smaller (26.2 percent of students). The combination of Exhibits 6 and 7 suggests that exposure to the language of schooling at a young age is important, but not necessarily to the exclusion of other languages in the home.

(Take in Exhibits 6 and 7 about here)

While examining student characteristics is a useful way to identify groups in inequitable situations, it is also important to recognize that students may possess more than one of these risk factors. The following results present the relative risk for students with multiple risk factors.

Boys Whose Parents Have Less than a Secondary Education

Exhibit 8 presents the relative risk ratios and weighted relative risk for boys whose parents have less than a secondary education. Of all combinations of characteristics that were examined, boys whose parents have little formal education are at increased risk of low achievement in the largest number (36) of countries. Fortunately, in the majority of countries, less than 10 percent of students are in this situation, so that efforts to remedy these inequities

can be concentrated on a relatively small group. Countries with the largest weighted relative risk for these students include Indonesia (27.4), Iran (25.6), and Romania (22.3).

One should note that in this combination of characteristics the students of interest represent about half of the original group of students whose parents have less than a secondary education, as is always the case when examining gender and another characteristic simultaneously. Because of this, the relative risk in many countries are similar to those seen in Exhibit 2, which examined all students whose parents have low levels of education. However, there are exceptions. In Slovenia, for example, students whose parents have little education had a relative risk of 2.85, and boys' relative risk low achievement was 1.56. Therefore, one might expect that students with both characteristics would have a relative risk close to, or perhaps lower than, 2.85. Instead, the relative risk for these students escalates to 3.12. This interaction suggests that this group deserves particular attention in Slovenia.

(Take in Exhibit 8 about here)

Boys Attending Rural Schools

Exhibit 9 presents the relative risk ratios and weighted relative risk for boys who attend rural schools, who were more likely to be low achievers in the majority of PIRLS countries. Twenty-seven countries had a higher relative risk associated with these characteristics, while only three countries (Germany, French Belgium, and England) had a relatively lower risk for boys in rural schools. The multiplicative effect of two risk factors can also be seen in this scenario. For instance, boys in Hong Kong SAR had a relative risk of 1.32, and students in rural schools had a relative risk of 1.75, but the combination of these characteristics elevates relative risk to 2.02, making these students more than twice as likely as their peers to be low achievers. In twenty-two of the countries where rural boys were at a significant risk they comprise over 10 percent of the student population, making this a substantial group of students potentially at risk for achievement inequity.

(Take in Exhibit 9 about here)

Boys Attending Urban Schools

Exhibit 10 presents the relative risk ratios and weighted relative risk for boys who attend urban schools, showing that these students are more likely to be low achievers in 10 of the PIRLS 2006 countries. Of these, the weighted relative risk was highest in England (11.2), the United States (7.9), and Scotland (6.8). In those countries where attending a school in an urban location was related to increased risk, the combination of also being a boy exacerbated inequity. For example, in the United States boys had a relative risk of 1.30 and students in

urban schools had a relative risk of 1.48; however, students possessing both of these characteristics have a relative risk of 1.60--increasing their likelihood of low achievement.

(Take in Exhibit 10 about here)

Students Attending Rural Schools Whose Parents Have Less than a Secondary Education

Exhibit 11 presents the relative risk ratios and weighted relative risk for students attending rural schools whose parents have less than a secondary education. This combination of characteristics put students at significant risk in 23 of the PIRLS countries. Countries with the highest weighted relative risk were Indonesia (58.7), Iran (48.1), and Romania (35.7). In several countries, though the percentage of students in this situation was small, the relative risk was quite large, reaching 4.24 in the Slovak Republic (affecting 3.5 percent of students) and 3.30 in the Russian Federation (affecting 3 percent of students).

(Take in Exhibit 11 about here)

Conclusion and Implications

These analyses provide an approach to measuring equity internationally that is easily accessible and interpretable. Relative risk ratios can be used to identify the degree to which various student groups are at risk for low achievement, or to examine various groups within a particular context. The results of this study show that having parents with little formal education, being a boy, attending a rural school, or not speaking the language of the test before starting school was associated with a high risk for low achievement in a large number of PIRLS countries. Combinations of these characteristics with other factors typically intensified the likelihood that students would be in the bottom 20 percent of their country's achievement. Attending an urban school or speaking a language other than the language of the test at home was associated with low achievement in a smaller number of countries. However, the severity of the risk and the size of the 'at risk' group varied considerably across countries.

Patterns also emerged across the student characteristics that were examined, with some countries tending to have more inequity than others. When examining the relative risk for the six student characteristics individually, several countries were among those with the five highest weighted relative risks (or relative risk, when considering gender) multiple times. Iran was among the five countries with the highest weighted relative risk for four characteristics, while French Belgium, Morocco, and Austria were for three characteristics. Additionally, Luxembourg, Germany, Indonesia, and Romania were among the countries with students groups at the highest weighted risk for two characteristics.

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Exhibit 1. Student Characteristic Variables

Student Characteristic	Data Provided By	Item Text	Analysis Categories
Gender	Student	Are you a boy or a girl?	Boy / Girl
School Location	School Principal	Where is your school located?	Rural / Urban or Suburban
			Urban / Rural or Suburban
Parental Education	Parents	Derived variable that reports highest level of education for either Parent based on: What is the highest level of education completed by the child's mother/ stepmother/female guardian? and What is the highest level of education completed by the child's father/stepfather/male guardian?	Less than upper-secondary education / At least upper-secondary education
Language Spoken at Home	Student	Did you speak <language of test> before you started school?	Yes / No
		How often do you speak <language of test> at home?	Always / Sometimes or Never

Exhibit 2. Relative Risk for Students Whose Parents Have Less than Secondary Education

COUNTRY	Relative Risk of Being in Bottom 20%			
	Weighted Relative Risk	Relative Risk		Percent of Students
IRAN, ISLAMIC REP. OF	206,3	4,18 (0,57)	h	64,8
INDONESIA	114,7	2,75 (0,35)	h	65,6
MOROCCO	104,6	2,33 (0,42)	h	78,6
LUXEMBOURG	83,4	2,92 (0,21)	h	43,5
ROMANIA	72,1	3,49 (0,43)	h	29,0
POLAND	71,3	2,84 (0,24)	h	38,8
MACEDONIA, REP. OF	70,5	3,96 (0,36)	h	23,8
GERMANY	67,5	2,89 (0,27)	h	35,7
SPAIN	48,0	2,56 (0,30)	h	30,8
ITALY	40,4	2,18 (0,20)	h	34,1
ENGLAND	39,7	3,26 (0,46)	h	17,6
ISRAEL	39,4	4,45 (0,48)	h	11,4
SOUTH AFRICA	37,6	1,92 (0,15)	h	41,0
MOLDOVA, REP. OF	35,2	1,81 (0,18)	h	43,6
TRINIDAD AND TOBAGO	34,5	2,32 (0,22)	h	26,1
HUNGARY	33,8	3,69 (0,40)	h	12,6
SINGAPORE	31,7	2,70 (0,16)	h	18,7
BELGIUM (FRENCH)	27,1	2,45 (0,21)	h	18,7
BULGARIA	26,7	2,32 (0,31)	h	20,2
QATAR	25,5	2,09 (0,13)	h	23,4
SLOVAK REPUBLIC	21,4	4,62 (0,44)	h	5,9
BELGIUM (FLEMISH)	21,1	2,79 (0,23)	h	11,8
NETHERLANDS	19,4	2,21 (0,24)	h	16,1
HONG KONG SAR	19,4	1,57 (0,13)	h	33,8
NEW ZEALAND	18,0	2,82 (0,29)	h	9,9
SCOTLAND	17,9	2,19 (0,37)	h	15,1
FRANCE	16,3	2,24 (0,21)	h	13,2
DENMARK	13,8	2,27 (0,23)	h	10,9
ICELAND	13,0	2,20 (0,21)	h	10,8
KUWAIT	12,7	1,66 (0,16)	h	19,1
SWEDEN	11,1	2,58 (0,28)	h	7,0
SLOVENIA	11,1	2,85 (0,21)	h	6,0
AUSTRIA	9,5	3,02 (0,25)	h	4,7
RUSSIAN FEDERATION	9,5	3,11 (0,35)	h	4,5
CHINESE TAIPEI	6,3	2,35 (0,17)	h	4,7
NORWAY	6,0	2,50 (0,31)	h	4,0
LATVIA	5,3	2,09 (0,33)	h	4,9
CANADA	4,4	1,90 (0,18)	h	4,9
LITHUANIA	3,2	1,94 (0,27)	h	3,4
GEORGIA	2,7	1,65 (0,44)		4,2
UNITED STATES	-	- -	-	-

h Indicates risk significantly greater than 1

\- Indicates data not available

Exhibit 3. Relative Risk for Boys

COUNTRY	Relative Risk of Being in Bottom 20%		
	Relative Risk		Percent of Students
KUWAIT	2,84 (0,33)	h	50,4
QATAR	1,95 (0,10)	h	50,4
TRINIDAD AND TOBAGO	1,68 (0,15)	h	50,4
NEW ZEALAND	1,67 (0,10)	h	50,8
LATVIA	1,63 (0,14)	h	51,8
ICELAND	1,60 (0,11)	h	50,3
SOUTH AFRICA	1,60 (0,08)	h	48,4
SLOVENIA	1,56 (0,10)	h	51,9
LITHUANIA	1,55 (0,11)	h	51,2
NORWAY	1,53 (0,13)	h	50,6
INDONESIA	1,49 (0,12)	h	50,9
SWEDEN	1,46 (0,11)	h	52,2
SINGAPORE	1,45 (0,08)	h	51,8
RUSSIAN FEDERATION	1,44 (0,10)	h	49,2
SCOTLAND	1,42 (0,14)	h	49,1
GEORGIA	1,42 (0,11)	h	51,9
BULGARIA	1,41 (0,14)	h	50,6
CHINESE TAIPEI	1,39 (0,08)	h	50,5
POLAND	1,39 (0,10)	h	48,6
MOLDOVA, REP. OF	1,38 (0,09)	h	50,4
SLOVAK REPUBLIC	1,36 (0,10)	h	51,2
CANADA	1,34 (0,06)	h	50,9
FRANCE	1,33 (0,08)	h	51,4
MACEDONIA, REP. OF	1,32 (0,10)	h	51,2
HONG KONG SAR	1,32 (0,08)	h	51,3
ROMANIA	1,31 (0,10)	h	52,0
MOROCCO	1,31 (0,12)	h	52,6
UNITED STATES	1,30 (0,09)	h	49,4
ENGLAND	1,28 (0,08)	h	50,4
BELGIUM (FLEMISH)	1,27 (0,09)	h	50,0
ISRAEL	1,27 (0,09)	h	51,6
DENMARK	1,25 (0,11)	h	48,6
IRAN, ISLAMIC REP. OF	1,23 (0,15)		53,6
AUSTRIA	1,23 (0,08)	h	50,5
NETHERLANDS	1,20 (0,08)	h	49,1
ITALY	1,16 (0,09)		51,5
SPAIN	1,15 (0,08)		50,7
BELGIUM (FRENCH)	1,15 (0,07)	h	50,3
HUNGARY	1,14 (0,09)		49,6
GERMANY	1,06 (0,08)		50,8
LUXEMBOURG	1,04 (0,05)		50,8

h Indicates risk significantly greater than 1

Exhibit 4. Relative Risk for Students Attending Rural Schools

COUNTRY	Relative Risk of Being in Bottom 20%			
	Weighted Relative Risk	Relative Risk		Percent of Students
SOUTH AFRICA	96,8	2,56 (0,33)	h	62,0
INDONESIA	95,7	2,30 (0,48)	h	73,9
IRAN, ISLAMICREP. OF	65,1	2,87 (0,40)	h	34,9
ROMANIA	64,1	2,34 (0,45)	h	47,7
MOROCCO	56,7	2,27 (0,53)	h	44,6
ISRAEL	55,6	2,67 (0,56)	h	33,3
RUSSIAN FEDERATION	52,6	2,69 (0,31)	h	31,1
MACEDONIA, REP. OF	40,8	2,30 (0,40)	h	31,4
MOLDOVA, REP. OF	33,2	1,51 (0,24)	h	64,8
SLOVAK REPUBLIC	32,6	1,82 (0,24)	h	39,7
GEORGIA	29,7	1,69 (0,23)	h	42,8
HUNGARY	21,9	1,70 (0,25)	h	31,3
LITHUANIA	21,2	1,83 (0,17)	h	25,5
POLAND	19,6	1,45 (0,14)	h	43,3
LATVIA	18,9	1,70 (0,22)	h	27,1
TRINIDAD AND TOBAGO	18,4	1,58 (0,27)	h	31,6
BULGARIA	17,0	1,70 (0,35)	h	24,4
NORWAY	11,8	1,23 (0,12)		50,2
ITALY	9,6	1,65 (0,28)	h	14,8
DENMARK	7,9	1,21 (0,13)		37,0
SPAIN	7,6	1,36 (0,23)		21,4
SLOVENIA	7,4	1,27 (0,12)	h	27,2
CANADA	4,1	1,22 (0,11)	h	18,4
HONG KONG SAR	3,7	1,75 (0,44)		4,9
ICELAND	3,6	1,13 (0,09)		28,6
KUWAIT	3,0	1,22 (0,24)		13,6
UNITED STATES	2,3	1,09 (0,19)		25,2
QATAR	1,9	1,69 (0,18)	h	2,7
NEW ZEALAND		0,96 (0,13)		21,9
SCOTLAND		0,96 (0,15)		31,4
NETHERLANDS		0,96 (0,12)		41,5
SWEDEN		0,83 (0,17)		19,1
FRANCE		0,87 (0,08)		41,1
BELGIUM (FLEMISH)		0,81 (0,08)	i	41,8
ENGLAND		0,44 (0,08)	i	18,5
BELGIUM (FRENCH)		0,66 (0,10)	i	32,7
AUSTRIA		0,70 (0,08)	i	48,1
GERMANY		0,62 (0,07)	i	43,1
LUXEMBOURG	-	- -	-	-
CHINESE TAIPEI	-	- -	-	-
SINGAPORE	-	- -	-	-

h Indicates risk significantly greater than 1

i Indicates risk signficantly less than 1

\- Indicates data not available

Exhibit 5. Relative Risk for Students Attending Urban Schools

COUNTRY	Relative Risk of Being in Bottom 20%			
	Weighted Relative Risk	Relative Risk		Percent of Students
ENGLAND	52,4	2,13 (0,33)	h	46,2
GERMANY	28,2	1,77 (0,19)	h	36,9
AUSTRIA	15,0	1,48 (0,17)	h	31,2
BELGIUM (FRENCH)	15,0	1,32 (0,20)		46,7
UNITED STATES	13,3	1,48 (0,17)	h	27,5
NETHERLANDS	12,6	1,49 (0,17)	h	25,8
SCOTLAND	11,5	1,36 (0,18)		32,4
CANADA	7,0	1,15 (0,08)	h	47,5
BELGIUM (FLEMISH)	6,6	1,32 (0,20)		20,8
DENMARK	2,5	1,08 (0,12)		33,1
FRANCE	0,5	1,02 (0,13)		34,3
SWEDEN		0,99 (0,13)		26,8
NORWAY		0,90 (0,10)		19,9
NEW ZEALAND		0,92 (0,10)		40,1
SLOVENIA		0,81 (0,08)	i	35,6
ICELAND		0,79 (0,07)	i	33,7
INDONESIA		0,34 (0,10)	i	12,1
SOUTH AFRICA		0,53 (0,09)	i	17,3
TRINIDAD AND TOBAGO		0,55 (0,15)	i	18,7
HUNGARY		0,66 (0,17)	i	28,4
KUWAIT		0,61 (0,10)	i	25,7
MOLDOVA, REP. OF		0,57 (0,09)	i	29,3
POLAND		0,73 (0,07)	i	51,9
ITALY		0,74 (0,11)	i	70,4
GEORGIA		0,54 (0,08)	i	42,2
QATAR		0,67 (0,04)	i	65,0
SLOVAK REPUBLIC		0,58 (0,07)	i	52,1
MOROCCO		0,39 (0,09)	i	37,1
HONG KONG SAR		0,60 (0,09)	i	58,4
SPAIN		0,58 (0,08)	i	58,4
BULGARIA		0,64 (0,12)	i	70,4
ROMANIA		0,43 (0,09)	i	47,1
ISRAEL		0,43 (0,10)	i	48,5
LATVIA		0,60 (0,08)	i	69,9
MACEDONIA, REP. OF		0,42 (0,08)	i	51,1
LITHUANIA		0,56 (0,05)	i	71,8
IRAN, ISLAMIC REP. OF		0,33 (0,05)	i	49,6
RUSSIAN FEDERATION		0,38 (0,04)	i	62,6
CHINESE TAIPEI	-	- -	-	-
LUXEMBOURG	-	- -	-	-
SINGAPORE	-	- -	-	-

h Indicates risk significantly greater than 1

i Indicates risk signficantly less than 1

\- Indicates data not available

Exhibit 6. Relative Risk for Students Who Did Not Speak the Language of the Test Before Starting School

COUNTRY	Relative Risk of Being Below in Bottom 20%			
	Weighted Relative Risk	Relative Risk		Percent of Students
LUXEMBOURG	41,1	1,61 (0,11)	h	66,9
IRAN, ISLAMIC REP. OF	38,1	2,51 (0,31)	h	25,3
AUSTRIA	11,8	2,81 (0,19)	h	6,5
BELGIUM (FRENCH)	11,5	2,80 (0,27)	h	6,4
MOROCCO	10,4	1,54 (0,36)		19,4
GERMANY	9,2	2,80 (0,27)	h	5,1
SOUTH AFRICA	8,9	1,47 (0,11)	h	19,0
ENGLAND	8,7	2,36 (0,26)	h	6,4
BULGARIA	8,6	1,82 (0,26)	h	10,5
SLOVAK REPUBLIC	8,3	2,88 (0,49)	h	4,4
SINGAPORE	8,2	1,53 (0,09)	h	15,5
QATAR	7,0	1,98 (0,15)	h	7,1
NEW ZEALAND	6,9	1,86 (0,17)	h	8,0
SPAIN	6,3	1,50 (0,17)	h	12,6
CHINESE TAIPEI	5,9	2,11 (0,22)	h	5,3
SWEDEN	5,7	2,06 (0,25)	h	5,4
RUSSIAN FEDERATION	5,7	1,93 (0,38)	h	6,1
BELGIUM (FLEMISH)	5,6	1,80 (0,19)	h	7,0
TRINIDAD AND TOBAGO	5,1	1,43 (0,21)	h	11,8
UNITED STATES	4,9	1,77 (0,18)	h	6,4
NORWAY	4,8	2,00 (0,25)	h	4,8
ROMANIA	4,6	1,71 (0,34)	h	6,5
CANADA	4,1	1,38 (0,09)	h	10,7
ICELAND	3,8	1,60 (0,17)	h	6,3
SLOVENIA	3,8	2,71 (0,26)	h	2,2
ISRAEL	3,2	1,56 (0,19)	h	5,8
DENMARK	3,2	1,81 (0,24)	h	3,9
SCOTLAND	3,1	1,77 (0,33)	h	4,0
LATVIA	2,5	2,34 (0,37)	h	1,9
NETHERLANDS	2,5	1,94 (0,27)	h	2,7
FRANCE	2,4	1,55 (0,22)	h	4,3
HONG KONG SAR	2,1	1,55 (0,21)	h	3,9
ITALY	2,0	1,59 (0,26)	h	3,4
GEORGIA	1,8	1,40 (0,46)		4,5
HUNGARY	1,7	2,06 (0,36)	h	1,6
MACEDONIA, REP. OF	1,4	1,41 (0,32)		3,4
LITHUANIA	1,0	1,64 (0,30)	h	1,6
MOLDOVA, REP. OF	0,9	1,16 (0,27)		5,5
POLAND	0,6	1,63 (0,42)		0,9
INDONESIA	0,2	1,01 (0,12)		23,1
KUWAIT		0,78 (0,08)	i	50,9

h Indicates risk significantly greater than 1

i Indicates risk signficantly less than 1

Exhibit 7. Relative Risk for Students Who Do Not Always Speak the Language of the Test at Home

COUNTRY	Relative Risk of Being in Bottom 20%			
	Weighted Relative Risk	Relative Risk		Percent of Students
IRAN, ISLAMIC REP. OF	58,9	2,25 (0,27)	h	47,0
GERMANY	37,4	2,36 (0,19)	h	27,4
SINGAPORE	33,8	1,43 (0,11)	h	78,8
AUSTRIA	32,7	2,25 (0,17)	h	26,2
BELGIUM (FLEMISH)	28,5	2,23 (0,18)	h	23,2
LUXEMBOURG	28,0	1,29 (0,35)		97,4
MOROCCO	23,0	1,46 (0,24)		50,5
BULGARIA	22,9	1,76 (0,21)	h	30,3
NETHERLANDS	16,8	1,69 (0,15)	h	24,4
BELGIUM (FRENCH)	15,4	1,45 (0,12)	h	33,9
SWEDEN	14,7	1,58 (0,16)	h	25,4
NEW ZEALAND	12,9	1,49 (0,10)	h	26,4
FRANCE	12,4	1,36 (0,09)	h	34,5
SLOVAK REPUBLIC	11,6	1,41 (0,16)	h	28,7
ENGLAND	11,1	1,43 (0,17)	h	25,8
UNITED STATES	10,1	1,35 (0,10)	h	28,5
DENMARK	6,9	1,37 (0,13)	h	18,6
SPAIN	6,5	1,16 (0,10)		39,5
ITALY	6,3	1,22 (0,12)		29,2
CANADA	6,3	1,17 (0,06)	h	36,4
QATAR	6,1	1,16 (0,07)	h	38,8
NORWAY	5,8	1,29 (0,13)	h	20,2
LATVIA	5,7	1,19 (0,15)		30,6
RUSSIAN FEDERATION	2,5	1,14 (0,17)		18,1
ROMANIA	2,1	1,11 (0,22)		18,7
HUNGARY	1,7	1,07 (0,12)		24,8
TRINIDAD AND TOBAGO	1,5	1,07 (0,14)		22,5
LITHUANIA		0,98 (0,09)		20,8
ICELAND		0,94 (0,07)		36,2
GEORGIA		0,83 (0,17)		14,8
SCOTLAND		0,87 (0,11)		19,9
POLAND		0,73 (0,10)	i	14,6
MOLDOVA, REP. OF		0,74 (0,09)	i	26,3
SOUTH AFRICA		0,82 (0,07)	i	37,9
HONG KONG SAR		0,78 (0,06)	i	34,5
MACEDONIA, REP. OF		0,52 (0,09)	i	16,8
ISRAEL		0,78 (0,09)	i	42,5
KUWAIT		0,85 (0,09)		74,4
INDONESIA		0,67 (0,07)	i	61,7
CHINESE TAIPEI		0,64 (0,04)	i	63,8
SLOVENIA	-	- -	-	-

h Indicates risk significantly greater than 1

i Indicates risk signficantly less than 1

\- Indicates data not available

Exhibit 8. Relative Risk for Boys Whose Parents Have Less than Secondary Education

COUNTRY	Relative Risk of Being in Bottom 20%			
	Weighted Relative Risk	Relative Risk		Percent of Students
INDONESIA	27,4	1,89 (0,15)	h	31,0
IRAN, ISLAMIC REP. OF	25,6	1,72 (0,18)	h	35,4
ROMANIA	22,3	2,63 (0,25)	h	13,7
POLAND	22,3	2,20 (0,16)	h	18,6
MACEDONIA, REP. OF	14,9	2,54 (0,20)	h	9,7
SINGAPORE	13,6	2,48 (0,15)	h	9,2
MOLDOVA, REP. OF	13,2	1,62 (0,14)	h	21,5
TRINIDAD AND TOBAGO	12,1	2,24 (0,21)	h	9,8
ITALY	11,2	1,68 (0,16)	h	16,5
MOROCCO	10,5	1,30 (0,12)	h	35,4
BULGARIA	10,4	2,09 (0,25)	h	9,5
HUNGARY	10,0	2,96 (0,31)	h	5,1
HONG KONG SAR	9,6	1,61 (0,15)	h	15,7
LUXEMBOURG	9,5	1,51 (0,11)	h	18,7
BELGIUM (FLEMISH)	9,0	2,66 (0,21)	h	5,4
CHINESE TAIPEI	8,7	2,40 (0,21)	h	6,2
QATAR	8,4	2,14 (0,12)	h	7,4
GERMANY	8,3	1,62 (0,14)	h	13,4
BELGIUM (FRENCH)	8,2	2,05 (0,16)	h	7,8
SLOVAK REPUBLIC	8,1	3,91 (0,39)	h	2,8
SOUTH AFRICA	7,5	1,62 (0,10)	h	12,1
KUWAIT	7,0	2,25 (0,24)	h	5,6
SLOVENIA	5,7	3,12 (0,24)	h	2,7
FRANCE	5,6	2,00 (0,20)	h	5,6
SPAIN	4,7	1,53 (0,17)	h	8,9
RUSSIAN FEDERATION	4,5	3,25 (0,33)	h	2,0
ISRAEL	4,3	2,35 (0,33)	h	3,2
SWEDEN	4,3	2,39 (0,31)	h	3,1
ICELAND	4,3	2,16 (0,23)	h	3,7
AUSTRIA	3,9	2,70 (0,26)	h	2,3
DENMARK	3,8	1,91 (0,25)	h	4,2
NEW ZEALAND	3,0	2,04 (0,24)	h	2,9
LATVIA	2,8	2,40 (0,38)	h	2,0
NORWAY	2,7	2,45 (0,39)	h	1,9
LITHUANIA	2,1	2,40 (0,41)	h	1,5
CANADA	1,8	1,91 (0,23)	h	2,0
SCOTLAND	1,3	1,42 (0,32)		3,0
NETHERLANDS	1,1	1,24 (0,19)		4,7
ENGLAND	1,1	1,36 (0,21)		3,1
GEORGIA	1,0	1,50 (0,67)		2,1
UNITED STATES	-	- -	-	-

h Indicates risk significantly greater than 1

\- Indicates data not available

Exhibit 9. Relative Risk for Boys Attending Rural Schools

COUNTRY	Relative Risk of Being in Bottom 20%			
	Weighted Relative Risk	Relative Risk		Percent of Students
SOUTH AFRICA	31,7	2,07 (0,13)	h	29,5
INDONESIA	29,8	1,79 (0,16)	h	37,6
RUSSIAN FEDERATION	23,8	2,51 (0,24)	h	15,7
IRAN	23,7	2,35 (0,31)	h	17,5
ISRAEL	23,1	2,43 (0,31)	h	16,1
ROMANIA	21,5	1,87 (0,22)	h	24,7
SLOVAK REPUBLIC	18,9	1,91 (0,19)	h	20,8
GEORGIA	16,8	1,75 (0,19)	h	22,4
MOLDOVA	16,7	1,52 (0,14)	h	31,9
TRINIDAD AND TOBAGO	16,2	2,01 (0,26)	h	16,0
LATVIA	14,4	2,02 (0,24)	h	14,1
LITHUANIA	12,7	1,94 (0,17)	h	13,4
POLAND	12,5	1,61 (0,15)	h	20,6
BULGARIA	12,1	2,01 (0,39)	h	11,9
MACEDONIA	12,0	1,90 (0,25)	h	13,3
NORWAY	11,8	1,50 (0,12)	h	23,7
MOROCCO	9,8	1,58 (0,24)	h	16,9
HUNGARY	8,2	1,57 (0,20)	h	14,4
ITALY	6,5	1,86 (0,29)	h	7,6
SLOVENIA	6,0	1,43 (0,14)	h	13,8
SPAIN	5,3	1,51 (0,23)	h	10,4
KUWAIT	5,2	1,88 (0,37)	h	5,9
DENMARK	5,1	1,31 (0,15)	h	16,6
ICELAND	4,6	1,36 (0,11)	h	12,9
CANADA	3,6	1,42 (0,14)	h	8,4
HONG KONG	2,3	2,02 (0,46)	h	2,3
UNITED STATES	2,2	1,18 (0,19)		12,4
NEW ZEALAND	2,2	1,21 (0,19)		10,3
SCOTLAND	1,8	1,14 (0,14)		12,2
NETHERLANDS	1,6	1,09 (0,10)		17,4
QATAR	1,3	2,22 (0,37)	h	1,1
SWEDEN	0,8	1,08 (0,24)		10,5
BELGIUM (FLEMISH)	0,3	1,02 (0,10)		20,0
FRANCE		1,00 (0,11)		19,5
AUSTRIA		0,91 (0,10)		23,8
ENGLAND		0,58 (0,14)	i	7,4
BELGIUM (FRENCH)		0,76 (0,10)	i	13,7
GERMANY		0,67 (0,07)	i	20,7
CHINESE TAIPEI	-	- -	-	-
LUXEMBOURG	-	- -	-	-
SINGAPORE	-	- -	-	-

h Indicates risk significantly greater than 1

i Indicates risk signficantly less than 1

\- Indicates data not available

Exhibit 10. Relative Risk for Boys Attending Urban Schools

COUNTRY	Relative Risk of Being in Bottom 20%			
	Weighted Relative Risk	Relative Risk		Percent of Students
ENGLAND	11,2	1,58 (0,15)	h	19,4
UNITED STATES	7,9	1,60 (0,16)	h	13,2
SCOTLAND	6,8	1,58 (0,17)	h	11,7
BELGIUM (FRENCH)	6,4	1,33 (0,15)	h	19,6
CANADA	5,8	1,26 (0,08)	h	22,4
QATAR	5,8	1,20 (0,06)	h	28,2
NETHERLANDS	5,6	1,54 (0,16)	h	10,4
GERMANY	5,4	1,33 (0,15)	h	16,7
BELGIUM (FLEMISH)	4,9	1,53 (0,20)	h	9,3
FRANCE	2,7	1,17 (0,13)		16,4
DENMARK	2,3	1,16 (0,10)		14,6
SWEDEN	2,2	1,17 (0,15)		13,1
NORWAY	2,0	1,22 (0,12)		9,3
SLOVENIA	1,8	1,10 (0,11)		17,7
LITHUANIA	1,3	1,04 (0,08)		36,0
ICELAND	1,0	1,07 (0,10)		15,1
AUSTRIA	0,8	1,48 (0,14)	h	1,6
LATVIA	0,3	1,01 (0,10)		35,6
KUWAIT	0,3	1,03 (0,18)		11,1
POLAND		0,99 (0,08)		25,5
NEW ZEALAND		0,96 (0,12)		19,5
SOUTH AFRICA		0,71 (0,12)	i	8,0
BULGARIA		0,92 (0,13)		33,9
INDONESIA		0,54 (0,18)	i	6,0
HUNGARY		0,79 (0,15)		13,2
TRINIDAD AND TOBAGO		0,68 (0,19)		10,2
ITALY		0,91 (0,10)		35,6
MOLDOVA, REP. OF		0,76 (0,11)	i	14,2
GEORGIA		0,80 (0,10)	i	20,4
HONG KONG SAR		0,84 (0,11)		27,8
SLOVAK REPUBLIC		0,79 (0,08)	i	26,4
SPAIN		0,79 (0,10)	i	27,3
MOROCCO		0,54 (0,12)	i	14,4
ROMANIA		0,65 (0,13)	i	24,1
MACEDONIA, REP. OF		0,56 (0,09)	i	22,1
RUSSIAN FEDERATION		0,68 (0,06)	i	30,7
ISRAEL		0,53 (0,11)	i	24,2
IRAN, ISLAMIC REP. OF		0,56 (0,08)	i	27,0
CHINESE TAIPEI	-	- -	-	-
LUXEMBOURG	-	- -	-	-
SINGAPORE	-	- -	-	-

h Indicates risk significantly greater than 1

i Indicates risk signficantly less than 1

\- Indicates data not available

Exhibit 11. Relative Risk for Students Attending Rural Schools Whose Parents Have Less than Secondary Education

COUNTRY	Relative Risk of Being in Bottom 20%			
	Weighted Relative Risk	Relative Risk		Percent of Students
INDONESIA	58,7	2,15 (0,26)	h	51,0
IRAN, ISLAMIC REP. OF	48,1	2,60 (0,30)	h	30,0
ROMANIA	35,7	2,83 (0,43)	h	19,5
POLAND	24,9	2,17 (0,18)	h	21,3
MOLDOVA, REP. OF	20,5	1,67 (0,16)	h	30,7
QATAR	17,4	2,07 (0,30)	h	16,3
MOROCCO	12,0	1,44 (0,32)		27,4
SLOVAK REPUBLIC	11,3	4,24 (0,46)	h	3,5
HUNGARY	11,0	2,92 (0,36)	h	5,7
MACEDONIA, REP. OF	10,5	2,21 (0,28)	h	8,7
SOUTH AFRICA	9,4	1,52 (0,10)	h	17,9
TRINIDAD AND TOBAGO	9,3	2,02 (0,25)	h	9,1
RUSSIAN FEDERATION	6,9	3,30 (0,45)	h	3,0
ISRAEL	6,4	2,88 (0,36)	h	3,4
ITALY	6,3	2,02 (0,44)	h	6,2
BULGARIA	5,6	1,66 (0,36)		8,5
DENMARK	4,0	2,01 (0,30)	h	4,0
BELGIUM (FLEMISH)	3,8	2,00 (0,23)	h	3,8
SLOVENIA	3,5	2,60 (0,33)	h	2,2
SPAIN	3,1	1,59 (0,22)	h	5,3
NORWAY	2,9	2,45 (0,38)	h	2,0
LATVIA	2,9	2,15 (0,46)	h	2,5
ICELAND	2,5	1,61 (0,20)	h	4,0
HONG KONG SAR	2,2	2,00 (0,58)		2,2
GEORGIA	2,2	1,73 (0,58)		3,0
FRANCE	2,1	1,51 (0,26)		4,1
NETHERLANDS	1,5	1,35 (0,21)		4,3
GERMANY	1,4	1,11 (0,13)		12,3
SWEDEN	1,3	2,02 (0,58)		1,3
BELGIUM (FRENCH)	1,3	1,37 (0,27)		3,4
AUSTRIA	1,2	1,94 (0,42)	h	1,3
LITHUANIA	1,1	1,70 (0,36)		1,6
CANADA	0,8	1,65 (0,29)	h	1,3
KUWAIT	0,8	1,26 (0,30)		3,0
NEW ZEALAND	0,1	1,08 (0,31)		1,6
ENGLAND		0,82 (0,50)		0,6
SCOTLAND		0,81 (0,32)		1,5
CHINESE TAIPEI	-	- -	-	-
LUXEMBOURG	-	- -	-	-
SINGAPORE	-	- -	-	-
UNITED STATES	-	- -	-	-

h Indicates risk significantly greater than 1

i Indicates risk signficantly less than 1

\- Indicates data not available