Do Economic Conditions Explain International Variation in Parenting Styles?

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Abstract

This thesis investigates the influence of economic conditions on parental attitudes and student performance using PISA and OECD data. In 2014, Matthias Doepke and Fabrizio Zilibotti published a paper theorizing that parenting styles emerge as equilibrium outcomes depending on both parental preferences and the economic environment (Doepke and Zilibotti, 2014). Their theory states that parents adopt more involved and overbearing parenting styles as the economic returns to student achievement rise. This thesis empirically tests Doepke and Zilibotti's theory using the triennial PISA survey, and it further tests whether parenting styles directly influence student performance in math, science, and reading. My results support Doepke and Zilibotti's theory by finding a positive relationship between the Wage Premium and Parental Dissatisfaction. I also find a negative relationship between Parental Dissatisfaction and Student Performance and a mixed relationship between the Wage Premium and Student Performance. The contribution of this thesis is empirical support for Doepke and Zilibotti's theory and a creative and novel use of the PISA data.

Keywords: Education, Parenting, Wage Premium, Student Achievement, PISA Survey

1. Introduction

Beginning in the mid-1990s, international educational assessments have enabled economists to conduct between-country studies to better understand what causes international variation in student achievement. The most noteworthy of these assessments is the PISA (Programme for International Student Assessment), which collects extensive student background data in addition to standardized math, science, and reading examinations. Participating countries can also opt into the Optional Parental Questionnaire, which surveys parents about their attitudes towards their child's school and the amount of money they invest in their child's education. This survey is useful for understanding the impact of parental behavior on the educational process but has thus far been underutilized by researchers.

In 2014, Matthias Doepke and Fabrizio Zilibotti published a paper titled "Parenting with Style" (Doepke and Zilibotti, 2014), which theorizes that parents choose their parenting strategies partly in response to economic conditions. The authors argue that "helicopter parenting" (i.e. a strict, overbearing parenting style) incurs economic costs on the parents (e.g. time, money) and that the returns to student achievement must be sufficiently high for a parent to choose to incur these costs. In other words, the benefits of "helicopter parenting" must outweigh the costs in order for such parenting styles to prevail. The authors predict that countries in which the economic returns to student achievement are large will also have large proportions of "helicopter parents" since parents in such countries have greater incentive to actively encourage their children's education. Their theory was publicized in the *New York Times (*Giridharadas, 2014) and *Chicago Magazine (*Moser, 2014) among other places, and it reinvigorated the public discourse over parenting styles.

This thesis empirically tests Doepke and Zilibotti's theory using PISA data, and it further tests whether parental attitudes influence student performance on standardized examinations. Three iterations of the PISA survey are combined with macroeconomic variables from the OECD to create a large sample of students from countries with varying degrees of economic inequality. The PISA background surveys allow me to control for student, family, school, and economic characteristics in order to limit the effect of omitted variables in the analysis. In simple terms, this study tests whether parents rate their child's school more severely when the economic returns to student achievement are higher, and it additionally examines the effects of the economic returns to education and parental attitudes on student achievement. This study is unique because it uses items from the PISA Parental Questionnaire as outcome variables instead of explanatory variables and it combines multiple iterations of the PISA survey into a single dataset. My thesis contributes to the growing bodies of economic research on international education and parental behavior as well as the public discourse over which parenting style is most effective.

2. Literature Review

In 2011, Amy Chua released her controversial book Battle Hymn of the Tiger Mother where she argues that the traditional Chinese method of strict, authoritarian child rearing is superior to the more nurturing and permissive styles of the West (Chua, 2011a). Her book sparked a vigorous public discussion after it was publicized in the Wall Street Journal (Chua, 2011b), but her concept of the "Tiger Mom" is not limited to China. For example, Japan coined the pejorative term "Kyoiku mama" to describe a mother that relentlessly forces her children to study (Lebra, 1985). The overbearing Asian parent is a common stereotype even within the United States, and Asian students are generally regarded as dedicated and high achieving.

Clearly parenting styles are influenced by cultural factors, but the question remains whether Amy Chua's style of authoritarian parenting is economically rational.

Diana Baumrind originally laid the foundation for parenting research by determining three broad parenting styles: permissive, authoritarian, and authoritative (Baumrind, 1966). Further research has determined a fourth category: neglectful parenting (Aunola, Stattin, & Nurmi, 2000). Not only do these differing styles influence student achievement, they have been shown to influence self-esteem, health, and risky behavior among other things. For example, permissive parenting was shown to correlate positively with risky behavior (Chan & Koo, 2011). One explanation for the prevalence of authoritative parenting in Asian cultures is the idea that strong cognitive abilities leads to preferable labor market outcomes. Authoritative parenting has indeed been shown to correlate positively with grade point average and school engagement (Darling & Steinberg, 1993). However, further research has shown that non-cognitive abilities (e.g. social skills) are equally if not more important than cognitive abilities (Heckman, Stixrud, & Urzua, 2006), so an authoritarian parenting style may be effective only to the extent that it emphasizes both cognitive and non-cognitive abilities.

One of the most heavily discussed aspects of parenting is the use of discipline and corporal punishment. In a 1999 study, researchers found that 94% of American 3-4 year olds received corporal punishment at some point (in the form of hitting and spanking), and this number slowly diminishes throughout childhood. This is in spite of a growing body of psychological research emphasizing the negative aspects of corporal punishment and negative reinforcement (Straus & Stewart, 1999). For example, violence rates diminished considerably after corporal punishment was banned in Europe (Bussmann, Erthal, & Schroth, 2011). Nevertheless, many parents

throughout the world still prefer the stick to the carrot when disciplining their children and corporal punishment is generally associated strict parenting styles.

Another stream of parental research analyses the effect of the parents' occupation, social standing, and the environment on their children's upbringing. Research shows that wealthier parents are better able to provide pecuniary incentives to their children, and in the absence of such incentives, poor parents are forced to resort to more authoritarian methods (Weinberg, 2001). This may partially explain the prevalence of corporal punishment in the Southern United States (Straus & Stewart, 1999). It also emphasizes the need to control for socioeconomic status in education analyses.

Although parents clearly influence the academic success of their children, many other factors influence student achievement. Chiefly among them are school resource endowments and institutional factors of the education system (Fuchs & Woessmann, 2004). In order to analyze the relationship between parenting styles and student achievement, it is helpful to control for these other factors. Thankfully, the PISA survey makes this feasible.

The Programme for International Student Assessment (PISA) is an international assessment conducted triennially by the Organization for Economic Cooperation and Development (OECD). Its purpose is to evaluate education systems worldwide by testing the knowledge of 15-year-old students. The PISA and other such international surveys have been incredibly fruitful for researchers, and Eric Hanushek and Ludger Woessmann (2014) offer a thorough analysis of the current state of international educational research. Much of the existing literature focuses on creating educational production functions that account for as much of the variance in student performance as possible both between and within countries (e.g. Fuchs & Woessman, 2004; Woessman, Luedermann, Schuetz, & West, 2007). The latter study was able to account for 87%

of the variance in student performance at the country level and 39% of the variance at the student level. Other attempts at estimating production functions have yielded similar results.

Although a full analysis of international education is beyond the scope of this review, several important findings are worth noting. Curriculum based external exit exams (CBEEEs) have been demonstrated to significantly affect student performance (Bishop, 1997) and to interact with institutional factors such as standardized testing and school autonomy (Fuchs & Woessman, 2004). CBEEEs affect the incentives of actors in the education system (e.g. teachers) by holding them accountable to an external standard. This minimizes the negative effect of opportunistic behavior and maximizes the positive gains from localized knowledge leads (i.e. teachers knowing best how to influence their particular students). Another important finding is that educational tracking (i.e. separating students into different school types on the basis of exam scores) has significant effects on educational inequality, especially when the tracking is conducted early in the educational cycle (Hanushek, 2006). Since achievement is strongly correlated with family characteristics and peer effects in the early schooling years (Schuetz, Ursprung, & Woessmann, 2008), these effects are exacerbated for students tracked into low-achieving schools at a young age. Overall, these findings emphasize the need to control for a variety of factors when analyzing the relationship between parenting and student achievement.

Another stream of research has criticized the production function methodology utilized by most education researchers since exam performance on math, science, and reading is only one desired outcome of the educational system (Bishop, 2006). Socialization, personal edification, and career guidance are other important schooling goals, as evidenced by the fact that mathematics only account for 14% of class time in American schools. Music, personal use, and vocational courses account for a large proportion of total student credits but are generally

disregarded by educational researchers (NCES, Digest of Education Statistics 2002, Table 139). However, the PISA distinguishes itself from other international surveys by addressing the concerns of these critics. "The PISA aims to define each domain not merely in terms of mastery of the school curriculum, but in terms of important knowledge and skills needed in adult life" (Fuchs & Woessmann, 2004). Rather than simply testing the students' ability to solve math or science problems, it tests more generally for cognitive ability and human capital. The PISA survey is used in this thesis because of its focus on real-world applications and its thorough inclusion of parental variables.

3. Data

The data used for this analysis includes the three most recent iterations of the PISA survey (i.e. 2006, 2009, and 2012) along with relevant macroeconomic data from the OECD. The dataset is limited to countries that have opted into the PISA Parental Questionnaire at least once (the Parental Questionnaire was first introduced in 2006) totaling over 300,000 students from 22 different countries. Because the PISA survey differs considerably between years, a core set of survey items is selected in order to run identical regressions for each time period. This list includes a subset of variables from the student, parent, and school questionnaires. The full list can be found in the Appendix.

The PISA Parental Questionnaire includes a series of seven Likert-type items pertaining to parental perceptions of school quality. I also compute an eighth item representing the average value of these seven parental items for each observation. Altogether, these eight items serve as measures of parental attitudes in my analysis. The figure below displays them as they are seen in the PISA Parental Questionnaire.

How much do you agree or disagree with the following statements?

(Please tick only one box in each row.)

	Strongly agree	*Agree*	*Disagree*	*Strongly disagree*
a) Most of my child's school teachers seem competent and dedicated.	☐ 1	☐ 2	☐ 3	☐ 4
b) Standards of achievement are high in my child's school.	☐ 1	☐ 2	☐ 3	☐ 4
c) I am happy with the content taught and the instructional methods used in my child's school.	☐ 1	☐ 2	☐ 3	☐ 4
d) I am satisfied with the disciplinary atmosphere in my child's school.	☐ 1	☐ 2	☐ 3	☐ 4
e) My child's progress is carefully monitored by the school.	☐ 1	☐ 2	☐ 3	☐ 4
f) My child's school provides regular and useful information on my child's progress.	☐ 1	☐ 2	☐ 3	☐ 4
g) My child's school does a good job in educating students.	☐ 1	☐ 2	☐ 3	☐ 4

One important detail is that these items are reversed-coded, meaning that an increase in each variable represents a *decrease* in parental satisfaction. They will henceforth be referred to as *Parental Dissatisfaction* variables. Regressions involving Parental Dissatisfaction are rerun using each of these variables because it is unclear which of them weighs most heavily in the minds of the parents.

I make two noteworthy assumptions about these Parental Dissatisfaction variables in the analysis. My first assumption is that parental behaviors and parental attitudes are essentially the same thing. Doepke and Zilibotti (2014) predict that parental behaviors become more severe as the economic returns to student achievement rise. However, I am testing this theory using parental attitude items because I simply do not have any data relating directly to parental behavior.

My second assumption is that the Parental Dissatisfaction variables are continuous. In other words, I make the assumption that points on the four-point Likert scale are equidistant from one another in order to simplify the analysis.

To measure the economic returns to student achievement, I utilize Wage Premium data from the OECD. The Wage Premium is a ratio describing the economic returns (in terms of hourly wages) to educational attainment. Educational systems vary by countries, so the OECD uses an international classification of educational attainment called the International Standard Classification of Education (ISCED). These classifications are displayed in the following figure.

ISCED Levels	
Level	**Description**
0	pre-primary
1	primary
2	lower secondary
3	upper secondary
4	post-secondary non-tertiary
5	first stage of tertiary
6	second stage of tertiary

For this analysis, the Wage Premium is computed as a ratio of the average wage of workers who have achieved tertiary education (ISCED levels 5 and 6) to the average wage of workers who have achieved up to an upper secondary education (ISCED levels 0 through 3). The figure below illustrates the wage premium for each country in the data set. The larger the Wage Premium is, the larger the economic returns to student achievement are in that country. For example, the Wage Premium is 1.49 in Belgium in 2006. This means that the average wages of workers with a tertiary education is 1.49 times that of workers who have with less than an upper secondary education. One noteworthy trend in this table is that the Wage Premium has diminished in seven of ten countries between 2006 and 2012.

Wage Premium			
Country	**2006**	**2009**	**2012**
Belgium	1.49	1.44	1.42
Denmark	1.52	1.51	1.58
Hungary	2.95	2.88	2.86
Germany	1.77	1.86	1.92
Italy	2.04	1.90	1.91
Korea	2.19	2.17	2.07
Luxembourg	2.07	2.45	2.40
New Zealand	1.56	1.44	1.51
Poland	2.06	2.01	2.02
Portugal	2.64	2.49	2.43

The final variable of interest is Student Achievement. For each subject, the PISA survey asks students to complete a subset of questions from a large question bank. This means that students from around the world take non-identical tests, and their results are therefore not directly comparable. To resolve this, PISA includes 5 Plausible Values for each subject, estimating a score that each student likely would have achieved if they had completed the full set of questions. These values are based on the Rasch Model (OECD, 2009). Although PISA recommends running each regression five times for each subject (once for each Plausible Value) and averaging the results, this thesis simply uses the first set of Plausible Values since results do not change substantially using PISA's recommended method. The following table compares national averages in math, science, and reading scores across each survey year. Included countries participated in the Parental Questionnaire at least once between 2006 and 2012.

Mean Test Scores

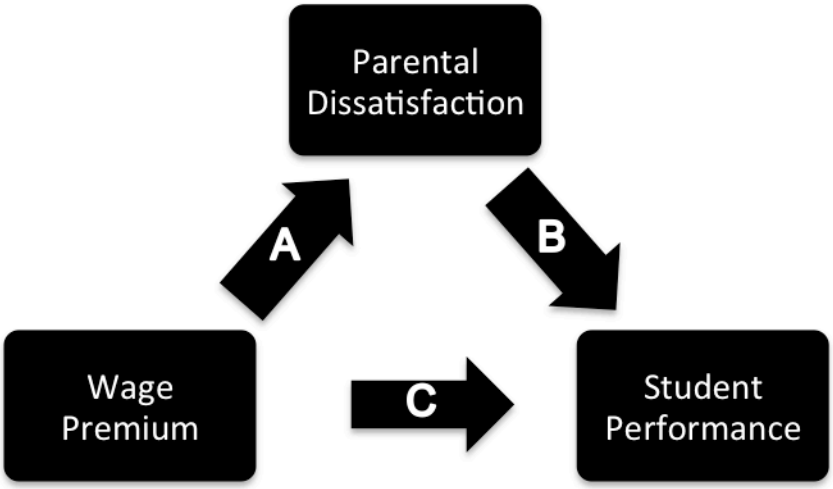
	2006			2009			2012		
Country	Math	Science	Reading	Math	Science	Reading	Math	Science	Reading
Belgium	***	***	***	***	***	***	549	537	535
Denmark	512	495	494	489	483	482	***	***	***
Hungary	***	***	***	496	508	499	487	504	498
Germany	504	516	496	511	519	496	532	542	527
Italy	474	487	477	490	496	491	496	505	501
Korea	547	522	555	549	539	541	554	538	536
Luxembourg	491	487	480	***	***	***	***	***	***
New Zealand	523	532	523	523	535	523	***	***	***
Poland	500	503	513	499	512	505	***	***	***
Portugal	470	479	477	487	492	489	491	492	492

Because collecting a true random sample would be prohibitively expensive, PISA uses a two-stage sampling design to select observations. Schools within each country are selected, and

then students within those schools are selected. The result is that certain schools and students have a greater probability of being sampled, so it is necessary to weight each observation by the inverse of the probability of being selected. For this analysis, the student weights provided by PISA are normalized to insure that the sum of the weights equals the total number of observations in the data set.

4. Conceptual Framework

This section describes the conceptual roadmap that my statistical analysis will follow. There are three key variables (i.e. Wage Premium, Parental Dissatisfaction, and Student Performance) and the figure below illustrates their relationship.



Relationship A is the effect of the Wage Premium on Parental Dissatisfaction. This is the key relationship of interest because it directly relates to Doepke and Zilibotti's (2014) theory. Relationship B is the effect of Parental Dissatisfaction on Student Achievement, which relates to the debate over which parenting style is most effective for rearing high-achieving children. Finally, Relationship C is the effect of the Wage Premium on Student Performance, which

investigates the responsiveness of students to the economic returns to student achievement in terms of standardized test scores.

I will begin by running an exploratory regression of test scores in math, science, and reading on country and time dummies to understand how student are performing across countries and across time periods. The ultimate goal of educational economic research is to improve student achievement and to develop human capital, so it is important to understand how students are performing currently and how student performance has changed over time.

Next I will test Relationship A by regressing Parental Dissatisfaction on the Wage Premium. According to Doepke and Zilibotti (2014), this relationship should be positive as parental attitudes become more severe in response to growth in the economic returns to education. Regression A essentially tests whether Doepke and Zilibotti's theory is empirically supported by PISA and OECD data.

Next I will test Relationship B by regressing Student Performance on Parental Dissatisfaction. In the context of international education, parental attitudes are only relevant to the extent that they influence student achievement, so Regression B investigates how much of the international variance in student achievement is attributable to parental attitudes. This regression will all so shed light on Amy Chua's theory that "Tiger" parenting results in high-achieving children.

Finally, Relationship C connects the previous two relationships by regressing Student Performance on the Wage Premium. This model investigates whether growth in the economic returns to education incentivizes students to perform well in school.

I will conclude by summarizing my results and discussing how this analysis contributes to our current understanding of the economics of education.

5. Exploratory Regression

The purpose of the first regression is to compare student performance across countries and across time. The regression includes year dummies as well as dummies for the 22 countries that have opted into the PISA Parental Questionnaire. The country coefficients are computed relative to Hong Kong (the highest achiever) and the year dummies are computed relative to 2006. Only the 10 countries for which Wage Premium data exists are includes in the regression output below since subsequent regressions will be limited to observations from these 10 countries. The full regression output can be found in the Appendix.

Exploratory Regression						
	Math		Science		Reading	
Country	Beta	Sig.	Beta	Sig.	Beta	Sig.
(Constant)	547.2	.000	543.2	.000	531.4	.000
Belgium	-15.9	.000	-21.7	.000	-13.5	.000
Denmark	-53.8	.000	-59.5	.000	-48.6	.000
Germany	-42.1	.000	-26.6	.000	-35.3	.000
Hungary	-70.1	.000	-48.9	.000	-45.2	.000
Italy	-69.4	.000	-54.6	.000	-49.4	.000
Korea	-6.5	.000	-17.9	.000	4.6	.000
Luxembourg	-56.7	.000	-56.3	.000	-50.9	.000
New Zealand	-29.2	.000	-13.5	.000	-12.0	.000
Poland	-52.0	.000	-39.5	.000	-26.0	.000
Portugal	-73.6	.000	-62.8	.000	-53.6	.000
2009 Dummy	9.7	.000	7.6	.000	8.1	.000
2012 Dummy	18.0	.000	15.0	.000	17.1	.000

Encouragingly, average test scores have increased significantly with time, and students in 2012 score 18 points higher in mathematics on average than students in 2006. The same trend also applies to science and reading scores. Most countries perform similarly in all three subjects,

but certain countries have a wide performance gap between math, science, and reading. For example, Hungary performs 20 points worse in math than in science or reading.

There is also a clear development effect on student performance, meaning that students from highly developed economies (e.g. South Korea, Belgium) generally perform far above students from highly underdeveloped economies (e.g. Portugal). As a dramatic example, student from Qatar score 185 points below students from Belgium in mathematics on average.

Subsequent regressions include macroeconomic variables to control as much as possible for these development effects and for economic shocks (e.g. the 2008 financial crisis). These variables include Real GDP per capita in the test year, annualized Real GDP per capita growth in the three years leading up to the test year, and the average unemployment rate in the three years leading up to the test year. By controlling for these variables, I can reduce the impact of omitted variable bias on my regression output.

6. Regression A: Wage Premium vs. Parental Dissatisfaction

The next regression investigates the effect of the Wage Premium on Parental Dissatisfaction. The model takes the following form:

$$D_i = \beta_0 + W_i\beta_1 + M_i\beta_2 + I_i\beta_3 + H_i\beta_4 + S_i\beta_5 + \varepsilon_i$$

The dependent variable *D* is Parental Dissatisfaction and the main explanatory variable *W* is the Wage Premium. Finally, *M, I, H*, and *S* represent vectors of macroeconomic, individual, home, and school characteristics respectively. Along with country and year fixed effects, these variables are used as controls, but they are not included in the regression output for the sake of clarity. The

model is rerun eight times, once with each Parental Dissatisfaction variable. The following table displays the Wage Premium coefficient and significance for each of these regressions.

Regression A			
Model	Dependent Variable	Wage Premium Beta	Wage Premium Sig.
1	Most of my child's school teachers seem competent and dedicated.	.397	.000
2	Standards of achievement are high in my child's school.	.105	.185
3	I am happy with the content taught and the instructional methods used in my child's school.	.288	.000
4	I am satisfied with the disciplinary atmosphere in my child's school.	.732	.000
5	My child's progress is carefully monitored by the school.	.254	.001
6	My child's school provides regular and useful information on my child's progress.	.345	.000
7	My child's school does a good job in educating students.	.301	.000
8	Parental Dissatisfaction Average	.364	.000

a. Independent Variable: Wage Premium

b. Full regression output can be found in the Appendix

The Wage Premium coefficient is positive in all eight regressions and statistically significant at a 1% confidence level in all but one regression. Interestingly, parental perception of the school's disciplinary climate (Model 4) is most strongly affected by the Wage Premium,

suggesting that parents tend to become disciplinarians when the Wage Premium increases, as predicted by Doepke and Zilibotti (2014).

The coefficient for Model 4 indicates that a 100% increase in the Wage Premium is associated with .732-point increase on the 4-point Parental Dissatisfaction scale when extensively controlling for other factors. The average effect (Model 8) is a .364-point increase. To put this into perspective, the Wage Premium in Luxembourg rose by just over 1% between 2006 and 2012. According to Regression A, a 1% in the Wage Premium is associated with a .00364-point increase in Parental Dissatisfaction. The relationship is significant and in the hypothesized direction, but the effect is not very economically significant. In other words, Regression A suggests that the Wage Premium causes parents to become less satisfied with their child's school, but the effect is very slight.

7. Regression B: Parental Dissatisfaction vs. Student Performance

The next regression investigates the effect of Parental Dissatisfaction on Student Performance. The model takes the following form:

$$T_i = \beta_0 + D_i\beta_1 + W_i\beta_2 + M_i\beta_3 + I_i\beta_4 + H_i\beta_5 + S_i\beta_6 + \varepsilon_i$$

For each observation there are eight Parental Dissatisfaction variables and three Student Performance variables (i.e. math, science, and reading scores). 24 separate regressions are run to test for every combination of variables. In other words, math scores are sequentially regressed on all eight Parental Dissatisfaction variables, and then the same is done for science and reading scores.

The following tables display the Parental Dissatisfaction coefficients and significance for each of these regressions. For each subject, the coefficient on all but one of the Parental Dissatisfaction variables is negative, indicating a negative relationship between Parental Dissatisfaction and Student Performance.

Regression B (Reading)		
Explanatory Variable	**Beta**	**Significance**
Most of my child's school teachers seem competent and dedicated.	-4.051	.000
Standards of achievement are high in my child's school.	-17.554	.000
I am happy with the content taught and the instructional methods used in my child's school.	-4.085	.000
I am satisfied with the disciplinary atmosphere in my child's school.	-7.243	.000
My child's progress is carefully monitored by the school.	-3.288	.000
My child's school provides regular and useful information on my child's progress.	1.131	.002
My child's school does a good job in educating students.	-7.957	.000
Parental Dissatisfaction Average	-12.012	.000

a. Dependent Variable: Reading scores

b. Full regression output can be found in the Appendix

Regression B (Science)		
Explanatory Variable	**Beta**	**Significance**
Most of my child's school teachers seem competent and dedicated.	-3.667	.000
Standards of achievement are high in my child's school.	-17.446	.000
I am happy with the content taught and the instructional methods used in my child's school.	-4.672	.000
I am satisfied with the disciplinary atmosphere in my child's school.	-6.285	.000
My child's progress is carefully monitored by the school.	-2.927	.000
My child's school provides regular and useful information on my child's progress.	1.834	.000
My child's school does a good job in educating students.	-7.578	.000
Parental Dissatisfaction Average	-11.016	.000

a. Dependent Variable: Science scores

b. Full regression output can be found in the Appendix

Regression B (Math)		
Explanatory Variable	**Beta**	**Significance**
Most of my child's school teachers seem competent and dedicated.	-4.431	.000
Standards of achievement are high in my child's school.	-18.76	.000
I am happy with the content taught and the instructional methods used in my child's school.	-4.672	.000
I am satisfied with the disciplinary atmosphere in my child's school.	-7.174	.000
My child's progress is carefully monitored by the school.	-3.853	.000
My child's school provides regular and useful information on my child's progress.	.900	.016
My child's school does a good job in educating students.	-8.727	.000
Parental Dissatisfaction Average	-13.13	.000

a. Dependent Variable: Math scores

b. Full regression output can be found in the Appendix

There are several possible explanations for this negative relationship. The first explanation is that "helicopter parenting" is simply ineffective and causes students to perform poorly. However, this explanation is unlikely because it contradicts prior studies (e.g. Darling & Steinberg, 1993). The more likely explanation for the negative relationship is reverse causality. Rather than Parental Dissatisfaction influencing Student Performance, Student Performance influences Parental Dissatisfaction (i.e. the better a student performs in school, the happier parents are with that school, and vice versa). Controlling for past student performance would be useful for resolving this reverse causality problem, but unfortunately this is not possible with the PISA data. I can conclude that Student Achievement negatively influences Parental Dissatisfaction, but I can make no such conclusion about the effect of Parental Dissatisfaction on Student Achievement.

8. Regression C: Wage Premium vs. Student Performance

The final regression tests for the effect of the Wage Premium on Student Performance. If the economic returns to student achievement rise, students will have greater incentive to perform well in school and to achieve higher levels of education. This model investigates whether students respond to these incentives in terms of standardized test scores. It takes the following form:

$$T_i = \beta_0 + D_i\beta_1 + M_i\beta_3 + I_i\beta_4 + H_i\beta_5 + S_i\beta_6 + \varepsilon_i$$

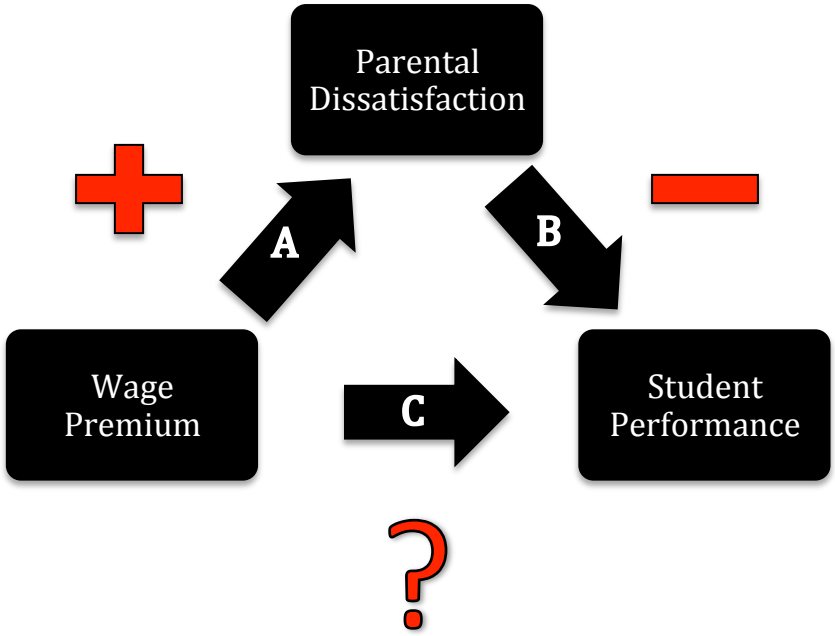
The model is identical to Regression B except it does not control for Parental Dissatisfaction. The results from this regression are summarized in the following table.

Regression C		
Dependent Variable	**Wage Premium Beta**	**Wage Premium Significance**
Math Scores	9.274	.314
Science Scores	38.862	.000
Reading Scores	-22.601	.014

Using math or science as the dependent variable, the Wage Premium coefficient is positive, indicating that students respond positively to rising economic returns to achievement. However, the opposite is true when using reading scores as the dependent variable. One explanation for these results is that the economic returns to student achievement are greater in STEM-related fields, so students focus their efforts on math and science while neglecting other subjects. In the United States, there is a 26% salary premium for entry-level STEM jobs relative to entry-level non-STEM jobs (Burning Glass, 2014), so it makes economic sense for students to focus on STEM subjects. This explanation accounts for the fact that the math and science coefficients are positive while the reading coefficient is negative. However, further research is necessary to determine whether this explanation is valid.

9. Conclusion

Now that my results have been presented, I will return to my conceptual roadmap to illustrate my findings.



For Relationship A, I found evidence that the Wage Premium positively influences Parental Dissatisfaction. This finding empirically supports Doepke and Zilibotti's (2014) economic theory, and it emphasizes the fact that parenting styles aren't simply cultural or behavioral traits; parenting styles are also a rational response to economic conditions.

For Relationship B, I was unable to conclude whether or not Parental Dissatisfaction influences Student Performance. However, I found evidence for the opposite effect (i.e. that Student Performance negatively influences Parental Dissatisfaction). In other words, when students perform better in school, parents become more satisfied with their child's school. It would be useful to control for past student performance in order to eliminate this reverse causality, but the PISA data does not permit such an analysis.

For Relationship C, I found a positive effect of the Wage Premium on math and science scores and a negative effect of the Wage Premium on reading scores. I argued that these results might be explained by the fact that the economic returns to student achievement are greater for

STEM subjects (i.e. math and science), so students focus on them at the expense of other subjects. This would be a fascinating question to address in future studies.

This thesis provides two main lasting contributions. The first contribution is empirical support for Doepke and Zilibotti's (2014) economic theory. Economic inequality in the United States has grown considerably since the 1970s (Moser, 2014) and "Helicopter parenting" has become more prevalent during that time. My research provides an empirical explanation for this behavior. Rather than relying on economic theory or basic correlations, my thesis uses a rich dataset and multivariate regression analysis to further our understanding of the determinants of parenting styles and student achievement.

The second contribution of my thesis is its unique and novel use of the PISA data. My research is the first to use parental attitude items from the PISA Parental Questionnaire as outcome variables, and it is the first to use the Wage Premium as an explanatory variable in a PISA study. I hope that this thesis will serve as a small step towards improving international educational outcomes.

Works Cited

Aunola, K., Stattin, H., & Nurmi, J. (2000). Parenting styles and adolescents' achievement strategies. *Journal of Adolescence, 23*(2), 205-222.

Baumrind, D. (1966). Effects of authoritative parental control on child behavior. *Child Development,* 887-907.

Bishop, J. (2006). Drinking from the fountain of knowledge: Student incentive to study and learn–externalities, information problems and peer pressure. *Handbook of the Economics of Education, 2*, 909-944.

Bishop, J. H. (1997). The effect of national standards and curriculum-based exams on achievement. *The American Economic Review,* 260-264.

Burning Glass (2014). *Real-Time Insight Into the Market For Entry-Level STEM Jobs.*

Bussmann, K., Erthal, C., & Schroth, A. (2011). Effects of banning corporal punishment in europe–a five-nation comparison. *Joan, E.Durrant/Smith, Anne (Hg.): Global Pathways to Abolishing Physical Punishment,* 299-322.

Chan, T. W., & Koo, A. (2011). Parenting style and youth outcomes in the UK. *European Sociological Review, 27*(3), 385-399.

Chua, A. (2011a). *Battle hymn of the tiger mother*. Bloomsbury Publishing.

Chua, A. (2011b). Why chinese mothers are superior. *The Wall Street Journal* (January 8, 2011).

Darling, N., & Steinberg, L. (1993). Parenting style as context: An integrative model. *Psychological Bulletin, 113*(3), 487.

Doepke, M., & Zilibotti, F. (2012). *Parenting with Style: Altruism and Paternalism in Intergenerational Preference Transmission*

Giridharadas, A. (2014, October 27, 2014). *The New York Times*

Hanushek, E. A. (2006). Does educational tracking affect performance and inequality? Differences-in-Differences evidence across countries*. *The Economic Journal, 116*(510), C63-C76.

Hanushek, E. A., & Woessmann, L. (2014). Institutional structures of the education system and student achievement: A review of cross-country economic research*. *Educational Policy Evaluation through International Comparative Assessments,* 145.

Heckman, J. J., Stixrud, J., & Urzua, S. (2006). *The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior.*

Lebra, T. S. (1985). *Japanese women: Constraint and fulfillment* University of Hawaii Press.

Moser, W. (October 15, 2014). Why are helicopter parents so intense? Maybe they're scared. *Chicago Magazine*

National Center For Education Statistics. ((2001a, 2002a, 2003a). *The digest of education statistics* ****. Wash, D,C,: U.S. Department of Education.

OECD. Publishing. (2009). *PISA Data Analysis Manual: SAS*. OECD.

Sapienza, P., Zingales, L., & Guiso, L. (2006). *Does Culture Affect Economic Outcomes?,*

Schütz, G., Ursprung, H. W., & Wößmann, L. (2008). Education policy and equality of opportunity. *Kyklos, 61*(2), 279-308.

Straus, M. A., & Stewart, J. H. (1999). Corporal punishment by american parents: National data on prevalence, chronicity, severity, and duration, in relation to child and family characteristics. *Clinical Child and Family Psychology Review, 2*(2), 55-70.

Weinberg, B. A. (2001). An incentive model of the effect of parental income on children. *Journal of Political Economy, 109*(2), 266-280.

Wöbmann, L., Lüdemann, E., Schütz, G., & West, M. R. (2007). School accountability, autonomy, choice, and the level of student achievement: International evidence from PISA 2003.

Woessmann, L., & Fuchs, T. (2004). What accounts for international differences in student performance? A re-examination using PISA data.

Appendix

Variable List	
Variable	**Type**
Student Achievement	Ordinal
Wage premium	Continuous
Real GDP/Capita (in thousands)	Continuous
GDP Growth	Continuous
Unemployment	Continuous
Student age	Continuous
Index of economic, social,and cultural status	Continuous
Home educational resources	Continuous
Home possessions	Continuous
Female	Dummy
Highest parental education level	Ordinal
Highest parental occupation	Ordinal
Immigration Status	Dummy
Ratio of school PCs connected to web and # of PCs	Continuous
Proportion of girls at school	Continuous
Proportion of certified teachers	Continuous
Proportion of teachers with ISCED 5A	Continuous
Index of school responsibility for curriculum and assessment	Continuos
Index of school responsibility for resource allocation	Continuous

CONTINUED	
Variable	**Type**
Quality of school educational resources	Continuous
Student-Teacher ratio	Continuous
Shortage of teaching staff	Continuous
Village	Dummy
Small Town	Dummy
Town	Dummy
City	Dummy
Private School	Dummy
Belgium	Dummy
Germany	Dummy
Denmark	Dummy
Hungary	Dummy
Korea	Dummy
Luxembourg	Dummy
New Zealand	Dummy
Poland	Dummy
Portugal	Dummy
2009 Dummy	Dummy
2012 Dummy	Dummy

Exploratory Regression (Complete)

Country	Math		Science		Reading	
	Beta	Sig.	Beta	Sig.	Beta	Sig.
(Constant)	547.2	.000	543.2	.000	531.4	.000
2009 Dummy	9.7	.000	7.6	.000	8.1	.000
2012 Dummy	18.0	.000	15.0	.000	17.1	.000
Belgium	-15.9	.000	-21.7	.000	-13.5	.000
Bulgaria	-130.0	.000	-103.8	.000	-124.2	.000
Chile	-124.8	.000	-94.7	.000	-85.7	.000
Columbia	-173.8	.000	-151.7	.000	-140.5	.000
Croatia	-89.5	.000	-59.6	.000	-59.7	.000
Denmark	-53.8	.000	-59.5	.000	-48.6	.000
Germany	-42.1	.000	-26.6	.000	-35.3	.000
Hungary	-70.1	.000	-48.9	.000	-45.2	.000
Iceland	-42.1	.000	-52.4	.000	-47.1	.000
Italy	-69.4	.000	-54.6	.000	-49.4	.000
Korea	-6.5	.000	-17.9	.000	4.6	.000
Lithuania	-80.1	.000	-59.2	.000	-70.6	.000
Luxembourg	-56.7	.000	-56.3	.000	-50.9	.000
Macao	-27.4	.000	-37.2	.000	-44.7	.000
Mexico	-146.1	.000	-138.0	.000	-118.4	.000
New Zealand	-29.2	.000	-13.5	.000	-12.0	.000
Panama	-195.8	.000	-175.0	.000	-162.6	.000
Poland	-52.0	.000	-39.5	.000	-26.0	.000
Portugal	-73.6	.000	-62.8	.000	-53.6	.000
Qatar	-206.0	.000	-181.9	.000	-189.4	.000
Turkey	-119.2	.000	-115.3	.000	-77.9	.000

Regression A (Complete)			
Variable	**Beta**	**Std. Error**	**Sig.**
(Constant)	1.956	.156	.000
Wage Premium	.364	.057	.000
Math Score	.000	.000	.000
Science Score	.000	.000	.001
Reading Score	.000	.000	.000
Real GDP/Capita (in thousands)	-.014	.002	.000
GDP Growth	.002	.004	.671
Unemployment	-.006	.002	.013
Student age	-.004	.005	.375
Index of economic,	.022	.004	.000
Home educational resources	.000	.000	.182
Home possessions	7.698E-5	.000	.588
Female	.022	.003	.000
Highest parental education level	.000	.002	.836
Highest parental occupation	-5.939E-5	.000	.640
Immigration Status	-.015	.004	.000
Ratio of school PCs connected to web and # of PCs	-.019	.010	.044
Proportion of girls at school	.000	.000	.001
Proportion of certified teachers	.028	.008	.001
Proportion of teachers with ISCED 5A	.016	.006	.008

CONTINUED			
Variable	**Beta**	**Std. Error**	**Sig.**
Index of school responsibility for resource allocation	-.020	.003	.000
Quality of school educational resources	-2.189E-5	.000	.727
Student-Teacher ratio	.000	.000	.642
Shortage of teaching staff	9.001E-5	.000	.130
Village	-.039	.008	.000
Small Town	-.014	.006	.021
Town	-.019	.005	.001
City	-.031	.005	.000
Private School	-.172	.005	.000
Belgium	.373	.031	.000
Germany	.344	.016	.000
Denmark	.348	.027	.000
Hungary	-.478	.055	.000
Korea	.186	.019	.000
Luxembourg	.652	.060	.000
New Zealand	.081	.036	.023
Poland	-.261	.039	.000
Portugal	-.298	.033	.000
2009 Dummy	.031	.012	.009
2012 Dummy	.034	.008	.000

Regression B (Math)

Variable	Beta	Std. Error	Sig.
(Constant)	309.935	28.868	.000
Parental Dissatisfaction	-13.133	.575	.000
Wage premium	-5.651	10.550	.592
Real GDP/Capita (in thousands)	.038	.290	.896
GDP Growth	-2.322	.794	.003
Unemployment	-.590	.452	.192
Student age	13.821	.888	.000
Index of economic, social,and cultural status	40.740	.708	.000
Home educational resources	-.072	.018	.000
Home possessions	.068	.026	.010
Female	-19.623	.532	.000
Highest parental education level	-7.858	.341	.000
Highest parental occupation	-.198	.024	.000
Immigration Status	-12.226	.670	.000
Ratio of school PCs connected to web and # of PCs	25.941	1.763	.000
Proportion of girls at school	.077	.020	.000
Proportion of certified teachers	5.726	1.528	.000
Proportion of teachers with ISCED 5A	8.762	1.081	.000
Index of school responsibility for curriculum and assessment	-3.996	0.312	0
Index of school responsibility for resource allocation	-7.18	0.505	0.16

CONTINUED

Variable	Beta	Std. Error	Sig.
Quality of school educational resources	.052	.012	.000
Student-Teacher ratio	3.562	.082	.000
Shortage of teaching staff	-.063	.011	.000
Village	-12.078	1.569	.000
Small Town	-5.841	1.107	.000
Town	1.210	1.018	.235
City	.894	.998	.370
Private School	1.220	.985	.215
Belgium	52.588	5.759	.000
Germany	.921	3.023	.761
Denmark	-.712	4.961	.886
Hungary	.184	10.273	.986
Korea	45.232	3.512	.000
Luxembourg	8.452	11.108	.447
New Zealand	25.987	6.596	.000
Poland	40.006	7.131	.000
Portugal	9.340	6.188	.131
2009 Dummy	-.025	2.162	.991
2012 Dummy	7.733	1.429	.000

Adjusted R^2 = .218

N = 103,425

a. Dependent Variable: Math Scores

Regression B (Science)			
Variable	**Beta**	**Std. Error**	**Sig.**
(Constant)	141.953	28.749	.000
Parental Dissatisfaction	-11.016	.572	.000
Wage premium	33.451	10.506	.001
Real GDP/Capita (in thousands)	1.683	.289	.000
GDP Growth	-.233	.791	.768
Unemployment	.353	.450	.433
Student age	15.615	.885	.000
Index of economic, social,and cultural status	37.145	.705	.000
Home educational resources	-.053	.018	.003
Home possessions	.033	.026	.212
Female	-7.210	.530	.000
Highest parental education level	-5.808	.340	.000
Highest parental occupation	-.154	.023	.000
Immigration Status	-18.572	.667	.000
Ratio of school PCs connected to web and # of PCs	27.364	1.756	.000
Proportion of girls at school	.161	.020	.000
Proportion of certified teachers	5.469	1.522	.000
Proportion of teachers with ISCED 5A	8.718	1.077	.000
Index of school responsibility for curriculum and assessment	-4.399	.311	.000
Index of school responsibility for resource allocation	-.650	.503	.197

CONTINUED			
Variable	**Beta**	**Std. Error**	**Sig.**
Quality of school educational resources	.050	.012	.000
Student-Teacher ratio	3.391	.082	.000
Shortage of teaching staff	-.063	.011	.000
Village	-7.621	1.562	.000
Small Town	-4.967	1.103	.000
Town	3.013	1.014	.003
City	3.346	.994	.001
Private School	1.328	.981	.176
Belgium	38.325	5.735	.000
Germany	-3.117	3.011	.301
Denmark	-3.602	4.941	.466
Hungary	-18.659	10.231	.068
Korea	7.314	3.498	.037
Luxembourg	-72.295	11.063	.000
New Zealand	58.105	6.569	.000
Poland	34.785	7.102	.000
Portugal	-9.488	6.162	.124
2009 Dummy	5.440	2.153	.012
2012 Dummy	12.441	1.423	.000
Adjusted R^2 = .190 N = 103,425			

a. Dependent Variable: Science Scores

Regression B (Reading)			
Variable	**Beta**	**Std. Error**	**Sig.**
(Constant)	459.471	28.600	.000
Parental Dissatisfaction	-12.012	.569	.000
Wage premium	-41.129	10.452	.000
Real GDP/Capita (in thousands)	-3.749	.287	.000
GDP Growth	2.022	.787	.010
Unemployment	-.209	.448	.641
Student age	13.679	.880	.000
Index of economic, social,and cultural status	39.034	.702	.000
Home educational resources	-.059	.018	.001
Home possessions	.020	.026	.433
Female	32.109	.527	.000
Highest parental education level	-6.672	.338	.000
Highest parental occupation	-.186	.023	.000
Immigration Status	-18.020	.663	.000
Ratio of school PCs connected to web and # of PCs	25.252	1.747	.000
Proportion of girls at school	.248	.019	.000
Proportion of certified teachers	13.984	1.514	.000
Proportion of teachers with ISCED 5A	11.822	1.071	.000
Index of school responsibility for curriculum and assessment	-3.753	.310	.000
Index of school responsibility for resource allocation	-.806	.501	.107

CONTINUED			
Variable	**Beta**	**Std. Error**	**Sig.**
Quality of school educational resources	.050	.012	.000
Student-Teacher ratio	3.773	.082	.000
Shortage of teaching staff	-.061	.011	.000
Village	-19.761	1.554	.000
Small Town	-11.178	1.097	.000
Town	-1.445	1.008	.152
City	-.273	.989	.783
Private School	3.136	.975	.001
Belgium	35.611	5.705	.000
Germany	-10.515	2.995	.000
Denmark	-3.024	4.915	.538
Hungary	-10.979	10.178	.281
Korea	17.047	3.479	.000
Luxembourg	142.237	11.005	.000
New Zealand	-10.234	6.535	.117
Poland	-28.982	7.065	.000
Portugal	2.293	6.130	.708
2009 Dummy	-8.719	2.142	.000
2012 Dummy	.244	1.415	.863
Adjusted R^2 = .240			
N = 103,425			

a. Dependent Variable: Reading Scores

Regression C (Math)			
Variable	**Beta**	**Std. Error**	**Sig.**
(Constant)	248.024	25.364	.000
Wage premium	9.274	9.212	.314
Real GDP/Capita (in thousands)	-.017	.283	.953
GDP Growth	-3.502	.694	.000
Unemployment	1.119	.261	.000
Student age	13.491	.820	.000
Index of economic, social,and cultural status	43.031	.624	.000
Home educational resources	-.063	.015	.000
Home possessions	.057	.024	.017
Female	-18.511	.489	.000
Highest parental education level	-8.137	.307	.000
Highest parental occupation	-.258	.021	.000
Immigration Status	-14.102	.582	.000
Ratio of school PCs connected to web and # of PCs	27.459	1.639	.000
Proportion of girls at school	.098	.018	.000
Proportion of certified teachers	5.469	1.422	.000
Proportion of teachers with ISCED 5A	7.991	.971	.000
Index of school responsibility for curriculum and assessment	-3.527	.290	.000
Index of school responsibility for resource allocation	.143	.465	.759

CONTINUED			
Variable	**Beta**	**Std. Error**	**Sig.**
Quality of school educational resources	.053	.010	.000
Student-Teacher ratio	3.640	.077	.000
Shortage of teaching staff	-.059	.009	.000
Village	-10.267	1.357	.000
Small Town	-4.352	1.015	.000
Town	2.346	.934	.012
City	1.638	.926	.077
Private School	4.128	.923	.000
Belgium	60.936	5.032	.000
Germany	-6.137	2.640	.020
Denmark	-.155	4.197	.971
Hungary	-14.289	9.129	.118
Korea	52.625	2.773	.000
Luxembourg	16.894	10.830	.119
New Zealand	33.748	5.415	.000
Poland	27.297	6.221	.000
Portugal	.078	5.463	.989
2009 Dummy	-1.673	1.981	.398
2012 Dummy	8.794	1.253	.000
Adjusted R^2 = .216			
N = 124,629			

a. Dependent Variable: Math Scores

Regression C (Science)			
Variable	**Beta**	**Std. Error**	**Sig.**
(Constant)	109.379	25.352	.000
Wage premium	38.862	9.207	.000
Real GDP/Capita (in thousands)	1.466	.283	.000
GDP Growth	-.801	.693	.248
Unemployment	1.233	.261	.000
Student age	15.460	.819	.000
Index of economic, social,and cultural status	39.871	.624	.000
Home educational resources	-.052	.015	.001
Home possessions	.025	.024	.298
Female	-5.959	.489	.000
Highest parental education level	-6.171	.307	.000
Highest parental occupation	-.217	.021	.000
Immigration Status	-20.394	.582	.000
Ratio of school PCs connected to web and # of PCs	29.409	1.638	.000
Proportion of girls at school	.180	.018	.000
Proportion of certified teachers	4.858	1.422	.001
Proportion of teachers with ISCED 5A	8.659	.970	.000
Index of school responsibility for curriculum and assessment	-4.206	.290	.000
Index of school responsibility for resource allocation	.128	.465	.783

CONTINUED			
Variable	**Beta**	**Std. Error**	**Sig.**
Quality of school educational resources	.046	.010	.000
Student-Teacher ratio	3.533	.077	.000
Shortage of teaching staff	-.057	.009	.000
Village	-4.801	1.357	.000
Small Town	-2.475	1.014	.015
Town	4.620	.934	.000
City	4.419	.926	.000
Private School	4.012	.923	.000
Belgium	41.943	5.029	.000
Germany	-10.282	2.638	.000
Denmark	-7.822	4.195	.062
Hungary	-24.490	9.125	.007
Korea	11.188	2.772	.000
Luxembourg	-61.717	10.825	.000
New Zealand	53.856	5.413	.000
Poland	26.619	6.218	.000
Portugal	-13.488	5.460	.014
2009 Dummy	4.232	1.980	.033
2012 Dummy	14.348	1.252	.000
Adjusted R^2 = .193 N = 124,629			

a. Dependent Variable: Science Scores

Regression C (Reading)			
Variable	**Beta**	**Std. Error**	**Sig.**
(Constant)	387.741	25.252	.000
Wage premium	-22.601	9.171	.014
Real GDP/Capita (in thousands)	-3.899	.282	.000
GDP Growth	1.028	.691	.137
Unemployment	1.056	.260	.000
Student age	13.866	.816	.000
Index of economic, social,and cultural status	41.788	.622	.000
Home educational resources	-.056	.015	.000
Home possessions	.014	.024	.560
Female	33.874	.487	.000
Highest parental education level	-7.152	.306	.000
Highest parental occupation	-.250	.021	.000
Immigration Status	-19.551	.580	.000
Ratio of school PCs connected to web and # of PCs	28.284	1.632	.000
Proportion of girls at school	.262	.018	.000
Proportion of certified teachers	12.651	1.416	.000
Proportion of teachers with ISCED 5A	11.878	.966	.000
Index of school responsibility for curriculum and assessment	-3.434	.288	.000
Index of school responsibility for resource allocation	-.107	.463	.817

CONTINUED			
Variable	**Beta**	**Std. Error**	**Sig.**
Quality of school educational resources	.042	.010	.000
Student-Teacher ratio	3.879	.077	.000
Shortage of teaching staff	-.049	.009	.000
Village	-16.322	1.351	.000
Small Town	-8.895	1.010	.000
Town	.298	.930	.749
City	.641	.922	.487
Private School	5.775	.919	.000
Belgium	46.404	5.009	.000
Germany	-15.538	2.628	.000
Denmark	.340	4.178	.935
Hungary	-28.808	9.089	.002
Korea	22.212	2.761	.000
Luxembourg	152.511	10.782	.000
New Zealand	-4.045	5.391	.453
Poland	-39.013	6.194	.000
Portugal	-8.541	1.972	.000
2009 Dummy	-8.541	1.972	.000
2012 Dummy	3.190	1.247	.011
Adjusted R^2 = .245 N = 124,629			

a. Dependent Variable: Reading Scores