ISSN: 2247-6172
Review of Applied Socio- Economic Research
(Volume 9, Issue 1/ 2015), pp. 58
URL: http://www.reaser.eu
e-mail: editors@reaser.eu

Inequality, socio-economic status, economic indicators, and student achievement

John J. McCreary[1+], Julianne M. Edwards[2++], and Gregory J. Marchant[3+++]
[1,2,3] Ball State University

Abstract*. HLM model fit was used to determine the relationship of the country level economic variables of GDP and the GINI Index to 2012 student PISA reading, math, and science achievement, along with individual SES, country SES mean, and country SES inequality. For all achievement areas the complete model of all variables represented the best fit. The significant predictors in the models were country SES inequality and student SES. This suggested a less direct relationship to achievement for the economic indicators of GDP and GINI, and demonstrated the significance of SES inequality related to student achievement.*

Keywords: economic inequality, socio-economic status, student achievement, international

JEL Codes: I24

1. Introduction

The relationship between economics and education could be considered reciprocal. In general, the better the economics, the higher the student achievement; and the better education level, the better the economic condition. When it comes to student achievement, money matters. The relationship between the Socio-Economic Status (SES) and academic achievement of a student is well established (Duncan & Brooks-Gunn, 2000). Money may not only buy happiness, it can also give a pretty good leg up on a decent education. It is not surprising that poorer countries do not do as well academically as wealthier ones (OECD, 2010). Simply put, richer countries have more money for schools and other resources that can promote learning. Students score higher on tests of achievement when they have more resources available, whether resources are measured at the country, school, or individual level (Chiu & Khoo, 2005). The effects of poverty on academic achievement have been noted in the United States (Battle, 2002; Chervin et al., 2003), Portugal (Bastos, Fernandes, & Passos, 2009), Africa (Appiah & McMahon, 2002),

[+] PhD candidate in educational psychology
[++] PhD candidate in educational psychology
[+++] PhD, Professor of educational psychology, Department of Educational Psychology, Teachers College
Ball State University, Muncie, IN 47306, (765) 285-850, *corresponding author*, e-mail address: gmarchant@bsu.edu.

ISSN: 2247-6172
Review of Applied Socio- Economic Research
(Volume 9, Issue 1/ 2015), pp. 59
URL: http://www.reaser.eu
e-mail: editors@reaser.eu

Brazil (da Cunha, Andrea Jimenez, Rus Perez, & de Andrade, 2009), as well as in other countries around the world (Chiu, 2007). Some studies give evidence that the socioeconomic status of a student is more predictive of academic achievement than family configuration (Battle, 2002), or race (Battle & Pastrana, 2007). Some show an effect of immigrant status above and beyond SES (Greene, Hynes, & Doyle, 2011), although others suggest that these factors, along with low income and education level, and material deprivation, comprise low family socioeconomic status (Huston & Bentley, 2010). What is unclear is why some developed countries with higher overall SES, such as the United States, have poorer overall academic performance than some less developed countries, such as the case of Singapore, Thailand (Marchant & Finch, 2014).

Although in education SES, wealth, and poverty are considered for their influence on student achievement, in economic circles education is considered a driver for financial success (Appiah & McMahon, 2002; Baldwin & Borrelli, 2008; Bornschier, Herkenrath, & Konig, 2005; Jamison, Jamison, & Hanushek, 2007) and economic, political, and social stability (Kim, 1996; Thyne, 2006). For instance, the positive effects of education on economic growth include the adoption of new technologies (Lin, 1991), health literacy (Kickbusch, 2001), higher wage levels (Hill, 2001), and better human capital in industry (Tsai, Hung, & Harriott, 2010).

Caldas and Bankston (1997) offer peer family social status as a possible explanation for some of this. They found that students whose classmates were of higher SES performed better academically, likely because schools with more high-SES students typically have more resources available to students than those that do not (Chiu & Khoo, 2005). This begins to explain the effect of a country's level of income inequality on students' academic achievement. A likely source of the difference in student achievement in countries, irrespective of SES, is the degree to which income equality is a factor in that country. Though there is a dearth of research directly tying the two together, there are studies showing a greater effect of economic instability on a nation's poor than on that nation's higher SES constituents (Elliott, 2013). In spite of study findings to the contrary showing that family and demographic characteristics and income inequality of students within a school explain a large portion of the effect (Beck & Muschkin, 2012; Caldas & Bankston, 1997) and those suggesting that much of the race gap in achievement remains unexplained (Beck & Muschkin, 2012; Dixon-Roman, Everson, & McArdle, 2013), inequality has been shown to have an effect in other regards. In terms of physical health of individuals, countries with greater inequality have poorer health and shorter life expectancy (De Vogli, Mistry, Gnesotto & Cornia, 2005; Kondo, Sembajwe, Kawachi & van Dam, 2009), including higher rates of infant mortality (Hales, Howden-Chapman, Salmond, Woodward, & Mackenbach, 1999). Countries with high income inequality also experience more violence (Poveda, 2011; Shihadeh & Steffensmeier, 1994), including homicides (Kawachi, Kennedy & Wilson, 1999) and higher incidence of bullying (Due et al., 2009). Mental health also decreases with income inequality (Black & Krishnakumar, 1998). Higher rates of depression in women (Pabayo, R., Kawachi, I., & Gilman, S.E., 2013), incidences of schizophrenia (Burns, Tomita, Kapadia, 2013), and increase in drug-related deaths (Najman, Toloo, & Williams, 2008). Further, although there may be a lack of research directly correlating income inequality and academic achievement, there is quite a bit of research tying the aforementioned effects of inequality to problems in academic

ISSN: 2247-6172
Review of Applied Socio- Economic Research
(Volume 9, Issue 1/ 2015), pp. 60
URL: http://www.reaser.eu
e-mail: editors@reaser.eu

achievement (Attar, Guerra, & Tolan, 1994; Black & Krishnakumar, 1998; Margolin & Gordis, 2000; Rutter, 1981).

The current study looks at the relationship of economic indicators, measures of SES, and inequality to student achievement.

2. Method

2.1. PISA

Of the 71 countries in the 2012 Programme for International Student Assessment (PISA) database, 54 countries had complete data including the two additional economic indicators of GDP and GINI. The countries included in the analyses were: Albania, Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong-China, Hungary, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Montenegro, Netherlands, New Zealand, Norway, Peru, Poland, Portugal, Qatar, Romania, Russian Federation, Serbia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Thailand, Tunisia, Turkey, United Kingdom, United States of America, and Uruguay

In addition to achievement scores for reading, math, and science, the PISA SES Index was used in three ways. The PISA SES index is derived from a factor analysis of variables that include parent education and occupation, and possessions in the home (mean = 0, standard deviation = 1). The individual student's SES Index was used, as well as the country SES mean for the students. The standard deviation for each country's SES was included as a measure of SES inequality related to the distribution of SES.

2.2. Economic Indicators

Gross Domestic Product (GDP) is defined by the Worldbank as "the sum of gross value added by all resident producers in the economy plus any taxes and minus any subsidies not included in the value of products."

GINI index, according to the World Bank website, is a measure of how unequally income or consumption expenditure is distributed among households/individuals**.**

3. Analyses

Three Hierarchical Linear Model (HLM) analyses were conducted to determine the model that best predicts achievement on each 2012 PISA subtests (i.e., mathematics, reading, and science). HLM is a statistical tool that is similar to regression, as it predicts the outcome of dependent variables from one or more predictors. The defining difference between HLM and regression is that HLM can account for multilevel data (e.g., student and school), which eliminates the violation of independence when multilevel data is used in a regression analysis. An HLM analysis was used, as both individual level student data and country level data were included. The three HLM models used to predict PISA achievement included 1) PISA achievement predicted from country GDP and country GINI, 2) PISA achievement predicted from country GDP, country GINI, country SES (mean SES), and country SES inequality (SES standard deviation), and 3) PISA achievement predicted from student individual SES, country GDP, country GINI, country SES, and country SES inequality.

4. Results

4.1. Mathematics

In Model 1 for mathematics, both GDP and GINI were significant predictors of mathematic achievement (see Table 1). However, Model 2 suggested that the impact GDP and GINI had on mathematic achievement was mediated by country SES inequality. This was indicated by GDP and GINI no longer being significant predictors of achievement when country SES inequality was included in the model. While the first two HLM models provide information about mathematics achievement, model 3 was the model that best fit the data, as it had the lowest AIC and BIC. Thus, model 3 will be explained in further detail.

Model 3 predicted mathematic achievement from student SES, GDP, GINI, country mean SES, and country SES inequality. Consistent with Model 2, GDP and GINI were no longer significant predictors of math achievement, again suggesting that country SES inequality mediated the impact of GDP and GINI. Further, this model showed that student SES and country SES inequality were significant predictors of mathematic success. The results suggested that country SES inequality was the strongest predictor of mathematic achievement, indicated by a higher coefficient (see Table 1), and scores would be most related to this variable. Specifically, as country SES inequality increased by 1 standard deviation, mathematic scores decreased by 138.97 points. The second most important predictor of mathematic achievement was the student individual SES. Unlike country SES inequality, student SES had a positive impact on mathematic achievement. That is, as student SES increases by one standard deviation, the student's mathematics score increased by 30.31 points.

4.2. Reading

The results for reading were similar to the results for mathematics. Model 1 for reading showed that GDP and GINI were significant predictors of reading achievement (see Table 1). However, as Model 2 incorporated country mean SES and country SES inequality, GDP and GINI were no longer significant predictors. Due to country SES inequality being the only significant predictor in Model 2, this suggested that country SES inequality mediated the relationship between reading achievement and the Model 1 predictor variables. Similar to the results of mathematics, Model 3 for reading fit the data the best, with this model having the lowest AIC and BIC compared to Models 1 and 2. As a result, model 3 will be discussed further.

Model 3 was used to predict reading achievement from student SES, GDP, GINI, country mean SES, and country SES inequality. Similar to Model 2, GDP and GINI were not significant predictors of reading achievement in Model 3. Again, due to country SES inequality being a significant predictor of reading scores this suggested that country SES inequality mediated the relationship between the Model 1 predictors and reading achievement. Within Model 3 there were two significant predictors in Model 3: country SES inequality, and individual student SES. Country SES inequality was the strongest predictor of reading achievement, as the predictor had the highest coefficient (see Table 1). The results for country SES inequality show that as this predictor increased by one standard deviation, reading scores decreased by 104.15 points. Student SES was the second most important predictor of reading achievement. Specially, the results suggest that when student individual SES increased by one standard deviation, reading score increases of 29.1.

4.3. Science

Science achievement also showed similar results to those found in mathematic and reading achievement. Model 1 showed that GDP and GINI were significant predictors of science (see Table 1). However, when Model 2 entered country SES mean and country SES inequality, the Model 1 predictors were no longer significant. The significance of country SES inequality suggested that it mediated the relationship between the Model 1 predictors (GDP and GINI) and science achievement. The final model, Model 3, best fit the data and had the lowest AIC and BIC.

Model 3 predicted science achievement from student SES, GDP, GINI, country mean SES, and country SES inequality. Consistent with Model 2, both GDP and GINI were no longer significant predictors, whereas country SES inequality was a significant predictor. This suggested that country SES inequality mediated the relationship between the Model 1 predictors and science achievement. Additionally, country SES was the strongest predictor of science achievement, as it has the highest coefficient. The results suggest that as country SES inequality increased by one standard deviation, science achievement decreased by 132.31 points. The only other significant predictor of science achievement was student level SES. The results indicated that as student SES increased by one standard deviation, science achievement increases by 28.78.

5. Discussion

As previously noted, the relationship between economics and education is considered reciprocal, and HLM is a correlational approach. This suggests that without strong theory or extraordinary circumstances, causal interpretations are inappropriate. This means that poor achievement may be resulting in higher country SES inequality, rather than country SES inequality leading to lower achievement.

Although lower SES students do better in wealthier countries than in poorer countries, a nation's wealth seems to most benefit the educational achievement of the wealthy (Marchant & Finch, 2014). This exacerbates inequality in education and SES. This was reflected in the strength of country SES inequality as a predictor of achievement (over three times stronger than the student's own SES for math and science).

Country GDP and GINI may be too removed from the student situation to have a strong direct relationship to student achievement. Researchers using these variables are likely to underestimate economic and inequality factors on student achievement. GDP did a better job of reflecting overall parent SES than GINI did at reflecting the economic inequality faced by students. Although country economic indicators are not the same thing as family SES, looking at the nature of SES of the collective parents of a country is a much more viable measure of economics related to student achievement. It also allows for consistent comparisons across levels rather than the lack of congruency of internal and external measures of income or SES (Chudgar & Luschei, 2009)

6. References

[1] Appiah, E. N., & McMahon, W. W. (2002). The social outcomes of education and feedbacks on growth in Africa. *Journal of Development Studies, **38***(4), 27-68. doi: 10.1080/00220380412331322411

[2] Attar, B. K., Guerra, N. G., & Tolan, P. H. (1994). Neighborhood disadvantage, stressful life events, and adjustent in urban elementary-school-children. *Journal of Clinical Child Psychology, **23***(4), 391-400. doi: 10.1207/s15374424jccp2304_5

[3] Baldwin, N., & Borrelli, S. A. (2008). Education and economic growth in the United States: Cross-national applications for an intra-national path analysis. *Policy Sciences, **41***(3), 183-204. doi: 10.1007/s11077-008-9062-2

[4] Bastos, A., Fernandes, G. L., & Passos, J. (2009). Analysis of school failure based on Portuguese micro data. *Applied Economics Letters, **16***(16), 1639-1643. doi: 10.1080/13504850701604094

[5] Battle, J. (2002). Longitudinal analysis of academic achievement among a nationwide sample of Hispanic students in one- versus dual-parent households. *Hispanic Journal of Behavioral Sciences, **24***(4), 430-447. doi: 10.1177/0739986302238213

[6] Battle, J., & Pastrana, A., Jr. (2007). The relative importance of race and socioeconomic status among Hispanic and White students. *Hispanic Journal of Behavioral Sciences, **29***(1), 35-49. doi: 10.1177/0739986306294783

[7] Beck, A. N., & Muschkin, C. G. (2012). The enduring impact of race: Understanding disparities in student disciplinary infractions and achievement. *Sociological Perspectives, **55***(4), 637-662. doi: 10.1525/sop.2012.55.4.637

[8] Black, M. M., & Krishnakumar, A. (1998). Children in low-income, urban settings - Interventions to promote mental health and well-being. *American Psychologist, **53***(6), 635-646. doi: 10.1037//0003-066x.53.6.635

[9] Bornschier, V., Herkenrath, M., & Konig, C. (2005). The double dividend of expanding education for development. *International Sociology, **20***(4), 506-529. doi: 10.1177/0268580905058329

[10] Caldas, S. J., & Bankston, C. (1997). Effect of school population socioeconomic status on individual academic achievement. *Journal of Educational Research**, 90***(5), 269-277.

[11] Chervin, R. D., Clarke, D. F., Huffman, J. L., Szymanski, E., Ruzicka, D. L., Miller, V., . . . Giordani, B. J. (2003). School performance, race, and other correlates of sleep-disordered breathing in children. *Sleep Medicine, **4***(1), 21-27. doi: 10.1016/s1389-9457(02)00243-5

ISSN: 2247-6172
Review of Applied Socio- Economic Research
(Volume 9, Issue 1/ 2015), pp. 64
URL: http://www.reaser.eu
e-mail: editors@reaser.eu

[12] Chiu, M. M. (2007). Families, economies, cultures, and science achievement in 41 countries: Country-, school-, and student-level analyses. *Journal of Family Psychology*, ***21***(3), 510-519. doi: 10.1037/0893-3200.21.3.510

[13] Chiu, M. M., & Khoo, L. (2005). Effects of resources, inequality, and privilege bias on achievement: Country, school, and student level analyses. *American Educational Research Journal*, ***42***(4), 575-603. doi: 10.3102/00028312042004575

[14] Chudgar, A., & Luschei, T. F. (2009). National income, income inequality, and the importance of schools: A hierarchical cross-national comparison. *American Educational Research Journal, 46*, 626-658. DOI: 10.3102/0002831209340043

[15] da Cunha, J. M. P., Andrea Jimenez, M., Rus Perez, J. R., & de Andrade, C. Y. (2009). Social segregation and academic achievement in state-run elementary schools in the municipality of Campinas, Brazil. *Geoforum*, ***40*(**5), 873-883. doi: 10.1016/j.geoforum.2009.06.003

[16] Dixon-Roman, E. J., Everson, H. T., & McArdle, J. J. (2013). Race, Poverty and SAT Scores: Modeling the Influences of Family Income on Black and White High School Students' SAT Performance. *Teachers College Record*, ***115***(4).

[17] Elliott, W. (2013). The effects of economic instability on children's educational outcomes. *Children and Youth Services Review, 35*(3), 461-471. doi: 10.1016/j.childyouth.2012.12.017

[18] Greene, K. M., Hynes, K., & Doyle, E. A. (2011). Self-care among school-aged children of immigrants. *Children and Youth Services Review,* ***33***(5), 783-789. doi: 10.1016/j.childyouth.2010.11.023

[19] Hill, E. T. (2001). Post-school-age training among women: Training methods and labor market outcomes at older ages. *Economics of Education Review*, ***20***(2), 181-191. doi: 10.1016/s0272-7757(99)00059-x

[20] Huston, A. C., & Bentley, A. C. (2010). Human Development in Societal Context *Annual Review of Psychology* (Vol. 61, pp. 411-437).

[21] Jamison, E. A., Jamison, D. T., & Hanushek, E. A. (2007). The effects of education quality on income growth and mortality decline. *Economics of Education Review,* ***26***(6), 771-788. doi: 10.1016/j.econedurev.2007.07.001

[22] Kickbusch, I. S. (2001). Health literacy: Addressing the health and education divide. *Health Promotion International*, ***16***(3), 289-297. doi: 10.1093/heapro/16.3.289

[23] Kim, W. (1996). Problems and remedies of the North Korean economy: A strategic approach. *Korean Journal of Defense Analysis,* ***8***(2), 223-&.

[24] Lin, J. Y. (1991). Education and innovation adoption in agriculture - Evidence from hybrid rice in China. *American Journal of Agricultural Economics, 73*(3), 713-721. doi: 10.2307/1242823

[25] Marchant, G. J., & Finch, W. H. (2014). *Does a rising tide lift all boats? International relative and absolute SES and achievement*. Paper presented at the American Educational Research Association, Philadelphia, PA.

ISSN: 2247-6172
Review of Applied Socio- Economic Research
(Volume 9, Issue 1/ 2015), pp. 65
URL: http://www.reaser.eu
e-mail: editors@reaser.eu

[26] Margolin, G., & Gordis, E. B. (2000). The effects of family and community violence on children. *Annual Review of Psychology, 51*, 445-479. doi: 10.1146/annurev.psych.51.1.445

[27] Rutter, M. (1981). The city and the child. *The American journal of orthopsychiatry, 51*(4), 610-625.

[28] Thyne, C. L. (2006). ABC's, 123's, and the Golden Rule: The pacifying effect of education on Civil War, 1980-1999. *International Studies Quarterly, 50*(4), 733-754. doi: 10.1111/j.1468-2478.2006.00423.x

[29] Tsai, C.-L., Hung, M.-C., & Harriott, K. (2010). Human capital composition and economic growth. *Social Indicators Research*, ***99***(1), 41-59. doi: 10.1007/s11205-009-9565-z

[30] Van Ewijk, R., & Sleegers, P. (2010). The effect of peer socioeconomic status on student achievement: A meta-analysis. *Educational Research Review*, ***5***(2), 134-150.

[31] Wilkinson, R. G., & Pickett, K. E. (2007). The problems of relative deprivation: Why some societies do better than others. *Social Science & Medicine*, ***65***(9), 1965-1978.

Yen, H. (2012, July 22). US poverty on track to rise to highest since 1960s. *Associated Press*. Retrieved from http://hosted.ap.org/dynamic/stories/U/US_POVERTY_IN_AMERICA

Table 1. HLM Results for All PISA Subtests

	Mathematics			Reading			Science		
Predictors	Coef.	SE	T-ratio	Coef.	SE	T-ratio	Coef.	SE	T-ratio
Model 1									
GDP	2.56	.001	2025.7**	2.44	.001	1890.88**	2.69	.001	2141.80**
GINI	-2.41	.002	-1013.9**	-1.75	.002	-724.815**	-2.01	.002	-853.50**
Model 2									
GDP	.27	44.11	.845	.18	.24	.783	.22	.26	.87
GINI	.37	.31	.470	.82	.63	1.30	.56	.68	.83
SES Mean	28.67	.79	1.15	41.81	21.29	1.96	36.28	23.14	1.57
SES SD	-146.29	24.9	-3.32*	-108.69	36.42	-2.98*	-134.55	37.05	-3.63*
Model 3									
SES	30.31	.02	1812.17**	29.10	.02	1664.95**	28.78	.02	1720.81**
GDP	.22	.31	.724	.16	.23	.70	.21	.25	.84
GINI	.42	.78	.538	.84	.62	1.36	.57	.66	.86
SES Mean	.98	24.7	.040	14.49	21.05	.68	8.75	22.84	.38
SES SD	-138.97	.02	-3.19**	-104.15	36.05	-2.89*	-132.31	36.04	-3.67*

Note. * < .05, ** < .01