

Achievement Equity by Urbanization in Latvia's Primary Education—Analysis of PIRLS 2006 and TIMSS 2007 Data

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Abstract

A significant problem for the Latvian education system has long been inequity in the quality of education offered to all students across the country. A significant part of the achievement variance can be explained by performance differences between urban and rural school communities. In addition to this being a persistent trend, the gap has kept increasing over time (Geske, Grinfelds, Dedze, Zhang, 2006; Johansone, Preuschoff, 2008; Johansone, 2009).

This paper focuses on the equity of student achievement by urbanization in Latvia's primary education (fourth grade). Data from two IEA studies, PIRLS 2006 and TIMSS 2007, were used. Even though Latvia's overall results in the international arena at the primary school level have always looked rather good (Latvia scored well above the international average in reading literacy, mathematics, and science), how these scores are distributed across the population is very important. Intraclass correlations and variance components alone provide little more than an indication of equity, or in this instance inequity, in student achievement, and further analyses of contextual information is necessary to explain these results. Socio-economic status was the most important determinant of student achievement, but socio-economic backgrounds of individual students could not fully explain the urbanization effect. Low achievement equity in education proves to be a problem of segregation by socio-economic status, and the urbanization effect is significant mostly because the segregation was more obvious in the rural areas of Latvia. Almost half of the originally stated urbanization effect was explained by controlling for the proportions of disadvantaged students in different schools.

Keywords: *Equity in Education, Achievement Gap by Urbanization, Socioeconomic Background, Community Composition Effects*

Purpose and Significance of the Research

In a knowledge-based society, quality basic and secondary education is the minimum starting capital necessary for a person to attain full and successful inclusion in the labor market and everyday life (Latvian National Development Plan, 2006). Leading European economic advisors (e.g., Sapir et al. 2003, Calmfors et al. 2006) stress that education and training

systems that create efficient and equitable outcomes are key to economic prosperity and social cohesion (Woessmann, 2006).

Most developed countries achieve virtually universal enrolment in primary and lower secondary (basic) education. Many research studies, however, conclude that despite the increase in the number of years of schooling for all children, outcome inequities continue to grow and the gap between the most advantaged and most disadvantaged is actually getting bigger (Duru-Bellat, 2002). “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.” (Trong, 2008). Quality and equity in education is rapidly becoming a major political issue in most developed countries.

The Review of National Policies for Education in Latvia (OECD, 2001) found that inequity of student achievement by urbanization was one major factor influencing the quality of education in Latvia. Over time, Latvian data from international studies (IEA TIMSS, PIRLS, and OECD PISA) have revealed huge differences in student achievement by type of community. The variations between the achievement levels by school community put children in rural communities at a distinct disadvantage. The rural population, consisting of approximately one third of the students, had significantly lower achievement on average than their urban counterparts. The results were especially shocking when communities were stratified further by “Riga” (about one fourth of the population), “cities and towns”, and “rural.” Riga outperformed other cities and towns by more than 20 scale points and the rural parts of the country by more than 30 points. The goal of this research was to identify key factors influencing the urban-rural achievement gap, and suggest policy initiatives that could be expected to increase equity among Latvian schools.

Theoretical Framework

Neither an emphasis on excellence alone, often accompanied by a policy of exclusion, nor an emphasis on equality alone with its policy of inclusion, is sufficient for the attainment of educational eminence. Excellence without a commitment to equality could result in arrogance, and equality without a commitment to excellence could result in mediocrity (Willie, 1987).

Hamilton (1983) argued that equity will be realized only when student achievement outcomes are equalized. It is obvious, however, that it is impossible to bring every individual to the same level of educational achievement because individuals are unique and have different innate abilities. While the principle of equality assumes fairness by the uniform application of the

same expectation, standard, or treatment, the principle of equity, on the other hand, acknowledges that applying the same treatment to everyone without regard to individual differences does not have an equitable impact on all members of the population. Even if all students went to the same school and had the same teachers and educational supplies, some would still score higher than others. Equity in education means that any given student should be expected to have the same level of achievement attending any school in the school system (Chamberlain, 1987).

Social Inequalities

It is true that some schools and teachers are more effective than others, and interventions in the educational system are generally viewed as both more acceptable and more likely to succeed than, for example, direct interventions in the families. However, families and their socio-economic status also have a considerable influence on children's educational outcomes. In fact, it is rather difficult to introduce instructional changes in schools that would overcome the effect of the families, especially in developed countries, where the concept of poverty has become a concept of social inequality. Social inequality refers to the ways in which socially-defined categories of individuals are differently positioned with regard to access to social goods, including education, moreover quality education. Social exclusion is the lack of resources of an individual household, inadequate social participation, lack of knowledge, and lack of power. Educational inequalities are greatly based on social stratification and people's views towards the costs and benefits of education differ between social strata. Educational disadvantage usually stems from more general social and economic disadvantage (Smith, Lusthaus, 1995).

Raymond Boudon (1974) distinguished between the primary and secondary effects of social class in education. The primary effects are the different academic abilities of children, while the secondary effects are the varying educational choices made by children and their families among different social classes. By considering the secondary effects of social class, the organization of an education system comes in place. Social selection is not only caused by institutional selection mechanisms, but also by mechanisms by social self-selection. Thus the different educational opportunities provided by the educational system are highly dependent on the social class. Boudon's approach goes beyond the human capital approach which is commonly used at the time and tended to view educational outputs as being rated equally among all social classes. He characterizes educational choices as being made relatively within social stratification by taking into consideration the costs and benefits in the course of life.

Another aspect of concerning constraints and opportunities for parents of different social groups has to do with community environment and its impact on education. In many European

countries, most of the population lives in cities that have undergone profound changes affecting the social environment in the neighborhoods themselves and schools children grow up in. This social environment can be considered as a form of individual and collective social capital (Bourdieu, 1980; Coleman, 1988; Lin, 2001; van Zanten, 2005). The geographical location of the neighborhood is important because, even if there is good public transportation, parents generally prefer children to go to a school near their home. In most cases, social groups are not distributed evenly across neighborhoods and segregation is conceived as an involuntary process associated with various forms of societal inequality and exclusion. This socialization is characterized by externally-imposed social closure, limited economic and cultural resources, and therefore scarce social capital in terms of aspirations and values, as well as social networks.

Research on school choice shows that because this strategy suppose parents' economic, cultural, and social resources, it tends to be used more frequently by upper and middle-class parents and thus increase the advantages of the already advantaged (Walford, 1992). Upper-class groups have always used elite schools extensively and had access to the most reputable schools through residential segregation. Parents who want to gain access to the best schools must spend more time choosing schools and developing successful strategies to get their children into them and more money on private lessons for their children to meet the school requirements and get by in competitive environments. Choice also gives different advantages to different middle-class groups. Those who have more financial assets can use the private sector and provide more extra-school support. Those who have more cultural capital can get more information about schools and better prepare their children to get into them. Lower-class families are at a disadvantage in the choice game, not only because they lack the financial, cultural, and capital resources to make the best choices, but also because, in many cases, they do not want to choose. Additionally, lower-class children are victims of middle-class choices that increase the already high levels of academic and social segregation in the schools they are enrolled in (van Zanten, 2005).

Community Composition Effects

Society has attempted to offer opportunities to individuals without realizing that people live, move, and altogether exist within the context of groups. According to the wisdom of sociology, effective individuals drive their effectiveness from the groups with which they affiliate and in which they participate. Likewise, effective groups derive their effectiveness from the skills and performance of their members. Individuals operate within the context of social organization (Willie, Alves, 1996).

Education is one of those numerous human activities characterized by social spillovers. The

spillover argument is particularly easy to understand when social circumstances become extreme. For example, in schools with severe drug addiction, parental violence or other serious problems, the learning and teaching activities are constantly compromised, no matter the individual's ability (Vandenberghe, 1996).

Coleman (1966) was the first to claim that a student's achievement is highly dependent on the characteristics of his or her classmates. Significant community composition effects were also identified by Willms and Echols (1992) for Scotland, by Duncan (1994) for the United States, and Schuemer (2004) for Germany. Mostly, students from high socioeconomic backgrounds are less affected by the characteristics of their classmates than students from low socioeconomic backgrounds (Vandenberghe, 2002).

Henderson, Mieskowski, and Sauvageau (1978) found that in Canada (sample drawn from the French part of the Montreal school district), the characteristics of the average students in a class have a strong impact on the achievement of individual students. The peer group effect is measured by the mean IQ of the students in the class in which the student is placed. The authors concluded that mixing low-performing and high-performing students will have a positive impact on the achievement in the overall student population because the gains of the low-performing students will offset the losses of the high-performing students.

The school-mix also matters because it provides the context for creating student's awareness of equity and so acts as a determinant of their lifelong aspirations. People growing up in segregated settings receive poorer instruction, fewer local services, substandard materials, less able teachers, face higher crime, and greater poverty. Thus, they grow up less prepared for academic challenges, and less prepared to face diversity (Gorard, Sundaram, Smith, 2006). Schuemer (2004) concluded from an analysis of German PISA-E data that despite a high self-concept of their achievement, students in schools with a high density of disadvantaged peers still are low performers. Students judge their own abilities relative to their classmates. If all peers are low achieving, a student who outperforms his classmates has a high self-concept of his or her own abilities. This also is known as the "big fish little pond effect" (Marsh, Koeller, & Baumert, 1999).

Early Childhood Interventions

Educational disparities start before school – children from low-income families are found disproportionately in the less formal, less enriched settings, which have been found by research to yield lower school readiness and lower achievement throughout the school years (Brandon, Maher, Joesch, 2003). The early years of a child's development are critical to establishing a foundation for success in school. Early exposure to literacy activities, for

example, is a key element of later reading achievement (Mullis, Martin, Kennedy, Foy, 2007). Returns of qualitative preschool education are particularly high for children from disadvantaged backgrounds whose homes do not provide them with the foundation of skills necessary to prosper at later educational stages. Lack of public intervention for children from low socio-economic backgrounds has especially harmful effects on further stages of schooling. This perspective, however, requires a particularly long time horizon, which may run against the political self-interest of many policymakers, because the positive returns to early childhood investments may not be fully visible for quite a few years (Woessmann, 2006).

An especially effective approach of early childhood interventions for disadvantaged children is involving them in an intensive preschool setup at very early ages, involving parents to any extent possible, and home visits by such professionals as social workers and early childhood educators (Cunha et al., 2006). Participation in high-quality early childhood education and care programs is positively associated with the cognitive, social, and emotional development of children, their school readiness and achievement for all children, but with associations being especially strong for children from disadvantaged backgrounds (Fuchs & Woessmann, 2004; Kamerman et al., 2006).

Data Sources and Methods

This research is based on the IEA studies – PIRLS 2006 and TIMSS 2007. The PIRLS 2006 study involved 40 countries around the world. Latvia participated with 147 schools, 211 reading (language) teachers, 4162 fourth-grade students, and 3974 parents. The TIMSS 2007 study involved 36 countries and 7 benchmarking participants at the fourth-grade population. Latvia participated with 146 schools, 339 mathematics and science teachers, and 3908 fourth-grade students.

In Latvia, schools were stratified by urbanization during the school sampling process. This information was used in this research to determine the urbanization of a community. It was generally used with two categories - “Rural” and “Urban”. The communities characterized as urban, included Riga, other cities, and towns.

The selection of background variables that would be used to better understand student achievement by urbanization was a crucial step in this research. Descriptive statistics were computed for each variable of interest (percentages, means, and correlations). Unfortunately, the content of the PIRLS 2006 and TIMSS 2007 background questionnaires differed substantially. Thus, it was not possible to explore the population distribution and relationship with student achievement in reading, mathematics and science based on the same indicators. For this particular research, the PIRLS 2006 background questionnaires seemed to be better

suiting, especially having the Learning to Read Survey completed by parents. Parents' reports on their educational levels, employment situation, their child's preschool experience, and educational activities during preschool years are extremely valuable.

Some variables were combined to form indices to better represent complex constructs. Some indices used in this research were already calculated for the international database and two others were created specifically for this research. For the internationally created indices, the scales were created by calculating averages of the responses and assigning students to the three levels based on cutoff points. For the indices created for this research, the scales were created by combining the responses and directly classifying cases into the high, medium, and low level of an index depending on combination of responses to the source questions.

For both PIRLS and TIMSS, an index of students' socio-economic background (SEB) was created. For PIRLS, students were assigned to the low index level if their parents reported to have 100 or less books in the home, both parents' highest level of education was some secondary or less, or both parents' highest level of education was post-secondary but not university, and either parent or both parents worked less than full-time for pay. Students were assigned to the high index level if their parents reported to have more than 100 books in the home, and either parent's highest level of education was finished university or higher. All other combinations were assigned to the medium category. For TIMSS, the SEB index was created based on students' responses to two questions in the Student Questionnaire about possessions students have in their homes. These possessions included the number of books in the home (0-10 Books; 11-25 Books; 26-100 Books; 101-200 Books; More than 200 Books) and a list of six home possessions (Computer; Internet Connection; Own room; Encyclopedia; DVD Player; CD player). Students were assigned to the low index level if they reported to have 100 or less books in the home and two or less of the six home possessions. Students were assigned to the high index level if they reported to have more than 100 books in the home and at least four out of the six home possessions. All other combinations were assigned to the medium category.

Finally, a multilevel approach was adopted for this research. Multilevel modeling explicitly models the nested structure of the data using separate regression equations at each level describing how variables at one level influence variables at the other level (Harrison, Raudenbush, 2006). "Hierarchical linear models (HLM) explicitly recognize the presence of hierarchical units of analysis and allow modeling them simultaneously, in interrelated sub-models" (Ramirez, 2004). These analyses allowed to control for individual students' socioeconomic background and for the aggregated socioeconomic background simultaneously and were performed at the student and school levels. The models first take into account only the students' individual socioeconomic background and early childhood

education (PIRLS only). Further school level variables, such as urbanization and the aggregate socioeconomic background at schools, are added. The reference category for PIRLS is a student at the low socio-economic background (SEB) index level, whose school is in a rural community and is in a school with 50% or less fourth-grade students at the medium or high SEB index level. For TIMSS The reference category is a student at the low SEB index level in a rural school with 10% or less students at the high SEB index level. Since there also is a significant variation in the effect among schools, it was taken into account when building the models. The community composition effect is conceptualized as a threshold effect. It is not expected to be constant anywhere along the continuum of students' aggregated socioeconomic background. Instead of estimating a linear effect, cutscores or thresholds were selected at which the effect appeared most influential.

Findings and Discussion

As shown in Exhibit 1, when student achievement by socio-economic background was compared using the SEB index, there was a higher concentration of well-off families in the urban parts of Latvia and the socio-economic background of families was highly correlated with student achievement. However, urban student achievement was markedly much higher than rural student achievement at all levels of socio-economic background.

Exhibit 1: Student Distribution and Achievement by Urbanization and Socio-economic Background (SEB) in Latvia.

Urbanization	Level of the SEB Index	Reading		Mathematics		Science	
		% of Students	Average Achievement	% of Students	Average Achievement	% of Students	Average Achievement
Rural	High	10 (1.2)	555 (10.3)	12 (1.2)	558 (10.2)	12 (1.2)	559 (9.4)
	Medium	77 (1.8)	529 (6.0)	60 (2.1)	527 (5.1)	60 (2.1)	532 (4.7)
	Low	13 (2.1)	505 (10.1)	28 (2.2)	508 (7.0)	28 (2.2)	522 (6.3)
Urban	High	33 (1.6)	573 (3.2)	23 (1.0)	567 (3.4)	23 (1.0)	569 (2.4)
	Medium	61 (1.4)	540 (2.2)	66 (1.0)	543 (2.7)	66 (1.0)	546 (3.1)
	Low	6 (0.5)	541 (6.5)	11 (0.9)	510 (4.5)	11 (0.9)	521 (4.5)

() Standard errors appear in parentheses.

Exposure to education resulting in early literacy skills also was found to be an especially important factor. However, the preschool attendance had a much stronger influence on the achievement of rural students – difference of 7 and 26 scale points, respectively. Also, 71% of urban students and only 38% of rural students attended preschool for more than two years. For rural students in Latvia, the effect of attending preschool for more than two years appeared to be even stronger in relation to student reading achievement than the early home

literacy activities with the parents. Of course, this is speculative because there might be several hidden factors involved. However, Exhibit 2 shows that the effect of early literacy skills that can be learned either in the family, preschool, or both, had an extremely strong and positive correlation with the student achievement.

Exhibit 2: Student Distribution and Reading Achievement by Urbanization and Early Literacy Skills (ELS) in Latvia.

Urbanization	Level of Early Literacy Skills	Reading	
		% of Students	Average Achievement
Rural	Very Well	29 (2.5)	562 (6.2)
	Moderately Well	37 (1.8)	526 (6.4)
	Not Very Well	27 (2.2)	500 (7.1)
	Not at All	7 (1.3)	484 (10.7)
Urban	Very Well	36 (1.1)	576 (3.0)
	Moderately Well	42 (0.9)	543 (2.5)
	Not Very Well	18 (0.9)	519 (3.9)
	Not at All	4 (0.4)	497 (10.2)

() Standard errors appear in parentheses.

On average, reading achievement in Latvia was 573 scale points for those whose parents reported their children could perform early literacy activities very well, 538 scale points for performing activities moderately well, 511 for performing them not very well, and only 491 for not being able to perform the activities at all. The difference between students with very good early literacy skills and those with just moderate skills was 33 scale points, the difference is 82 scale points – comparable to a whole school year – in relation to students with no early literacy skills when starting primary school.

Community Composition Effects in Latvia

In PIRLS 2006, 98% of urban students were in schools with more than 50% of students from high or medium (SEB index levels) socio-economic backgrounds. In rural communities, there were only 76% of students in such schools. Moreover, 94% of urban students were in schools with even more than 60% of students from high or medium socio-economic backgrounds, while there were only 64% of students in such schools in rural areas.

Exhibit 3 shows to what extent the most influential students' individual and school level characteristics account for the observed differences in reading achievement scores in Latvia. The models first take into account only the students' individual socio-economic background (SEB index levels) and early literacy experiences (including EHLA – Early Home Literacy Activities index levels), then adds the community context and, finally, the aggregated

socioeconomic background at the school level represented by threshold effects.

Exhibit 3: Socio-economic, Early Literacy Background, and Student Composition Effects on Student Reading Literacy Achievement in Latvia.

	Model 1	Model 2	Model 3	Model 4	Model 5
Average Reading Achievement	521 (4.9)	509 (5.3)	502 (6.1)	492 (6.1)	486 (9.2)
Student-Level Effects					
Estimated Advantage for a Student at the Medium or High SEB Index Level	16.0 (4.1)	10.2 (3.5)	9.9 (3.4)	9.0 (3.5)	9.0 (3.5)
Estimated Advantage for a Student at the High EHLA Index Level		9.7 (3.2)	8.5 (3.4)	8.5 (3.4)	8.3 (3.4)
Estimated Advantage for a Student with Very Good Early literacy Skills		40.5 (2.7)	39.5 (2.8)	39.5 (2.9)	39.2 (2.8)
School-Level Effects					
Estimated Advantage for a Student Attending an Urban School			18.6 (6.0)	12.5 (6.7) ¹	14.6 (6.4)
Estimated Advantage for a Student Attending a School where More than 60% of Students are at the Medium or High SEB Index Level				17.7 (7.6)	
Estimated Advantage for a Student Attending a School where More than 50% of Students are at the Medium or High SEB Index Level					20.9 (10.7)

() Standard errors appear in parentheses. ¹ The effect is not significant.

Model 1: This first model estimated only the average impact of an individual student's socio-economic background at home. As a result, a student at the level of the low SEB index in Latvia scored on average 521 scale points on the PIRLS 2006 assessment. At the same time, a student at the medium or high level of the SEB index scored 16 points higher. The difference is statistically significant.

Model 2: This model estimated the effect of adding early literacy activities and skills to the individual student's socio-economic background. A student at the low level of the SEB index, who also was at the low or medium level of the early home literacy activities (EHLA) index and who did not have very good early literacy skills when starting school, scored on average 509 scale points on the PIRLS 2006 assessment. The model estimated that, if this student would be at the medium or high level of the SEB index, he or she would be expected to score 10 points higher. Moreover, if this student would be at the high EHLA index, he or she would also be expected to score another 10 points higher. It is striking that the estimated

advantage of a student having very good early literacy skills when starting school could be as high as 41 scale points. All estimated effects are significant.

Model 3: The third model added the urbanization effect at the school level. A student at the low level of the SEB index, who also was at the low or medium level of the early home literacy activities (EHLA) index and who did not have very good early literacy skills when starting school, and attended a rural school, scored on average 502 scale points on the PIRLS 2006 assessment. A student with the same individual characteristics, but attending an urban school, would be expected to score 19 points higher. The urbanization effect still is statistically significant even after accounting for the individual student characteristics.

Model 4: This model estimated community composition effects on student reading achievement in Latvia. The author estimated the effect on reading achievement for a student attending a school where more than 60% of the fourth-grade students were at the medium or high level of the SEB index. The results of this model shows that a student at the low level of the SEB index, who also was at the low or medium level of the early home literacy activities (EHLA) index and who did not have good early literacy skills when starting school, and also attended a rural school with 60% or less fourth-grade students at the medium or high level of the SEB index, scored on average only 492 scale points on the PIRLS 2006 assessment. A student with the same individual characteristics attending an urban school with 60% or fewer students at the medium or high level of the SEB index would be expected to score on average 13 points higher. The urbanization effect is no longer significant in this model. A student with the same individual characteristics attending a rural school with more than 60% of the fourth-grade students at the medium or high level of the SEB index would be expected to score 18 points higher.

Model 5: In this model, the author estimated the community composition effect by lowering the percentage of students at the medium or high level of the SEB index to “more than 50%”. The effect remained very strong. However, the urbanization effect became significant again. Thus, the author considers the “more than 60%” level the most influential threshold in explaining the urbanization effect.

The analysis of the PIRLS 2006 data in Latvia has proven that the community effects are extremely influential in shaping individual student achievement. It is remarkable that Model 4 of the analysis explained almost half of the original rural-urban achievement gap. By desegregating students within the rural areas in Latvia, could potentially improve the average reading achievement of rural students by about 18 scale points and thereby reduce the urbanization effect. Apart from student segregation, if rural children of preschool age would have the opportunity to acquire very good early literacy skills, their reading

achievement could be expected to improve by additional 40 points. Rural students with very good early literacy skills when starting school would be expected to score on average 532 scale points. If, later on, these rural students would attend schools with more than 60% of fourth-grade students at the medium or high level of the SEB index, they would be expected to have reading achievement of about 550 scale points, which would very likely reduce the urbanization effect to an insignificant level.

From the TIMSS 2007 results, 36% of urban students were in schools with more than 10% of students from high socio-economic backgrounds. In rural communities, there were only 34% of students in such schools. However, 30% of urban students were in schools with even more than 20% of students from high socio-economic backgrounds, while there were only 14% of students in such schools in rural areas. Thus, although weaker, the segregation by socio-economic status can be seen in the TIMSS data as well.

Exhibits 4 and 5 demonstrate to what extent students' individual and school-level socio-economic characteristics account for observed differences in mathematics and science achievement in Latvia. The models first take into account only students' individual SEB index levels, then add community context and, finally, aggregated socioeconomic background at the school level as represented by threshold effects.

Exhibit 4: Socio-economic and Student Composition Effects on Student Achievement in Mathematics in Latvia.

	Model 1	Model 2	Model 3	Model 4
Average Mathematics Achievement	524 (4.3)	519 (5.7)	516 (5.9)	503 (8.3)
Student-Level Effects				
Estimated Advantage for a Student at the High SEB Index Level	33.7 (4.9)	30.0 (5.0)	27.8 (4.9)	25.5 (4.6)
School-Level Effects				
Estimated Advantage for a Student Attending an Urban School		16.1 (6.7)	12.4 (6.6) ¹	11.6 (6.0) ¹
Estimated Advantage for a Student Attending a School where More than 20% of Students are at the High SEB Index Level			13.1 (6.0)	
Estimated Advantage for a Student Attending a School where More than 10% of Students are at the High SEB Index Level				26.7 (8.3)

() Standard errors appear in parentheses. ¹ The effect is not significant.

Model 1: This model estimated only the average impact of an individual student's

socio-economic background at home. As a result, a student at the medium or low level of the SEB index in Latvia scored on average 524 scale points on the TIMSS 2007 mathematics assessment. At the same time, a student at the high level of the SEB index scored 34 points higher. The difference is statistically significant.

Model 2: The second model added the school-level effect of urbanization. A student at the low or medium level of the SEB index, who also attended a rural school, scored on average 519 scale points on the TIMSS 2007 mathematics assessment. At the same time, a rural student at the high level of the SEB index scored 30 points higher. A student with the same level of individual socio-economic background, attending an urban school, would be expected to score 16 points higher. Thus, a student at the high level of the SEB index attending an urban school would be expected to score 46 (30+16) points higher than a student at the medium or low level of the SEB index attending a rural school. When controlling for individual student socio-economic background, the urbanization effect was slightly reduced, but still statistically significant.

Model 3: This model estimated community composition effects on student mathematics achievement in Latvia. The author estimated the effect on mathematics achievement for a student attending a school where more than 20% of the fourth-grade students were at the high level of the socio-economic index. In this model, a student at the low or medium level of the SEB index, who also attended a rural school with 20% or less fourth-grade students at the high level of the SEB index, scored on average 516 scale points on the TIMSS 2007 mathematics assessment. A student in the same school and community context at the high level of the SEB index would be expected to score 28 points higher. Moreover, a student with the same individual characteristics attending a rural school with MORE than 20% of the fourth-grade students at the high level of the SEB index would be expected to score 13 points higher. The urbanization effect was reduced to 12 points in this model, which is no longer significant.

Model 4: In this model, the author estimated the community composition effect by lowering the percentage of students at the high SEB index to “more than 10%”. The effect was very strong and the results are quite striking. A student at the low or medium level of the SEB index, who also attended a rural school with 10% or less fourth-grade students at the high level of the SEB index, scored on average only 503 scale points on the TIMSS 2007 mathematics assessment. A student with the same individual characteristics attending a rural school with more than 10% of fourth-grade students at the high level of the SEB index would be expected to score on average 27 points higher. The urbanization effect was reduced to 12 points in this model, which also becomes insignificant.

Exhibit 5: Socio-economic and Student Composition Effects on Student Achievement in Science in Latvia.

	Model 1	Model 2	Model 3	Model 4
Average Science Achievement	530 (4.3)	525 (5.7)	523 (6.1)	513 (8.3)
Student-Level Effects				
Estimated Advantage for a Student at the High SEB Index Level	30.0 (4.0)	26.9 (4.2)	25.2 (4.2)	23.6 (4.2)
School-Level Effects				
Estimated Advantage for a Student Attending an Urban School		13.8 (6.6)	10.9 (6.4) ¹	10.1 (6.3) ¹
Estimated Advantage for a Student Attending a School where More than 20% of Students are at the High SEB Index Level			10.6 (5.9) ¹	
Estimated Advantage for a Student Attending a School where More than 10% of Students are at the High SEB Index Level				21.6 (8.7)

() Standard errors appear in parentheses. ¹ The effect is not significant.

Model 1: This model estimated only the average impact of an individual student's socio-economic background at home. As a result, a student at the medium or low level of the SEB index in Latvia scored on average 530 scale points on the TIMSS 2007 science assessment. At the same time, a student at the high level of the SEB index scored 30 points higher. The difference is statistically significant.

Model 2: The second model added the school-level effect of urbanization. A student at the low or medium level of the SEB index, who also attended a rural school score on average 525 scale points on the TIMSS 2007 science assessment. At the same time, a rural student at the high level of the SEB index scored 27 points higher. A student with the same level of individual socio-economic background, attending an urban school, would be expected to score 14 points higher. A student at the high level of the SEB index attending an urban school would be expected to score 41 (27+14) points higher than a student at the medium or low level of the SEB index attending a rural school. Just as for mathematics, when controlling for individual student socio-economic background, the urbanization effect on student science achievement was slightly reduced, but still statistically significant.

Model 3: This model estimated community composition effects on student science achievement in Latvia. A student at the low or medium level of the SEB index, who also attended a rural school with 20% or less fourth-grade students at the high level of the SEB

index, scored on average 523 scale points on the TIMSS 2007 science assessment. A student in the same school and community context at the high level of the SEB index would be expected to score 25 points higher. The urbanization effect was reduced to 11 points in this model, which is no longer significant. A student with the same individual characteristics attending a rural school with MORE than 20% of the fourth-grade students at the high level of the SEB index would be expected to score 11 points higher. However, this effect is not significant either.

Model 4: In this model, the author estimated the community composition effect by lowering the percentage of students at the high SEB index to “more than 10%”. This time, the effect was significant, leaving the urbanization effect insignificant. A student at the low or medium level of the SEB index, who also attended a rural school with 10% or less fourth-grade students at the high level of the SEB index, scored on average only 513 scale points on the TIMSS 2007 science assessment. A student with the same individual characteristics attending rural school with more than 10% of fourth-grade students at the high SEB index level would be expected to score, on average, 22 points higher. The urbanization effect was reduced to 12 points in this model and becomes insignificant.

Due to the limited amount of family background information, it was somewhat more difficult to analyze the possible background effects on student achievement for TIMSS. One of the most influential socio-economic determinants – parents’ education and occupation –in relation to student achievement could not be explored in relation to mathematics and science achievement. Information on early childhood education and skills also is not available from the TIMSS data. Thus the models built for TIMSS provide less information and are likely to have more measurement error. For example, only the high level of the socio-economic background (SEB) index is used. Due to the index including only the number of books in the home and other home possessions, while missing parents’ education and occupation, the probability of being in the high level is much higher, while the effect is weaker. However, the results still show a strong impact of student composition on student mathematics and science achievement.

Conclusion and Implications

The research did identify some influential determinants of student achievement. Apart from socio-economic inequalities, such input factors as early literacy activities, early childhood exposure to education, and early literacy skills proved to be extremely important determinants of later achievement in school. Returns of qualitative preschool education turned out to be particularly high for children from disadvantaged backgrounds.

Also, even though socio-economic status is the most important determinant of student achievement, differing socio-economic backgrounds of individual students did not explain the urbanization effect. Poor equity of achievement in Latvia's primary education is a problem of segregation by socio-economic status, and the urbanization effect is significant mostly because the segregation is more obvious in the rural areas of the country. Almost half of the originally stated urbanization effect was explained by controlling for the proportions of disadvantaged students in different schools, reducing the urbanization effect to an insignificant level. The unexplained part of the urbanization effect would need additional research. However, from personal observations, the author has some insights on possible reasons that, unfortunately, could be difficult to measure. For example, the urban environment that an urban child is exposed to on an everyday basis, including access to museums, theaters, concerts, public libraries, even book stores, exposure to media (including internet at home), and all kinds of extracurricular activities may be all contributing factors.

As a result of this research, the author believes that the following proposals for policy makers, if combined, should help reduce the student achievement gap by urbanization and the disparity of achievement at the school level.

- Extensive, high quality preprimary education should be provided to all children with emphasis for disadvantaged communities and families. Because in some rural areas reaching the closest preschool would be impossible on a daily basis, preschool education (e.g., from the age of three to the age of five) in these areas should be provided on an individual or semi individual basis using a program especially developed to provide comprehensive child development services to disadvantaged children and their families, with a special focus on helping preschoolers develop the early reading and mathematics skills.
- Every rural school providing primary/basic education should be carefully evaluated and compared to neighboring schools in terms of student achievement and characteristics of student composition. After rural school desegregation to the greatest possible extent, these schools should receive extra financial support methodically in order to promote teacher movement from towns and cities to rural areas creating healthy competitiveness.
- To achieve the two above points, preschool and primary/basic education should be centrally funded by government, even if the funds coming from different districts would have to first flow into this common budget. This would not allow segregation by district in terms of funding and would make the "money follows the student" approach easier to realize.

Latvia should continue participating in acknowledged international comparative studies conducted by the IEA and OECD in order to monitor trends in student achievement internationally and within the country. Reliable methods of assessing learning achievement are an important part of an educational system that seeks to meet the needs of all children. In fact, international comparative studies are the only reliable way of obtaining trend data and evaluate whether any newly applied policies work the way they have been intended to.

References

- Boudon, R. (1974). *Education, Opportunity, and Social Inequality*. New York: Wiley.
- Brandon, R.N., Maher, E.J., Joesch, J.M. (2003). *Ohio's school readiness goal: starting early to close the achievement gap*. Human Services Policy Center. Evans School of Public Affairs. University of Washington.
- Chamberlain, J.D. (1987). *Equal educational opportunity: Expenditure equalization and peer group effects*. Dissertation in economics: University of California.
- Coleman J.T. (1966). *Equality of educational opportunity*. Washington DC: US Department of Health, Education and Welfare, U.S. Office of Education.
- Cunha, F., Heckman, J.J., Lochner, L., Masterov, D.V. (2006). *Interpreting the evidence on life cycle skill formation*. In Hanushek, E.A., Welch, F. (Eds.) *Handbook of the economics of education*. Vol.1. Amsterdam. pp.697-799.
- Duncan, G.J. (1994). *Families and neighbors as sources of disadvantage in the schooling decisions of white and black adolescents*. *American Journal of Education*. Vol.103. pp.20-53.
- Duru-Bellat, M. (2002). *Les inegalites sociales a l'ecole [Social Inequalities at School]*. Paris: Presses Universitaires de France.
- Fuchs, T., Woessmann, L. (2004). *Governance and primary-school performance: international evidence*. Ifo Institute for Economic Research at the University of Munich.
- Geske, A., Grinfelds, A., Dedze, I., Zhang, Y. (2006). *Family background, school quality and rural-urban disparities in student learning achievement in Latvia*. *Prospects*. Vol.XXXVI Pt.4.
- Gorard, S., Sundaram, V., Smith, E. (2006). *Why does the school mix matter?: equity from the students' perspective*. British Educational Research Association Annual Conference. University of Warwick.
- Hamilton, B.W. (1983). *The flypaper effect and other anomalies*. *Journal of public economics*. Vol.22. pp.347-361.
- Harrison, D.M., & Raudenbush, S.W. (2006). *Linear regression and hierarchical linear models*. In J. Green, G. Camilly, & P. Elmore (Eds.), *Complementary Methods for Research in Education*. Washington, DC: American Educational Research Association.
- Henderson, V., Mieskowski, P., Sauvageau, Y. (1978). *Peer group effects and educational production functions*. *Journal of Public Economics*, Vol.10, pp. 97-106.

- Johansone, I. (2009). *Managing Primary education in Latvia to assure quality and achievement equity*. Dissertation for the degree of Doctor in Management: Educational Management, University of Latvia.
- Johansone, I., & Preuschoff, A.C. (2008). *Izglītības kvalitāte Latvijas laukos un pilsētās ar ieskatu IEA PIRLS 2006 pētījuma rezultātos [Quality of education in rural and urban areas of Latvia: Results of the IEA PIRLS 2006 study]*. Latvijas Universitātes Raksti. Izglītības vadība. Vol. 749. Rīga: LU Akadēmiskais apgāds.
- Kamerman, S.B., Neuman, M., Waldfogel, J., Brooks-Gunn, J. (2003). *Social policies, family types and child outcomes in selected OECD countries*. OECD Social, Employment and Migration Working Paper No.6. Paris: OECD.
- Latvian National Development Plan 2007-2013. (2006). Ministry of Regional Development and Local Government of the Republic of Latvia. Latvia: Jelgavas tipogrāfija Ltd.
- Marsh, H.W., Koeller, O., Baumert, J. (1999). *Reunification of East and West German school systems: Longitudinal multilevel modeling study of the big fish little pond effect on academic self-concept*. American Educational Research Journal, Vol.38, pp. 321-350.
- Mullis, I.V., Martin, M.O., Foy, P., Kennedy A. (2007). *PIRLS 2006 international report: IEA's study of reading literacy achievement in primary schools*. Chestnut Hill, MA: Boston College.
- Organisation for Economic Co-operation and Development. (2001). *Reviews of national policies for education, Latvia*. Paris: OECD.
- Ramirez, M.J. (2004). *Understanding the low mathematics achievement of Chilean students: a cross-national analysis using TIMSS data*. Dissertation for the degree of Doctor of Philosophy: Lynch Graduate School of Education, Boston College.
- Schuemer, G. (2004). *Zur doppelten Benachteiligung von Schuelern aus unterprivilegierten Gesellschaftschichten im deutschen Schulwesen [The double disadvantage of students from low socioeconomic background in the German school system]*. Schumer, Tillmann & Weiss (Ed.): Die Institution Schule und die Lebenswelt fuer Schueler. Wiesbaden: VS Verlag fuer Sozialwissenschaften.
- Smith, W.J., Lusthaus, C. (1995). *The nexus of equality and quality in education: a framework for debate*. Canadian Journal of Education. No. 20(3)
- Trong, L.K. (2008). *Using PIRLS data to measure equity in reading achievement across countries*. Proceedings of the IEA International Research Conference, IRC2008-PIRLS, Taipei, Chinese Taipei: National Taiwan Normal University.
- Vandenberghe, V. (1996). *Functioning and regulation of educational quasi-markets*. Nouvelle Serie No.283. CIACO: Louvain-la-Neuve.
- Vandenberghe, V. (2002). *Evaluating the magnitude and the stakes of peer effects analyzing science and math achievement across the OECD*. Applied Economics, Vol.34, pp. 1283-1290.

- van Zanten, A. (2005). *New modes of reproducing social inequality in education: the changing role of parents, teachers, schools and educational policies*. European Educational Research Journal. 4(3). p.155-169.
- Willie, C. V. (1987). *When excellence and equity complement each other*. Harvard Educational Review. Vol. 57, pp. 205–207.
- Willie, C.V., & Alves, M.J. (1996). *Controlled choice: A new approach to school desegregated education and school improvement*. Education Alliance Press and the New England Desegregation Assistance Center: Brown University.
- Willms, D.J. & Echols, F, (1992a). *Alert and Inert Clients: The Schools Experience of parental choice of schools, experience of Schools*. Economics of Education Review: 11 (4), pp. 339 – 350.
- Willms, D.J. & Echols, F. (1992b). *The impact of differential expenditures on school performance*. Educational Researcher, Vol. 18, pp. 45-61.
- Woessmann, L. (2006). *Efficiency and equity of European education and training policies*. CESifo Working Paper No. 1779. Category 1: Public Finance.