Published in final edited form as:

Compare. 2014 September 1; 44(5): 732–755. doi:10.1080/03057925.2013.792670.

Universal patterns or the tale of two systems? Mathematics achievement and educational expectations in post-socialist Europe

Katerina Bodovski*, Stephen Kotok, and Adrienne Henck

Department of Education Policy Studies, The Pennsylvania State University, University Park, PA, USA

Abstract

Although communist ideology claimed to destroy former class stratification based on labor market capitalist relationships, de facto during socialism one social class hierarchy was substituted for another that was equally unequal. The economic transition during the 1990s increased stratification by wealth, which affected educational inequality. This study examines the relationships among parental education, gender, educational expectations, and mathematics achievement of youths in five post-socialist Eastern European countries, comparing them with three Western countries. We employed the 8th-grade data from the Trends in International Mathematics and Science Study (TIMSS) 1995 and 2007. The findings point to the universal associations between parental education and student outcomes, whereas gender comparisons present interesting East-West differences. The theoretical and policy implications of these findings are discussed.

Keywords

student achievement; educational expectations; gender; Eastern Europe

This study focuses on relationships among parental education, gender, educational expectations, mathematics self-concept and achievement of students in five post-communist Eastern European countries, comparing them with three Western countries. It is widely known that communist governments in Eastern Europe and the former Soviet Union emphasized the acquisition of mathematics and science knowledge and technical skills in order to promote the growth of industries directly related to military purposes. On the other hand, the humanities and social sciences were censored and tightly controlled by the government because the regimes perceived liberal education to be a threat to the established social order (Harris 2010). After the revolutions of 1989, many of the former communist countries made a concerted effort to integrate into the world economy by changing both their political and labor market structures. Naturally, these changes required rethinking educational systems; the new economic order also stimulated a need for new skills and

*Corresponding author. kxb918@psu.edu.

knowledge, particularly in the fields of economics, business and law (Bukodi 2010; Konstantinovskiy 2012; Silova 2009).

With this background in mind, we employed 8th-grade data from the Trends in International Mathematics and Science Study (TIMSS) 1995 and 2007 for the Russian Federation, Czech Republic, Lithuania, Romania, and Slovenia, and the three Western countries: Italy, Sweden and the United Statesⁱ. Students who were in the 8th grade during TIMSS 1995 data collection started school right before the fall of communism (associated with the fall of the Berlin Wall in 1989), namely in 1987. Since educational systems are known to be social institutions that process change slowly, TIMSS 1995 is likely to have captured relationships within educational systems that can be attributed to the old regimeⁱⁱ. On the other hand, TIMSS 2007 captures students and schools 18 years after the change. Thus, the important empirical question to be asked here is whether attitudes towards mathematics, as well as the associations among parental education, gender, and students' mathematics achievementⁱⁱⁱ, self-concept and educational expectations, have changed or remained the same. We chose mathematics achievement for two main reasons. First, it is perceived as a more neutral subject and studies showed that mathematics curriculum content is similar across otherwise different national contexts (Baker & LeTendre, 2005). Second, research on postsecondary educational transitions in the US identified mathematics achievement as a strong predictor of high school completion, tertiary enrollment and graduation (Kelly, 2009; Lee & Frank, 1990; Lucas, 1999). In the next sections, we summarize the existing literature on education in the post-socialist countries of Central and Eastern Europe and the former Soviet Union, articulate our theoretical framework, and identify the research questions for the current investigation.

Current literature on education in post-communist Europe^{iv}

Studies of education in former socialist countries reveal that although these societies were characterized by solid infrastructures for educational provision and administration, free education for all children, nearly universal general education enrollments and high literacy rates (Silova 2009), there existed pervasive inequality in educational outcomes based on family background (Bukodi 2010; Kraaykamp and Nieuwbeerta 2000; Konstantinovskiy 2012; Mateju & Strakova 2005; Prokic-Breuer 2011). Although communist ideology claimed to destroy former class stratification based on labor market capitalist relationships, in fact, one social class hierarchy was substituted for another that was equally unequal.

Research on socialist educational systems showed that despite ideological efforts to eliminate inequality, it persisted, but according to different lines compared to the West (Dobson 1977; Dobson and Swafford 1980). Lack of private property and thus lack of

ⁱOur choice of countries was limited by the availability of data on our variables of interest and thus somewhat weakens the theoretical argument about both historical and "East" vs. "West" comparison. More recent waves of data should allow more meaningful, theoretically guided comparisons.

ⁱⁱThe Soviet Union collapsed in 1991; thus, the 1995 wave for Russia represents even more so the relationships during the old regime.

ⁱⁱⁱWe treat mathematics achievement as an indicator of academic achievement in general for our purposes of the examination of educational stratification. Future studies should consider examining specific changes that occurred in teaching mathematics, such as changes in pedagogical approaches, teachers' preparation, and mathematics curriculum.

^{iv}We are aware that our literature review is based on English language publications; that leaves publications in the Eastern European languages beyond the scope of our review.

opportunity to pass financial capital to the next generation eliminated social class reproduction in the Western sense. However, scholars have argued that education became an inscriptive factor because assignment to a particular job or rank for the most part was based on educational qualifications (Dobson 1977; Dobson and Swafford 1980; Titma et al. 2003), with the exception of positions within nomenclature that were based on political power and social connections (Volker and Flap 1999; Wong 1996, 1998). In addition to the inequalities based on political affiliation, there is some evidence of the existence of the informal economy under socialist regimes in a shape of the differences between urban and rural areas, such as limited property rights on “second houses” in the country side with the opportunity of having a small agricultural business. These economic and social benefits of the past were indeed transformed to the new “capitalist” benefits. For instance, often the top managers of governmental plants and factories became their owners through the privatization channels of early 90s. Thus, inequality in post-socialist Eastern Europe can be seen as a somewhat continuous process, rather than suddenly appearing capitalist conditions.

By maintaining tight political control over education, the state regulated the societal hierarchical structure. Several studies on the Soviet educational system have shown strong effects for parental education on the respondents’ educational and occupational attainment, in particular for the professional stratum (intelligentsia). Rigid tracking prevalent in secondary schooling, with disproportionate numbers of boys channeled to vocational education, significantly increased women’s opportunities for social mobility, accompanied by a suppression of these trends among men (Gerber and Hout 1995; Titma et al. 2003). Indeed, differences in both access to quality of education and educational attainment were found among regions (with Central Asia and the Caucasus being the most disadvantaged), between urban and rural areas (with the latter lagging behind), and by parental education and gender. These differences persisted into the post-communist period of economic and political transition (Gerber 2000; Titma and Saar 1995).

The economic transition during the 1990s increased stratification by wealth and widened the gap between rich and poor, which affected educational inequality. Indeed, the “elitist ethic” of Russian education led to a growing number of special schools for talented children (both public and private), while general public education suffered severely from a lack of resources (low and unstable teacher salary, lack of appropriate textbooks, and decreasing state funding for education) (Johnson 2010; Micklewright 2000). Gerber and Hout (2004) found stronger effects associated with social origin during the transition to market economy, less upward mobility and more incidence of downward mobility. The authors attributed these trends to the fact that the new Russian government no longer promoted mobility for underrepresented groups; competition for higher status occupation has intensified while earning gaps increased dramatically. Konstantinovskiy (2012) came to a similar conclusion stating that his study found no evidence for upward social mobility through education, “but rather the legitimization of the inheritance of social status and reproduction of inequality” (20). At the same time, in the current discourse in the Russian Federation, both politicians and employers criticize the current state of education, blaming it for the deteriorating state of Russian human capital and complaining about the lack of a qualified labor force for a changing economy.

In their influential work, Shavit and Blossfeld (1993) examined patterns of stability and change in educational attainment and educational transitions in 13 countries, characterized by different stratification systems. Empirical studies on Poland, Hungary, and Czechoslovakia tested and confirmed the “socialist transformation hypothesis” that suggests that once the new elite establish their privilege and gain control over the educational system, they take steps to secure their advantages for their own children, thus creating a new type of social inequality. In an analysis of educational trends in socialist Czechoslovakia, Mateju (1993) found a decrease in class inequality in education completion rates at lower schooling levels and no change in higher levels. The very limited overall increase in educational opportunity, particularly at the secondary level, caused socialist Czechoslovakia to experience significant downward educational mobility and stagnation in upward mobility. Gender gaps, however, narrowed over the years. Mateju (1993) argued that under socialism, positions of power, informal social networks, and other resources in the hands of state bureaucrats essentially took meritocratic competition out of the educational system. He concluded: “Women won over men, and Slovaks won over Czechs, but the main loser in the game has been the educational system itself, the quality of education has been eroded, and the economy lost its vital source of innovation, acceleration and effectiveness” (Mateju, 1993, 268). Similar trends persist in post-socialist Czech Republic in the form of rigid institutional tracking, limited access to tertiary education, strong effects of family socioeconomic background on educational attainment, and large between school variance (Strakova et al. 2006).

Verashchagina (2012) examined the patterns of intergenerational educational mobility in twelve post-communist countries of Central Europe and the former Soviet Union. She argued that there is no evidence of a weakening relationship between parental education and the educational attainment of their children under socialism. While the absolute level of educational attainment has increased during the period of socialism, the increase in educational mobility is found only up until the generation of 1950s. The author points out that when average educational attainment increases, it may lead to a decrease in mobility because if everyone is highly educated, there is little room for improvement, while downward mobility remains possible. Coupled with an inefficient use of educated labor, the attempts of the socialist government to minimize income inequality led to very low returns from education. The author suggests that in post-communist economies, there is an increasing transition from the perception of education as a consumption good to an investment good.

The majority of studies surveyed above looked at the educational transitions, focusing on the processes shaping educational *attainment*. In the absence of standardized tests in the socialist educational systems, decisions regarding transition to the next educational level (particularly upper secondary and tertiary levels) relied on school and entrance examinations grades. Lack of the detailed and comparable data on measurable achievement, coupled with the much stronger importance of educational attainment for occupational outcomes may explain the virtual absence of studies on processes shaping educational *achievement* in the region. In fact, the first systematic studies of achievement in several Eastern European countries are based on PISA 2003 data (Willms et al. 2006). Educational trajectories are a cumulative process; several studies pointed to the crucial importance of both skills and attitudes

formation in early years to later outcomes (Alexander et al. 1997; Bodovski and Youn 2012). Thus, it seems important to examine trends shaping students' educational expectations and achievement that, in turn, have been linked to future educational attainment (Sewell and Hauser 1976; Sewell et al. 1970; Trusty 2002; Tyson et al. 2007).

Due to the rigid institutional tracking prevalent in all socialist education systems and many post-socialist systems to this day, 8th-grade students' achievement and attitudes are particularly important given that 8th grade is usually the year in which decisions are made regarding track placement for secondary school. The emergence of international studies, such as the Trends in International Mathematics and Science Study (TIMSS), have provided researchers with opportunities to examine various factors that determine students' achievement across countries, including family effects, teacher and school quality effects, and also opportunities to identify national trends. Interestingly, however, relatively few studies have focused specifically on Central and Eastern European countries, with the exceptions being reports prepared by international organizations (e.g., Mullis et al. 2000; UNICEF 2007) and studies focused on one specific country^V. Our study fills this gap by focusing on five former socialist countries, examining differences and similarities across time and countries with regard to relationships among parental education and gender on one hand, and educational expectations, mathematics self-concept, and achievement on the other. This topic is particularly important because studies have shown that post-socialist countries vary dramatically in their pace of transition to a new system and even in their ideas about the make-up of that system (Ammermuller et al. 2005; Mitter 2003; Silova 2009). Further, many social benefits existed during socialism, such as guaranteed health, education and within the context of a centrally planned economy, returns to schooling were low and differences in educational attainment had minimal impact on earning differentials (Flabbi et al. 2008; Verashchagina 2012). Moreover, the returns for education were lower for women than those for men (Mertus 1999). Thus, it is an empirical question whether these trends have any impact on the relationship among family background, gender, student self-concept, educational expectations, and achievement.

Theoretical framework

In comparative education research there seems to be a tension between two theoretical approaches. One approach identifies with the neo-institutional perspective that emphasizes convergence of structures and processes in the educational systems around the world (Baker and LeTendre 2005; Benavot et al. 1991). This line of research examines the presence of educational structures and content of educational institutions across countries arguing that with the rapid expansion of public education and with more people around the world spending more time than ever in different educational settings, these systems become more and more similar across different contexts. It is understood from the neo-institutional perspective that while not all the content and operation of education has, or will, necessarily become identical (DiMaggio and Powell 1983; Meyer and Rowan 1977), similar cultural ideas about education diffuse worldwide and shape national systems in similar directions. In the context of post-socialist countries, these processes imply a convergence of educational

^VSee, for example, the collection of articles organized by Willms et al. 2006.

institutions, as well as of mechanisms shaping success and failure within the educational system. Specifically, Baker and LeTendre (2005) argued that the improving quality of schools will make the family effects on educational outcomes more profound because of existing inequality among families within many countries. Further, the neo-institutional perspective predicts that with the expansion of mass education and increasing labor market opportunities for women, the gender effects in mathematics performance will vanish.

Building upon this theoretical argument, we formulate our first set of hypotheses:

H1: *Universal scenario*. The associations between family background and educational outcomes are similar between Eastern Europe and the West both in 1995 and 2007.

H2: *Convergence*. The associations between family background and educational outcomes are weaker in Eastern Europe than in the West in 1995, but they become stronger and more similar with the West in 2007. Gender differences in educational outcomes are less pronounced in 2007 compared to 1995.

A different theoretical approach focuses on divergences among educational systems; studies under this approach investigate the unique constellation of historical, social, economic and political processes in each country as a separate case. The Eurasia studies advocate particularly strongly for understanding the unique processes in educational systems in the post-socialist countries in their own right. They forcefully advise against the expectation that these countries would follow a linear path towards “Western” models or adopt “Western” content. They argue that each post-communist country has taken its own distinct path, often negotiating its historic legacy and culture on one hand and pressures from the international organizations to “convert”, on the other hand. The scholars within this tradition use concepts of “transitions”, “transitologies” and “transformations” to describe developments in Central and Eastern Europe and the former Soviet Union over the last two decades, emphasizing the uncertainty, ambiguity and open-endedness of these processes (Carney et al. 2012; Cowen 2000; Silova 2009, 2010). Building upon this theoretical approach we formulate the next two hypotheses:

H3: *The tale of two systems*. The associations between family background and gender on one hand, and educational outcomes on the other hand, differ between Eastern Europe and West in both the 1995 and 2007 waves.

H4: *No pattern*. The differences among Eastern European countries persist in both waves of data and there is no clear pattern in comparison with the West.

Simplifying the theoretical complexity of each approach, we can summarize that the former approach is looking for similarities and the latter for differences across countries. Both approaches employ a macro perspective looking at the policy and politics of education with the country being a unit of analysis. In this paper we do not aim to resolve the aforementioned theoretical tension. Instead, we are interested in *both* differences and similarities across countries and within countries across time. We believe that the two approaches can enrich one another since the study of divergence often lacks empirical evidence at the micro level and thus can be strengthened through quantitative analysis of the countries in question, while the neo-institutionalism perspective may overlook the

peculiarities of developments in specific countries that would help to better contextualize the findings.

We test our hypotheses by answering the following research questions (the analyses are performed for each country for both waves):

- ❖ How did students' mathematics scores, self-concept, and educational expectations change between 1995 and 2007?
- ❖ What were the associations among parental education and mathematics self-concept, educational expectations, and performance in 1995 and 2007?
- ❖ What was the magnitude of gender differences in mathematics scores, self-concept, and educational expectations in 1995 and 2007?
- ❖ What were the associations between mathematics self-concept and mathematics scores and future educational expectations in 1995 and 2007? In other words, what was the nature of these associations during socialism and has it changed since?

Data and methods

The 8th-grade data from the Trends in International Mathematics and Science Study (TIMSS) 1995 and 2007 fit very well with the study aims. TIMSS measures student achievement in mathematics and science and collects information on curriculum and instructional practices for many countries. Additionally, TIMSS collects key background information in order to allow for meaningful comparative analysis. Both TIMSS 1995 and 2007 used a two-stage stratified cluster sampling design in which schools were sampled with probability proportional to their size, and 8th grade classrooms were randomly selected from those schools. We restricted our choice of countries based on the availability of the valid data on mathematics scores, self-concept and educational expectations in both waves (1995 and 2007). As such, we employed data from five Eastern European countries (the Russian Federation, Czech Republic, Lithuania, Romania, and Slovenia) as well as three Western countries (Italy, Sweden, and the United States) as a comparison. Sample sizes are shown in Table 1.

Both TIMSS 1995 and 2007 assigned sampling weights to ensure the data matched the actual population of schools, classrooms, and students. Using the weights allows the results to be generalized to 8th graders for each country included in the study. All analysis in this study used weighted cases.

Three main dependent variables are examined. First, the student questionnaire includes several questions regarding the **student's mathematics self-concept**: "I usually do well in mathematics," "I enjoy learning mathematics," "I like mathematics", and "I think mathematics is boring" (all items were coded so that higher values indicated positive responses). Reliability testing indicates a Cronbach's alpha of 0.79 for 1995 and 0.82 for 2007. Second, the questionnaire includes a question about **student's educational expectations** ("How far in school do you expect to go?"). We dichotomized this variable so that a student aspiring for tertiary education equivalent to 4 years of college or a university received a value of 1. Finally, TIMSS assesses student **performance scores in**

mathematics in five domains and uses item response theory (IRT) method to map proficiency on a scale with an international mean of 500 with a standard deviation equaling 100. Since students answer different questions, TIMSS uses multiple imputation to create five plausible values (PV). We used specific PV commands in STATA to sum the plausible scores and to account for the additional standard error associated with PVs.

Our independent variables reflect the background of the student participants. We included a variable for gender (**female=1**). Both waves include a categorical variable on **parental education**. However, due to some discrepancy of coding between waves, we recoded the variable for consistency into four new categories: less than high school (omitted category), graduated high school, some college, and bachelors degree and above. Finally, we created a dummy variable indicating whether the student attended a school in a rural or urban setting (**rural=1**). This new variable bridged inconsistent coding between 1995 (physical description) and 2007 (population parameter). We used World Bank statistics to verify that our new rural variable closely reflected actual national populations for each year.

As a first step in the analysis and to answer the first and second research questions, we compared descriptive statistics for mathematics self-concept and educational expectations, and mathematics score between 1995 and 2007 data waves, by country and gender. In the first model of a multivariate regression analysis, to answer our third research question, we assessed the associations between family background (measured by parental education), gender, and the three dependent variables. In the second model, to answer our fourth research question, we treated two of our dependent variables as exogenous and examined their associations with the third.

In these data, students were sampled within previously sampled schools. Thus, the usual ordinary least squares (OLS) regression assumption of completely independent observations may be violated, since students in the same school tend to be similar on unmeasured variables. In order to correct for this, we applied a jackknife repeated replication (jrr) technique in order to provide unbiased estimates for all results. The analysis was performed separately for each country for both waves (1995 and 2007), and the coefficients were compared. Since our dependent variable for student's education attainment is a dichotomous variable, we used logistic regression for this analysis using jrr techniques to estimate correct standard errors.

Results

Table 2 presents descriptive statistics for the variables used in the analysis. The descriptive results show an increase in mathematics achievement between 1995 and 2007 in Lithuania and the United States, and decrease in mathematics achievement in the rest of the countries. While educational expectations increased between 1995 and 2007 in all studied countries, we found considerable differences among the countries: 13% of 8th graders in Romania, 35% in the Czech Republic, and 54% in the US aspired for a four-year college degree or equivalent in 1995. In 2007, these numbers were 49%, 38%, and 83%, respectively. Mathematics self-concept increased between 1995 and 2007 in Lithuania and the Russian Federation, but decreased in the rest of the countries.

Table 3 presents gender differences in our dependent variables by year. In 1995, boys had higher mathematics scores than girls in Czech Republic, Slovenia, and the US, while no gender difference was found in other countries. In 2007, girls in Lithuania, Romania, and Russia outperformed boys, but no gender difference was found in Czech Republic and Sweden, and boys had an advantage in Slovenia, the US, and Italy. Girls had higher educational expectations than boys in all countries in both waves (with the exception of Sweden where in 2007 no gender differences in educational expectations were found). However, there are considerable differences among the countries: 42% of girls aspired for a four-year college degree or equivalent in Czech Republic, 73% of girls in Russian Federation, and 86% of girls in the US. Interestingly, in 2007 in four out of five Eastern European countries and Sweden, girls had higher mathematics self-concepts than boys; no difference was found in Slovenia and the US, and boys had an advantage in Italy.

The descriptive results showed that more complex analysis is warranted. Our next step was to perform multivariate regression analysis adjusted for clustering in order to assess the associations between family background (measured by parental education), gender, and the three dependent variables. Table 4 presents the results of the multivariate regression analysis of mathematics scores in 1995^{vi}; Table 5 presents the same models for 2007. In model 1, we assessed the associations among parental education, gender, whether the school was in a rural area and mathematics scores. In model 2, we added students' educational expectations and mathematics self-concepts to the analysis. Parental education had a strong significant association with mathematics scores for all countries in both waves, and the magnitude of the association increased with the increased levels of parental education. The association between parental education and the outcomes increased between 1995 and 2007 in Czech Republic, Lithuania, and Romania.

In 1995, controlling for parental education, girls had lower mathematics scores than boys in Czech Republic. The 2007 results indicated an advantage for boys in Italy. In both waves of data, in the Russian Federation and Slovenia, the gender coefficient was not significant in Model 1. But adding educational expectations and mathematics self-concept to the model, both of which are positively associated with mathematics score, made the gender coefficient negative and significant. In other words, girls had lower mathematics scores in these countries, controlling for their educational expectations and mathematics self-concept. Romanian girls actually had higher scores in 2007 controlling for other variables in the model. Students in rural areas had lower mathematics scores than their peers in urban schools in the Russian Federation, Lithuania, and Slovenia in 2007. In all countries in both waves of data, educational expectations and mathematics self-concept were positively associated with students' mathematics scores.

Next, we conducted multivariate logistic regression analysis of educational expectations in 1995 and 2007^{vii}. Parental education had strong significant associations with whether a student aspired to graduate from college/university in both waves in all studied countries. Controlling for parental education, the gender differences were mixed in 1995 (they did not

^{vi}For Tables 4–7 the calculations for Italy, Sweden and the US are available upon request.

^{vii}We did not include the respective tables due space concerns. The analysis is available upon request.

reach significance in several countries), but in 2007, girls had greater educational expectation in all countries. Students in rural areas had somewhat lower educational expectations, but the significance of those results varied by country and by wave. Although our research design does not allow for establishing causal relationships among the variables, we modeled educational expectations as a function of both mathematics scores and mathematics self-concept. The literature points out to the reciprocal relationship among these constructs: higher performing students may have stronger self-concept and higher expectations, but having higher expectations students may also try harder and receive higher scores. Indeed, both mathematics self-concept and mathematics scores had positive significant associations with educational expectations.

We also conducted multivariate analysis predicting mathematics self-concept (the results are available upon request). Girls in the Russian Federation had higher mathematics self-concepts than boys in both waves of data. Multivariate analysis did not detect significant gender differences in other countries. In 1995, in all countries except Lithuania, higher levels of parental education were associated with a stronger mathematics self-concept. This finding was consistent with those of 2007 in all countries except the Russian Federation. In all countries in both waves, mathematics scores and educational expectations had positive significant associations with mathematics self-concept.

Discussion

We employed the 8th-grade data from the Trends in International Mathematics and Science Study (TIMSS) 1995 and 2007 for five Eastern European countries – the Russian Federation, Czech Republic, Lithuania, Romania, and Slovenia – to answer four main research questions: a) Have students' mathematics scores, self-concept, and educational expectations changed between 1995 and 2007? b) What was the magnitude of gender differences in mathematics scores, self-concept, and educational expectations in 1995 compared to 2007? c) What were the associations among parental education, gender and mathematics self-concept, educational expectations, and performance in 1995 and 2007? d) What were the associations between mathematics self-concept, mathematics test scores, and future educational expectations in 1995 and 2007? We compared the findings with three Western countries: Italy, Sweden, and the United States.

The findings of the study show that mathematics scores and mathematics self-concepts have fluctuated between 1995 and 2007; they increased in some countries and decreased in others. Student educational expectations have risen consistently between 1995 and 2007 with girls having higher expectations than boys in all studied countries, except for Sweden. At the same time, significant variation has been detected among the countries with students in all European countries having lower educational expectations than students in the US possibly indicating faster expansion of higher education in the latter country. Further, by contrast to the US and Italy where boys hold the advantage in mathematics, by 2007 in four out of five Eastern European countries girls achieved parity or out performed boys in mathematics and also had higher mathematics self-concepts. Parental education had a strong significant association with mathematics scores and educational expectations for all countries in both waves, and the magnitude of these associations increased with the

increased levels of parental education (especially, for mathematics scores). Here again, we found variation among the countries; the association between parental education and the mathematics scores has increased between 1995 and 2007 in the Czech Republic, Lithuania, and Romania. On average, Eastern European students in rural areas had lower mathematics scores and educational expectations than their peers in urban areas. A similar pattern appears in Sweden, but not in the US or Italy. In all countries in both waves of data, students' educational expectations and mathematics self-concept were positively associated with their mathematics score.

We conclude that with respect to the relationships among mathematics self-concept, educational expectations, and mathematics performance, as well as the association between parental education and all three outcomes, our findings confirm the *universal scenario* with a note that stratification by family background has somewhat intensified in several Eastern European countries as a result of transition to the market economy. Thus, our study supports the neo-institutional theory view about the universal mechanisms that are found in different educational systems across the world, as well as the argument that the family effects on educational outcomes become more salient because of existing (or growing) inequality among families within countries.

With respect to gender differences we found some evidence supporting the *tale of two systems scenario*. Our findings show that girls in Eastern European countries seem to hold an advantage in their mathematics scores and mathematics self-concept, while having significantly higher educational expectations than boys. Although it may appear that the gender patterns in post-socialist countries resemble these in the West with girls being the majority on the university campuses and women holding the majority of semi-professional and routine non-manual strata (lower white-collar) jobs (Titma et al. 2003), these trends are worrisome. Throughout the educational history of socialist regimes, boys, especially those from less educated families, were disproportionately channeled into vocational education which in turn significantly restricted their access to tertiary education. Eastern European societies may be at risk of further alienation of young males from the educational system (which is shown by their lower test scores, academic self-concepts, and educational expectations as early as in 8th grade) which may increase the incidence of undesirable outcomes such as dropping out of high school, unemployment, and delinquent behavior. The fact that several Eastern European countries (in particular, Czech Republic and Romania) have significant industrial sectors, serving often as “assembly plants” for transnational corporations, highlights the need for maintaining high quality vocational education. It particularly challenges an “American” assumption of college for all.

On the other hand, women's education and employment in Eastern Europe should remain in the focus of policy makers. The proliferation of state bureaucracy under socialism created an unusually large professional/managerial class that allowed employment of women with tertiary education (Gerber and Hout 2004). The disappearance of these jobs after the collapse of the centralized economy left many women across the region without employment. The prevalence of pervasive gender stereotypes, traditional cultural patterns, and patriarchal attitudes in the region coupled with the erosion of access to state-subsidized early childhood care, makes it rather difficult for women to find a niche in the changing

labor market, thus highlighting a necessity of providing women with appropriate human capital and opportunities to employ it (Magno et al. 2003; Mertus 1999).

Thus, our findings of girls' academic advantage are contradicted by the evidence from other studies that highlight persistent gender inequality in labor market participation favoring men, as well as gender inequality in other spheres of life. Further, our findings are worrisome in regards to boys' academic patterns. These trends both converge with the Western trajectories of more equal participation of women in the education realm, but at the same time they diverge from these trajectories by posing unique challenges to men and women in post-socialist countries. As such, the findings of our study regarding gender differences support the Eurasia studies argument about the unique processes in educational systems in the post-socialist countries. It is important to carefully examine the constellation of economic, cultural, political and social circumstances of the countries in this region that shape gendered processes and transformations within their educational systems. We agree with the scholars who emphasize the uncertainty, ambiguity and open-endedness of the educational processes in post-communist Europe. Thus, it is likely that the processes we attempted to capture are neither convergent, nor divergent. Instead, we witness a scenario of emergent cultural hybridity, with both narratives present. It remains to be seen which influences will prevail and which new themes will emerge.

Describing post-socialist transformations, scholars raise many problematic issues; increasing economic inequality being only one of them. The collapse of planned economy left many people without an employment. As mentioned above, women were greatly affected by these changes. Older people, particularly generations of 45 years old and above, experienced difficulties fitting their human capital with the new economic realities. At the same time, residents of former socialist countries lost a great deal of the safety net in terms of health care, publicly funded education, including higher education, to name a few, all of which they have enjoyed during socialism. The negative impacts of transition to a market economy were distributed unevenly both across and within the nations in the region.

Commercialization and privatization of many aspects of social life created problems that these societies are facing to the present day. In this paper we by no means argue for a linear process of transformation, or a movement from a more problematic to a less problematic state of the affairs. Our goal was to compare using sociological lenses the stratification of educational achievement over time and between post-socialist and established Western educational systems. Thus, interpreting our findings, it is hard to separate the influences of the socialist past, obstacles and challenges of post-socialist transition from the historical heritage of the region prior to socialism.

Our study has several limitations. The data availability restricted our analysis to the five Eastern European and three Western countries that had valid data on all our variables of interest in both waves of data collection. Future studies should investigate in more detail the relationship between family background and youth's educational outcomes (because of data limitations, the current study focused on parental education only). One of the promising future directions for research is to tease out the effects of gender from the effects of parental background (in other words, to examine whether boys and girls equally benefit from the socio-economic characteristics of their parents). Moreover, a new wave of data (TIMSS

2011) includes information on more post-socialist countries, as well as more Western countries allowing a more comprehensive investigation. As the unique social and political contexts of post-socialist nations continue to evolve, an investigation of educational inequality should remain an important focus of research in Eastern Europe.

Acknowledgments

This research was supported by the seed grant of the Population Research Institute, The Pennsylvania State University. The authors would like to thank Aaron Benavot, David Baker, Soo-yong Byun, and two anonymous reviewers for *Compare* for their insightful comments, as well as Jill Armington and Yunyi Deng for their help with the literature search.

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Table 1

Sample sizes, by country by wave.

Country	1995	2007
Czech Republic	3327 (149)	4745 (147)
Lithuania	2525 (145)	3931 (142)
Romania	3723 (163)	4198 (149)
Russian Federation	4022 (174)	4472 (210)
Slovenia	2708 (121)	4043 (148)
Sweden	1926 (116)	5215 (159)
Italy	2328 (137)	4408 (170)
United States	7087 (183)	7377 (239)

Note: number of students with number of schools in parentheses.

Table 2a

Descriptive comparison between 1995 and 2007 (Eastern Europe, US and Western Europe).

	Czech Republic		Lithuania		Romania		Russian Federation		Slovenia	
	1995 (n=3327)	2007 (n=4845)	1995 (n=2525)	2007 (n=3991)	1995 (n=3725)	2007 (n=4198)	1995 (n=4022)	2007 (n=4472)	1995 (n=2708)	2007 (n=4043)
Math Score										
Mean	545.55 ^a	503.81	471.84	505.82 ^a	473.73 ^a	461.32	523.62 ^a	511.73	530.95 ^a	501.48
SD	(75.05)	(73.69)	(82.23)	(79.74)	(95.51)	(99.75)	(80.21)	(83.08)	(72.95)	(71.62)
Math self- concept										
Mean	2.50 ^a	2.42	2.51	2.60 ^a	2.83 ^a	2.69	2.77	2.83 ^a	2.68 ^a	2.34
SD	(0.62)	(0.78)	(0.62)	(0.76)	(0.58)	(0.82)	(0.57)	(0.70)	(0.62)	(0.73)
Educational Expectations ^b										
Mean	0.35	0.38 ^a	0.46	0.59 ^a	0.13	0.49 ^a	0.56	0.63 ^a	0.44	0.51 ^a
SD	(0.48)	(0.48)	(0.50)	(0.49)	(0.34)	(0.50)	(0.50)	(0.48)	(0.50)	(0.50)
Female										
Mean	0.49 ^a	0.48	0.55 ^a	0.50	0.50 ^a	0.49	0.53 ^a	0.52	0.51 ^a	0.50
SD	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Parent's Education										
Finished HS	0.35	0.66 ^a	0.19	0.30 ^a	0.28	0.53 ^a	0.19 ^a	0.13	0.36 ^a	0.19
Some college	0.15 ^a	0.12	0.30	0.45 ^a	0.25 ^a	0.18	0.39 ^a	0.38	0.26	0.44 ^a
BA or more	0.23 ^a	0.20	0.43 ^a	0.19	0.11	0.16 ^a	0.37	0.43 ^a	0.20	0.30 ^a
Rural										
Mean	0.16	0.18 ^a	0.32 ^a	0.24	0.31 ^a	0.27	0.23	0.24 ^a	0.33 ^a	0.26
SD	(0.37)	(0.39)	(0.47)	(0.43)	(0.46)	(0.45)	(0.42)	(0.43)	(0.47)	(0.44)

	United States		Italy		Sweden	
	1995 (n=7087)	2007 (n=7377)	1995 (n=2328)	2007 (n=4408)	1995 (n=1926)	2007 (n=5215)
Math Score						
Mean	492.32	508.35 ^a	491.01 ^a	479.63	539.57 ^a	491.30
SD	(84.18)	(76.74)	(87.58)	(73.00)	(74.00)	(67.06)
Math self- concept						
Mean	2.84 ^a	2.71	2.87 ^a	2.56	2.72 ^a	2.61
SD	(0.70)	(0.81)	(0.71)	(0.80)	(0.64)	(0.71)
Educational Expectations ^b						
Mean	0.54	0.83 ^a	0.25	0.62 ^a	0.31	0.49 ^a
SD	(0.50)	(0.37)	(0.43)	(0.24)	(0.46)	(0.50)
Female						
Mean	0.49	0.51 ^a	0.51 ^a	0.48	0.49	0.48
SD	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Parent's Education						
Finished HS	0.19	0.26 ^a	0.41	0.42	0.45 ^a	0.26
			(0.49)	(0.49)	(0.50)	(0.44)
Some college	0.38 ^a	0.09	0.05	0.06	0.10	0.21 ^a
			(0.22)	(0.24)	(0.29)	(0.41)
BA or more	0.36	0.54 ^a	0.09	0.24 ^a	0.32	0.47 ^a
			(0.29)	(0.43)	(0.47)	(0.50)
Rural						
Mean	0.24 ^a	0.06	0.41 ^a	0.06	0.17	0.33 ^a
SD	(0.43)	(0.24)	(0.49)	(0.24)	(0.38)	(0.18)

^aThe mean for year is significant at the p<.05 level.

^bEducational expectations is a dummy variable measuring if student expects to graduate from a university (equivalent to bachelor's degree).

Table 3

Achievement, expectations, and self-concept by country, year, and gender.

	Czech Republic				Lithuania				Romania			
	Male		Female		Male		Female		Male		Female	
	1995	2007	1995	2007	1995	2007	1995	2007	1995	2007	1995	2007
Math score	552.25 ^a * (74.85)	502.63 (71.85)	538.61 ^a (69.26)	505.06 (70.23)	471.74 (79.26)	502.63 ^a (78.81)	472.03 (78.99)	509.21 ^a <i>b</i> (78.81)	474.90 ^a (92.62)	452.47 (99.54)	472.92 ^a (87.21)	470.42 ^a (91.77)
Educational expectation ^c	0.33 (0.47)	0.34 ^a (0.47)	0.37 ^b (0.48)	0.42 ^a <i>b</i> (0.49)	0.36 (0.48)	0.48 ^a (0.50)	0.53 ^a (0.50)	0.69 ^a <i>b</i> (0.46)	0.13 (0.33)	0.40 ^a (0.49)	0.14 ^a (0.34)	0.58 ^a <i>b</i> (0.49)
Math self-concept	2.51 ^a (0.62)	2.40 (0.77)	2.50 ^a (0.62)	2.45 ^b (0.80)	2.47 (0.61)	2.58 ^a (0.75)	2.54 ^b (0.62)	2.61 ^a <i>b</i> (0.77)	2.84 ^a (0.58)	2.63 (0.82)	2.83 ^a (0.58)	2.76 ^b (0.80)
	Russian Federation				Slovenia							
	Male		Female		Male		Female					
	1995	2007	1995	2007	1995	2007	1995	2007				
Math score	523.06 ^a (82.80)	509.33 (83.49)	524.22 ^a (72.02)	513.97 ^b (77.00)	534.87 ^a <i>b</i> (70.12)	502.86 (71.08)	527.19 ^a (70.19)	500.22 (66.41)				
Educational expectations	0.46 (0.50)	0.53 ^a (0.50)	0.64 ^b (0.48)	0.73 ^a <i>b</i> (0.45)	0.39 (0.49)	0.44 ^a (0.50)	0.48 ^a (0.50)	0.59 ^a <i>b</i> (0.49)				
Math self-concept	2.71 (0.57)	2.74 ^a (0.71)	2.82 ^a (0.57)	2.90 ^a <i>b</i> (0.75)	2.66 ^a (0.63)	2.34 (0.71)	2.70 ^a (0.63)	2.35 (0.75)				

	United States				Italy				Sweden			
	Male		Female		Male		Female		Male		Female	
	1995	2007	1995	2007	1995	2007	1995	2007	1995	2007	1995	2007
Math score	494.81 ^a (83.93)	510.23 ^{a b} (75.36)	489.90 (78.26)	506.60 ^a (72.62)	493.81 ^a (89.50)	487.30 ^{a b} (81.32)	488.32 ^a (85.65)	476.52 (71.36)	538.75 ^a (75.60)	490.11 (68.62)	541.60 ^a (71.85)	493.74 (65.25)
Educational expectations	0.51 (0.50)	0.80 ^a (0.40)	0.57 ^a (0.50)	0.86 ^{a b} (0.35)	0.22 (0.41)	0.57 ^a (0.50)	0.28 ^a (0.45)	0.68 ^{a b} (0.47)	0.28 (0.45)	0.48 ^a (0.50)	0.34 ^a (0.48)	0.50 ^a (0.50)
Math self-concept	2.84 ^a (0.69)	2.72 (0.81)	2.83 ^a (0.70)	2.70 (0.81)	2.91 ^{a b} (0.70)	2.59 ^a (0.80)	2.83 ^a (0.72)	2.52 (0.80)	2.75 ^{a b} (0.64)	2.58 (0.71)	2.68 ^a (0.63)	2.65 ^a (0.70)

^aThe mean difference for year is significant at the $p < .05$ level.

^bMean difference for gender is significant at the $p < .05$ level.

^cEducational expectations is a dummy variable measuring if student expects to graduate from a university (equivalent to bachelor's degree).

Table 4

OLS Regression for math achievement (TIMSS 1995, Eastern Europe).

	Czech Republic		Lithuania		Romania		Russian Federation		Slovenia	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Female	-13.35*** (3.70)	-14.73*** (3.81)	-0.98 (5.47)	-11.01 (6.37)	-0.67 (3.79)	-1.32 (4.29)	-0.98 (3.68)	-11.14** (3.77)	-5.50 (3.42)	-13.25*** (3.29)
Parental education	37.18*** (4.94)	22.56*** (4.39)	5.00 (10.81)	7.10 (15.23)	18.67* (9.26)	1.28 (9.54)	25.67** (7.52)	24.92** (7.40)	37.05*** (5.02)	24.29*** (4.98)
Finished HS	31.91*** (6.05)	16.16** (5.71)	34.23** (10.81)	27.84** (14.20)	54.34*** (9.26)	36.64*** (9.98)	40.11*** (6.47)	29.78*** (7.16)	38.01*** (5.33)	21.73*** (5.58)
Some college	59.35*** (6.93)	29.97*** (5.66)	63.28*** (10.27)	49.80*** (14.38)	58.03*** (12.59)	34.21** (12.38)	69.89*** (8.25)	50.53*** (7.12)	78.78*** (5.40)	41.28*** (5.21)
BA or more										
Rural	-4.34 (9.71)	3.17 (8.12)	-17.12 (8.60)	-14.73 (8.57)	-19.20 (11.22)	-15.68 (10.55)	-38.37*** (6.19)	-35.33*** (7.08)	-14.27* (6.23)	-11.84 (6.30)
Educational expectations		61.50*** (4.44)		47.45*** (6.45)		32.10*** (6.34)		29.45*** (8.19)		50.04*** (3.86)
Math self-concept		27.29*** (2.88)		33.74*** (5.73)		36.96*** (4.70)		38.26*** (3.32)		30.73*** (3.08)
Constant	525.47*** (4.80)	449.76*** (8.01)	451.54*** (10.41)	361.24*** (21.54)	464.13*** (8.90)	371.13*** (18.37)	488.91*** (8.93)	389.39*** (12.09)	502.19*** (4.87)	420.40*** (8.83)
R ²	0.09	0.34	0.11	0.32	0.09	0.17	0.12	0.25	0.13	0.35
N	2980	2716	1400	814	2886	2307	3484	2695	2074	1739

Notes:

Standard errors in parenthesis.

* $p < .05$;

** $p < .01$;

*** $p < .001$.

Table 5

OLS Regression for math achievement (TIMSS 2007, Eastern Europe).

	Czech Republic		Lithuania		Romania		Russian Federation		Slovenia	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Female	3.17 (2.31)	-2.34 (2.31)	6.15 (3.26)	-2.14 (3.52)	19.58*** (3.27)	4.97 (3.55)	5.21 (3.37)	-9.46** (3.24)	-2.12 (3.53)	-9.89** (3.63)
Parental education	36.08** (13.07)	20.38 (11.67)	52.12*** (7.05)	44.41*** (9.61)	42.55*** (8.44)	22.09* (9.54)	9.69 (9.12)	8.61 (11.21)	19.61* (7.57)	11.01 (8.63)
Finished HS	49.68*** (13.37)	32.04** (11.70)	72.14*** (6.16)	49.21*** (8.80)	73.38*** (9.09)	41.13*** (9.97)	47.13*** (9.40)	32.48** (9.98)	35.38*** (7.34)	16.75* (7.41)
Some college	83.43*** (14.02)	40.24** (12.14)	101.04*** (7.69)	58.82*** (10.51)	104.46*** (10.37)	54.61*** (10.94)	72.84*** (9.49)	46.38*** (9.12)	54.21*** (7.60)	27.08** (7.94)
BA or more										
Rural	-9.71 (7.55)	-10.69 (6.19)	-24.74*** (6.20)	-17.86* (6.89)	-20.71 (14.27)	-14.46 (13.05)	-24.56** (7.32)	-26.11*** (7.36)	-11.47* (5.40)	-12.16* (5.40)
Educational expectations		56.43*** (3.15)		60.08*** (3.96)		61.18*** (6.36)		39.26*** (4.82)		59.08*** (3.46)
Math self-concept		22.89*** (1.76)		26.77*** (2.52)		24.39*** (2.29)		32.41*** (2.95)		24.64*** (2.41)
Constant	463.01*** (14.26)	410.18*** (14.72)	447.42*** (6.52)	368.98*** (8.47)	413.07*** (9.94)	352.24*** (11.09)	467.39*** (9.74)	378.81*** (12.26)	471.71*** (7.51)	406.55*** (8.97)
R ²	0.08	0.30	0.13	0.35	0.13	0.26	0.12	0.26	0.08	0.31
N	4167	3758	2938	2254	3367	2908	4001	3607	2841	2078

Notes:

Standard errors in parenthesis.

* $p < .05$;** $p < .01$;*** $p < .001$.