2013-06-24

Family Matters: Operationalization of Intergenerational Educational Background

Elizabeth Warnick
Brigham Young University - Provo

Family Matters: Operationalization of Intergenerational Educational Background

Elizabeth Warnick

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of requirements for the degree of

Master of Science

John Hoffmann, Chair
Mikaela Dufur
Benjamin Gibbs

Department of Sociology

Brigham Young University

June 2013

ABSTRACT

Family Matters: Operationalization of Intergenerational Educational Background

Elizabeth Warnick
Department of Sociology, BYU
Master of Science

This study seeks to replicate and extend Roksa and Potter's (2011) analysis of the association between intergenerational family background and academic outcomes by utilizing the Education Longitudinal Study of 2002 to examine alternative methods for operationalizing maternal educational background. Results indicate a positive association between maternal upward mobility and adolescent academic achievement. Measures of mobility affect adolescent achievement even when controlling for both mother's and maternal grandmother's educational attainment. Future research should examine the differential impact of extreme mobility, specifically downward mobility, on adolescent academic outcomes.

Keywords: intergenerational mobility, educational attainment, academic achievement, family background, educational mobility

ACKNOWLEDGMENTS

First, I would like to thank my loving family, especially my parents, for their unconditional support throughout this process. Thank you for always encouraging me to do my best and to keep my head up. A special thanks to my sister, Claire, and my brother, Seth, for their love, support and perspective.

Completion of this project would not be possible without the help of my thesis committee. I would like to thank Ben Gibbs and Mikaela Dufur for their insights, encouragement and willingness to take the time to help me develop this project. I would especially like to thank John Hoffmann for his continual encouragement and support and for inspiring me to pursue a graduate degree in the first place.

Finally, I would like to thank all of the professors and fellow graduate students in the sociology department who have instilled in me an interest in sociology and have motivated me to conduct quality research.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

INTRODUCTION

Although the ideal of a meritocratic society is optimistically imposed upon the United States, the reality is that every American is born with a certain degree of advantage and disadvantage which has attendant effects on later educational and occupational outcomes (Blau and Duncan 1967; Sewell, Hauser 1976; Lee and Burkham 2002; Entwisle, Alexander, and Olson 2005), though one's background is not completely deterministic (Kingston 1996). Prior studies have found that the degree to which individuals are imbued with economic and social advantage is partially predicated upon their socioeconomic class of origin. Family background conceptualized as class status has been found to be not only an indication of resources available to individuals, but also different orientations towards and expectations of social institutions such as schools (Bourdieu 1986; Coleman 1988). However, family background is neither a static nor simplistic concept. In order to fully understand the association between family background and an individual's status attainment, it is instructive to not only consider current parents' status with regards to child outcomes, but also their point of origin to assess the extent and effects of social mobility (Blau and Duncan 1967). For example, individuals who are upwardly mobile in relation to their parents in terms of educational and occupational attainment may be better equipped to facilitate their child's success than those who are downwardly mobile (Roksa and Potter 2011).

Mobility studies typically focus on occupational or economic mobility (Hauser and Featherman 1977; Beller and Hout 2006). However, educational mobility acts a major facilitating factor for economic mobility because of the close association between educational and occupational structures (Sewell and Hauser 1976; Kingston et al. 2003; Hertz 2006). Historically, the association between education and occupational outcomes in the United States represents a globally unique relationship given the early American focus on free and accessible

basic schooling for the public through the common school movement and the perceived role of education to socialize and prepare students to enter the workforce (Brint 2006:36-38). A study of the effects of educational mobility independent of economic mobility on academic outcomes is productive since parents' level of education has a pronounced influence on child academic achievement (Parcel and Dufur 2001; Harding et al. in Bowles, Gintis and Groves 2005; Lareau 2003 Attewell and Lavin 2007). Previous studies indicate a greater association between parental education and child academic outcomes than the association between parental economic assets and child academic outcomes (Bradley and Corwyn 2002:375-376) since education "influences the beliefs and behaviors of the parent, leading to positive outcomes for children and youth" as well as increases parent expectations for child academic achievement (Davis-Kean 2005:294).

The effects of inequalities in family educational background on early educational outcomes have been the topic of several stratification and educational studies (Heckman 2008). Whereas some studies indicate a weakening of the effects of family background on achievement as a child progresses through school (Sewell and Hauser 1976; Burnett and Farkas 2009; Hsin and Xie 2012), most of these studies do not operationalize family background as a three-generation concept (see Roksa and Potter 2011 for an exception). Thus, the effects of family background conceptualized across three generations on later adolescent achievement warrants further investigation.

PURPOSE OF THE STUDY

The purpose of this study is to first replicate the work of Roksa and Potter (2011) and then examine alternative operationalizations of educational background to provide additional insight into the association between intergenerational educational background and academic outcomes for American adolescents. The study builds on the assumptions of status attainment

theory, as outlined by Blau and Duncan (1967), that an individual's educational and occupational attainment are influenced by their parents' socioeconomic status. But it also considers the influence of grandparents' educational achievement in relation to parents' achievement. The study utilizes the Education Longitudinal Study of 2002 (ELS:2002), a nationally representative sample of American high school sophomores, to examine the effects of intergenerational maternal education measures on adolescent outcomes. In this study, intergenerational refers to educational measures across three generations including the adolescent, their mother, and their maternal grandmother. Maternal rather than paternal educational background was chosen given the close association established among maternal education, parent-child interactions, and child academic outcomes. Maternal intergenerational educational background is measured by an additive measure of the adolescents' mother's level of educational attainment and maternal grandmother's level of educational attainment. Intergenerational educational background is also operationalized as relative mobility determined by the difference between mother and maternal grandmother's educational position. For the purposes of this study, academic outcomes are measured by reading and math scores on cognitive tests administered as part of the survey.

LITERATURE REVIEW

Initial Inequality and Family Background

Studies have long established that one's family background has significant implications for what one achieves both educationally and economically (Haller and Davis 1981; Roscigno and Ainsworth-Darnell 1999; Lee and Burkham 2002; Entwisle, Alexander and Olson 2005; Engle and Black 2008). Whereas family background is often a vague concept, it is generally conceptualized as class or socioeconomic status, a composite of parental occupational prestige, education and family income (Lee and Burkham 2002; Cheadle 2008). When examining the

association between family background and academic outcomes, some have conceptualized family status solely in terms of educational attainment (Roksa and Potter 2011) whereas others argue that status refers more specifically to occupational status and credentials (Lareau 2003:279). Family background also includes family structure, although its effects are hard to separate from socioeconomic effects given that certain family structures such as single parenthood are more prevalent among the lower socioeconomic strata (Burnett and Farkas 2009; Carlson and England 2011). Regardless of its source, children's family background has important implications for how they are treated by teachers and fellow students and subsequently how they fare within a school context (Lee and Burkham 2002; Lareau 2003; Condron 2007; Duncan et al. 2007; Claessens, Duncan and Engel 2009). For example, the Matthew effect posits that those at the top continue to follow a path of high achievement and those at the bottom continue along a path of lower achievement resulting in a fan spread pattern, thus emphasizing the importance of fostering early academic achievement (Farkas 2003; DiPrete and Eirich 2006; Bodovski and Farkas 2007; Morgan, Farkas and Hibel 2008:187).

Given the consequential initial impacts of family socioeconomic status on academic achievement, substantial attention has been afforded to examining *why* socioeconomic status affects early childhood achievement. Child academic achievement is not solely contingent on socioeconomic factors, but other influential factors such as individual motivation and ability, factors that have also been linked to socioeconomic status. Byrnes and Wasik (2009) hypothesized that early childhood math achievement is facilitated through three interactive primary channels: opportunity, propensity and antecedent factors. Antecedent factors refer to family background characteristics such as parent socioeconomic status and parental aspirations. Antecedent factors were found to be significantly associated with a child's propensity for math

achievement but not with opportunity factors in the classroom. Similarly, Hackman, Farah and Meany (2010) found that family socioeconomic status has direct associations with child "cognitive and emotional development" (2010:11), which can alternatively be conceptualized as hard and soft skills and abilities. Although ability and achievement are closely related, they are distinct in that ability is a more inherent and stable trait while achievement is something that can be acquired and is thus more susceptible to outside influences (Guo 1998:259-260). Cognitive and non-cognitive abilities independently and differentially affect academic outcomes (Hall and Farkas 2011), although cognitive skills are associated more consistently with academic outcomes than soft or non-cognitive skills (Duncan et al. 2007; Claessens et al. 2009; Grimm et al. 2010; Hsin and Xie 2012; see Romano et al. 2012 for an exception). Hsin and Xie (2012) argued that there is a relatively weak link between family socioeconomic status and non-cognitive skills and a relatively strong link between family socioeconomic status and cognitive skills, although Heckman (2007) posited that both hard and soft skills are highly correlated with family background factors, specifically parental education and maternal ability: children whose parents are more educated tend to have greater cognitive as well as non-cognitive skills.

Although the initial impact of family background has a pronounced effect on early childhood cognitive and non-cognitive skill development (Heckman 2008), the direct effects of background on academic achievement may lessen as a child progresses through school (Burnett and Farkas 2009). Some support has been found for the contention that cognitive skills stabilize by adolescence, and that the association between maternal education and verbal achievement via child cognitive skills somewhat strengthens as children age, although the direct effects of maternal education and permanent income on achievement decrease over time (Hsin and Xie 2012:20). Alternatively, Guo (1998) found that family poverty (a measure of socioeconomic

status) continue to have an effect on adolescent achievement beyond childhood. More research is required to understand the effects of family background in adolescence on academic achievement to further assess the association between family background and achievement beyond initial cognitive development.

Family Background as a Three-Generation Concept

Whereas family background generally refers to a child's parents' position in the social structure, some have expanded it to consider grandparent characteristics since the facilitation of achievement may be influenced not only by parents' destination class but also by their class of origin (Blau and Duncan 1967; Roksa and Potter 2011). Although Warren and Hauser (1997) found that grandfather's occupational status, schooling and income did not have direct, significant effects on their grandchild's occupational or educational status once parent characteristics were considered, they did not account for potential social mobility between parents and grandparents. Whether or not a parent was mobile relative to their parents may affect their ability to create home environments which foster learning and development accrued through educational attainment. For example, if a mother was upwardly mobile relative to her mother, this may be indicative of greater motivation and ability to promote similar trajectories for her children (Roksa and Potter 2011). Although prior studies have used measures of grandparent achievement as control variables in models of intergenerational mobility, (e.g. Parcel and Dufur 2001), few have explicitly conceptualized family background across three generations in terms of mobility and alternative measures such as additive operationalizations of parent and grandparent status or achievement. Thus, the examination of alternative intergenerational conceptualizations of family background and mobility beyond raw measures of

educational attainment may better illuminate the effects of family background on subsequent achievement (Roksa and Potter 2011).

It is also important to address factors that facilitate or impede intergenerational mobility (Haller and Portes 1973). Although many factors influence the transmission of advantage across generations, the following represent consistent influential factors beyond individual attributes and motivations: health (Hertz 2006), race (Hertz 2006), education (Sewell and Hauser 1976; Hertz 2006; Pew 2012 et al. 2012), state of residence (Hertz 2006), neighborhood poverty (Pew 2012 et al. 2012), occupational structure (Hauser and Featherman 1977) and family savings (Pew 2012 et al. 2012).

Education is a mechanism of special interest with regards to social mobility and inequality (Haller and Portes 1973; Sewell and Hauser 1976). In the United States, formal schooling represents an almost universal experience for children and adolescents. As such, it can either serve as an equalizing context for children who come from different socioeconomic backgrounds, or it can exacerbate pre-existing disparities through segregation and discriminatory practices (Downey, von Hippel and Broh 2004; Boudieu and Passeron 1990). With regards to stratification and mobility, education is significant primarily through its ties to the labor market. In an intergenerational context, education tends to act as a protective barrier from downward mobility from one generation to the next since higher levels of educational attainment typically translate into more prestigious employment and subsequent greater income (Alm 2011; Pew 2012 et al. 2012). However, as explained by Sewell and Hauser (1976), education is a "key variable in the status attainment process because it serves both as a status variable of considerable importance in its own right and as a major facilitator of achievement in the occupational, economic, and social spheres" (1976:13). Parent, specifically maternal, education

is a measure of family background which is especially salient in terms of promoting child academic achievement. Augustine, Cavanagh and Crosnoe (2009) identified a positive association between maternal education and early childhood academic experiences beyond maternal economic resources. They emphasize that education is beneficial beyond financial assets since education "enhances . . . critical thinking skills, personal efficacy and social networking" (2009:2). Similarly Attewell and Levin (2007) found that mothers who are college-educated tend to parent in an academically beneficial way for their children through the investement of time and resources at home and at school, and that these benefits are distinct from economic benefits (2007:6). Consequently, an examination of the association between educational intergenerational attainment rather than economic status across three generations and child academic outcomes is productive given the well-established effect of parent education on child achievement (Davis-Kean 2005).

Intrafamilial Mechanisms of Educational Stratification

Although there is a well-established association between parental status and achievement (Haller and Davis 1981; Roscigno and Ainsworth-Darnell 1999), as well as between parental education and child educational attainment as discussed above (Davis-Kean 2005: Buchanan and DiPrete 2006), measures of parent income, occupation, and education are only moderately associated with academic achievement (Sewell and Hauser 1967; Winne and Nesbit 2010:66). Consequently, there are additional factors that may further explicate the impact of family educational attainment and academic outcomes that warrant further exploration (DiPrete and Eirich 2006).

Substantial research suggests that child educational attainment is strongly influenced by intrafamilial processes between parents and children (Entwisle, Alexander and Olson 2000;

Attewell and Lavin 2007; Durham et al. 2007; Engle and Black 2008; Gordon and Cui 2012). Parents with higher levels of educational attainment may have greater amounts of human capital and other resources to invest in their children's academic experiences (Coleman 1988; Lareau 2003; Heckman 2008; Hsin and Xie 2012). Although paternal and maternal education are both associated with child cognitive development, the impact of maternal educational attainment is especially salient in terms of early cognitive development and academic experiences (Bradley and Corwyn 2002; Heckman 2008; Augustine, et al. 2009) since mothers rather than fathers tend to act as primary caregivers in the home (Augustine et al. 2009; Roksa and Potter 2011) and are subsequently more likely to be directly involved in their child's educational experiences (Lareau 2003).

Parental involvement in child educational experiences represents a broad concept referring to practices at home and at school (Epstein et al. 1997). It is generally perceived positively since it facilitates effective socialization as well as parental social control (Domina 2005), and prior studies substantiate the perceived positive association between parental involvement and academic achievement (Hara and Burke 1998; Jeynes 2003; Fan and Chen 2001; Sandefur, Meier and Campbell 2006; Condron 2009; see McNeal 1999 and Domina 2005 for exceptions). Parental educational expectations represent a specific type of educational involvement and investment (Haller and Portes 1973; Parcel and Dufur 2001; Davis-Kean 2005; Entwisle et al. 2005; Sandefur et al. 2006; Cheadle 2008; Byrnes and Wasik 2009; Erickson, McDonald and Elder 2009; Bodvoski 2010; Roksa and Potter 2011; Wells et al. 2011). Parents with higher levels of educational attainment tend to hold higher expectations for their children in terms of education (Hao and Bonstead-Bruns 1998). As with other forms of involvement such as volunteering and helping with homework, there is an established positive association between

high parental educational expectations and academic outcomes (Coleman 1988; Bowen et al. 2012), especially for early adolescents (Froliand et al. 2012). The impact of high parental expectations is heightened when these expectations are shared by children (Hao and Bonstead-Bruns 1998).

Roksa and Potter 2011

Although the association between maternal educational attainment, parental involvement and academic achievement is well-established, few studies have examined the effects of family educational background across three generations, parental involvement and academic achievement. In an analysis of the association between maternal intergenerational education background, parental involvement and scores on math and reading assessments, Roksa and Potter (2011) found that differences in achievement across class categories is partially attributed to different levels of parental involvement. In their study, family background is defined solely as maternal educational attainment rather than occupational or income measures (2011:304). Their results demonstrated that children whose mothers were upwardly mobile were able to close the gap with children whose mothers were stable middle class when parenting and sociodemographic controls were included (2011:314). However, parental involvement did not completely explain the association between disparate levels of parental educational attainment and academic achievement. Ultimately, class of destination mattered more than class of origin in terms of which parenting practices mothers employed.

In their study, maternal upward, downward or static mobility was determined by whether or not a mother and her mother were "highly educated" (0.4 standard deviations above the mean of their respective cohorts). Mothers and grandmothers who were both highly educated were categorized as stable middle; mothers who were highly educated but whose mothers were not

were categorized as new middle; mothers who were not highly educated but whose mothers were highly educated were classified as new working; and mothers and grandmothers who were not highly educated were classified as stable working. However, although this approach is analytically attractive given its simplicity, it does not account for mobility across disparate point of origin and point of destination beyond "highly educated" resulting in a lack of precision, a point acknowledge by the authors.[1] Their study rests on the assumption that distinct classes "actually exist as relatively cohesive social entities with common life experiences" (Kingston 1996:324) with life experiences referring specifically to parental involvement practices. Additionally, they propose that measuring intergenerational educational background in terms of the association between parent and grandparent educational attainment beyond independent measures of parent and grandparent educational attainment is a productive endeavor that provides a more complete explanation of the effects of family background on child academic outcomes. Consequently, the extent to which more precise operationalizations of intergenerational maternal background are associated with adolescent academic outcomes remains to be seen. The present study attempts to advance Roksa and Potter's (2011) research by operationalizing intergenerational background as an additive measure as well as measures of relative mobility to provide a more precise measure of mobility in examining the subsequent effect on adolescent rather than child academic outcomes.[2]

RESEARCH QUESTIONS

The present study will address the following research questions: What association exists between maternal educational background conceptualized intergenerationally for mothers and maternal grandmothers and adolescent scores on math and reading assessments? What effect do different methodological approaches to conceptualizing intergenerational educational

background have on adolescent academic outcomes? Since the effects of family background on educational outcomes decrease over time (Sewell and Hauser 1976; Burnett and Farkas 2009; Hsin and Xie 2012), I hypothesized that the effects of maternal educational background on adolescent achievement operationalized as performance on math and reading assessments are small, but significant. Additionally, consistent with previous research, I hypothesized that adolescents whose mothers were upwardly educationally mobile relative to their own mothers have higher scores on both reading and math assessments than those whose mothers were downwardly mobile. I hypothesized a significant and positive association between high levels of maternal educational attainment and adolescent reading and math assessments. Ultimately, the purpose of this study is to utilize a nationally representative sample of high school sophomores to extend Roksa and Potter's (2011) measure of family educational background conceptualized in terms of intergenerational mobility (stable middle, new middle, new working and stable working) beyond whether or not the adolescent's mother and her mother were highly educated to further explicate the rationale of examining measures of family educational background across three generations. Although previous studies have examined the independent effects of grandparent and parent education on grandchild education and occupational status and have found no direct association between grandparent status and grandchild outcomes once parent characteristics are included in the model, they have not considered the potential role of relative mobility or additive educational advantage (Warren and Hauser 1997). As Roksa and Potter (2011) suggest, operationalizing family background in terms of mobility beyond raw measures of grandparent and parent status may provide a more complete understanding of the association between family background and adolescent outcomes.

DATASET

Addressing the research questions outlined above requires a data set with information about parent and grandparent characteristics. The Education Longitudinal Study of 2002 (ELS:2002) represents such a dataset with measures of mother and maternal grandmother educational background. The ELS:2002 is a nationally representative sample of American adolescents who were followed from their sophomore year in high school until their transition into the labor market or future educational pursuits; initial data collection began in 2002, and students were re-surveyed in 2004, 2006 and 2012. Since the purpose of the ELS:2002 is to obtain a more holistic understanding of adolescents' transitions from high school to postsecondary pursuits, student information is available from multiple contexts, specifically home and school. The data set is well-suited for an examination of the association between family background and adolescent academic outcomes since information is available about parent and grandparent educational attainment via parent surveys. In addition to student and parent questionnaires, sophomore math and English teachers, principals and library media center directors at the students' schools were surveyed in the base year of the study (NCES 2004a). Analytic variables were drawn from the base year of the survey since information specific to parent surveys and integral to the present analysis are only available in the 2002 data.

The survey adopted a multi-stage, probability sampling procedure wherein 750 schools across the country were selected within which approximately 15,000 sophomores were randomly selected and subsequently completed base year questionnaires. Of these sophomores, about 13,400 (approximately 87%) have information available from parent respondent questionnaires. Base year sample size represents an oversampling of non-public schools as well as Asian and Hispanic students in order to ensure larger comparative sample sizes for analyses (NCES 2004b).

MEASURES

Intergenerational Educational Background

In order to assess intergenerational family educational background, the key explanatory variable in the present study, information was obtained from parent reports of parent and spouse/partner's highest level of education as well as their parents' highest level of education, resulting in information about mother figure and maternal mother highest levels of education attained at the time of the survey.[3] Although foundational status attainment research focuses primarily on paternal lines, specifically the influence of father occupational and educational status on son's occupational and educational attainment (Blau and Duncan 1967), considerable research suggests that mothers exert a significant, primary influence on their children's academic achievement (McLanahan 2004; Attewell and Lavin 2007; Dussaillant 2011; Roksa and Potter 2011). Based on prior research only maternal measures of educational background were included in the analysis to replicate and extend Roksa and Potter's (2011) analysis.

Educational attainment was determined by responses to the following question: "What is the highest level of education you and your spouse/partner have reached?" Response categories were coded as the following: 1=Did not finish high school, 2=Graduated from high school or GED, 3=Attended 2-year school, no degree; 4=Graduated from two-year school; 5=Attended college, no 4-year degree, 6=Graduated from college, 7=Complete Master's degree or equivalent, 8=Completed PhD, MD or other advanced degree. A similar question with identical response categories was asked of the parent about their spouse/partner, their parents, and their spouse/partner's parents. Education variables were treated as continuous variables in the analysis although the categories are not exactly one unit apart. This is consequently a limitation of the

study. These questions were used to create variables that measure educational attainment for the sophomore's mother and maternal grandmother.

In order to replicate Roksa and Potter's (2011) study, the first measure of educational background used in the analysis was determined using their conceptualization of "highly educated" and subsequent class categories: stable middle, new middle, new working, stable working. Family background categories were determined by whether or not a mother and her mother were both more than 0.4 standard deviations above the mean or "highly educated." The cutoff of 0.4 standard deviations was conditioned on the PSID and CDS sample since it created enough observations in each category to conduct analysis as well as to account for education inflation so that the "highly educated" classification for mothers was higher than for grandmothers. The cutoff of 0.4 standard deviations had the same effect for the ELS:2002 analytic sample: mothers who were "highly educated" included those who attended college, but did not obtain a 4-year degree or more; maternal grandmothers who were "highly eduated" included those who graduated from a two-year school or more. Using a cutoff of 0.4 standard deviations created greater dispersion among classifications of stable middle, new middle, new working and stable working than a cutoff of 1 standard deviations above the mean.

Next, in order to obtain an alternative measure of intergenerational educational background with regards to adolescent academic outcomes, measures of maternal additive educational background were created to account for mothers and grandmothers who both achieved high levels of educational attainment. Since relative educational mobility beyond raw measures of educational attainment may indicate transmission of advantage (Roksa and Potter 2011), the difference in relative position in the educational distribution of each generation was also created. Difference in mothers' and grandmothers' relative position was determined by first

standardizing the educational attainment variables for each generation and then subtracting grandmother z-scores from mother z-scores. Doing so provided a continuous measure of mother intergenerational educational mobility relative to her mother which allows for operationalization of educational mobility beyond Roksa and Potter's (2011) "highly educated" cutoff since there may exist differences in terms of the impact of maternal education for mothers who are substantially downwardly mobile compared to those who are only slightly downwardly mobile relative to their mothers.

Parent Involvement and Investment Controls

Previous research has established a number of measures of parental educational involvement and investment that are consistently associated with academic outcomes such as parental volunteering at school, parent-teacher discussion, and parent educational expectations. Such measures are consequently included as additional controls in the present analysis. The ELS:2002 contains extensive information about parent-school interaction (e.g. whether or not parents were involved in parent-teacher organizations, how often parents contacted their adolescent's school about volunteer work, post-high school plans, and school program information, etc.), parent educational expectations for their adolescent, and parent-child learning promoting practices (e.g. how often parents discuss report card, provide advice to adolescent about post-high school plans, how often parents check homework). I hypothesized that there would be three distinct factors measuring parent involvement and investment: parent involvement at home, parent school involvement, and parent school communication (Fan and Chen 2001). However, exploratory factor analysis (Kline 1998:56-57) restricted to three factors and with oblique rotation yielded three similar but not identical factors: parent-school contact, parent-school involvement and parent-child discussion.[4] *Parent-school contact* included the

following variables: since school started in the fall, how often did parent or spouse/partner contact school about the school program for the year (0=None 1= Once or twice 2=Three or four times 3=More than four times), how often did parent or spouse/partner contact school about plans after high school (0=None 1= Once or twice 2=Three or four times 3=More than four times), how often did parent or spouse/partner contact school about course selection (0=None 1= Once or twice 2=Three or four times 3=More than four times), and how often did parent and spouse/partner contact school about good behavior (0=None 1= Once or twice 2=Three or four times 3=More than four times). *Parent-school involvement* included the following: since the school started in the fall, how often did parent or spouse/partner contact school about fundraising or volunteer work (0=None 1= Once or twice 2=Three or four times 3=More than four times), over the past year, how often did parent or spouse/partner attend school events with their 10th grader (1=Never 2=Rarely 3=Sometimes 4=Frequently), during the current school year, did parent or spouse/partner belong to parent-teacher organization (0=No 1=Yes), did parent or spouse/partner attend parent-teacher organization meetings (0=No 1=Yes), did parent or spouse/partner take part in parent-teacher organization activities (0=No 1=Yes) and did parent or spouse/partner act as a volunteer at the school (0=No 1=Yes) (Parcel and Dufur 2001). *Parent-child discussion* included the following: during the first semester of the school year, how often did parent or spouse/partner provide advice to 10th grader regarding course selection (1=Never 2=Sometimes 3=Often), how often did parent or spouse/partner provide advice about college entrance exams (1=Never 2=Sometimes 3=Often), and how often did parent or spouse/partner provide advice about applying to college (1=Never 2=Sometimes 3=Often). Parent expectations for 10th grader educational attainment (1=Less than high school graduation 2=High school graduation or GED only 3=Attend or complete 2-year college/school 4=Attend college, 4-year

degree incomplete 5=Graduate from college 6=Obtain Master's degree or equivalent 7=Obtain PhD, MD, or other advanced degree) did not load onto any of the aforementioned factors and was subsequently included as an independent measure in the analysis. The Cronbach's alpha for each measure is as follows: *Parent-school contact*=0.57; *Parent-school involvement*=0.59; *Parent-child discussion*=0.62. Factor loadings are presented in Table 1, and Bartlett factor scores were ultimately used as measures of parental involvement control variables in the analysis.

(Table 1 about here)

Additional Control Variables

Sociodemographic controls in the analysis include gender (male as reference group), race/ethnicity (American Indian, Asian, Black, Hispanic, Multiracial non-Hispanic with Caucasian as a reference group), whether the student was born in a non-US country student born in the US and mother born in the US both as reference groups), family income (0=None 1=$1,000 or less 2=$1,001-$5,000 3=$5,001-$10,000 4=$10,001-$15,000 5=$15,001-$20,000 6=$20,001-$25,000 7=$25,001-$35,000 8=$35,001-$50,000 9=$50,001-$75,000 10=$75,001-$100,000 11=$100,001-$200,000 12=$200,0001 or more; treated as continuous in the analysis), whether or not the adolescent lived in a two-parent headed household at the time of the survey (dummy coded 1=two parent 0=other family structure) (Parcel and Dufur 2001; Carlson and England 2011; Roksa and Potter 2011; Peterson 2012). Since age is a critical concept to consider in mobility studies (Blau and Duncan 1967), mother's age was included. Adolescent age was also included in the analyses although over 50% of the sample was born in 1986, and over 80% of the sample was born in either 1985 or 1986.[5]

Outcome

Consistent with previous education research, I used mathematic and reading test scores as measures of adolescent academic outcomes (Parcel et al. 1996; Parcel and Dufur 2001; McNeal 1999; Domina 2005; Cheadle 2008; Condron 2009). As part of the ELS:2002, math and reading assessments were administered to high school sophomores in addition to student questionnaires. Test content was drawn from previous assessments such as the NELS:88, NAEP and PISA (NCES 2004b:18). Tests for both math and reading were administered in two steps: the first stage of the assessments was identical for all students, and the second stage was conditioned on student performance on the first stage. There are four types of math and reading test scores available for the ELS:2002: IRT, standardized, quartile and probability of proficiency scoring. I chose to use the IRT (Item Response Theory) scores for math and reading, which is preferable to the other options for the present study since IRT scores account for probabilities of answering questions correctly, providing a more complete assessment of sophomore performance on cognitive skills assessments (NCES 2004b:19-20).[6] As explicated in the the ELS:2002 Base Year User's Manual, IRT scores are appropriate for analyses examining the association between family background measures and achievement (2004b:26-27).

Descriptive statistics for the outcomes and the explanatory variables are presented in Table1. Overall, 24.78% mothers graduated from high school and 45.05% of maternal grandmothers graduated from high school; 21.29% of mothers graduated from college whereas only 8.39% of maternal grandmothers graduated from college. As evidenced by the mean values of the relative mobility measure, the majority of the sample was relatively static in terms of mother's mobility (0.105).[7] Only 28 sophomores had mothers who were the most downwardly

mobile at a difference of -4 standard deviations and only 23 had mothers who were the most upwardly mobile at a difference of 3 standard deviations across the distribution.[8]

(Table 2 about here)

METHOD

In order to examine the association between intergenerational educational background and adolescent test scores, I employed multiple linear regression given the continuous nature of the outcome variables. The study seeks to build on Roksa and Potter's (2011) work by alternatively focusing on continuous approaches to measuring educational background. As such, measures of parental involvement and investment are included as controls rather than potential mediators in the present analysis in order to provide a comparison. It is expected that the role of parental investment is understandably less pronounced in the present analysis given the sample composition of adolescents rather than younger children who benefit more from measures of parental involvement such as volunteering and parent-school contact. Future research should consider alternative measures of intergenerational educational background in conjunction with parental investment, but doing so is beyond the scope and purpose of the present study.

Weighted regression analyses were conducted for the effects of maternal educational background on math and reading scores using the ELS:2002 base year student weight (*bystuwt*). The final analytic sample included 7,782 sophomores. The first regression analysis involved an examination of the association between raw measures of mother and maternal grandmother educational attainment and adolescent math and reading scores to provide a baseline understanding of the extent of the effect of maternal education in the analytic sample. The next analysis was a replication of Roksa and Potter's (2011) analysis to identify whether or not Roksa and Potter's (2011) operationalization of family background yielded similar effects for a

different, older sample. In order to examine a more precise operationalization of family background beyond Roksa and Potter's (2011) "highly educated" classification, I then conducted regression analyses which included additive measures of mother-maternal grandmother educational attainment as well as rounded differences in standardized scores between mother-maternal grandmother. Although the inclusion of differences in highest education level of mother/father and maternal grandmother/maternal grandfather was considered, measures were highly correlated (0.68) with measures of differences in z-scores and were thus omitted from the analyses to avoid potential multicollinearity.[9] Model 1 examines the association between additive measures of maternal educational background, measures of relative maternal educational mobility and adolescent math and reading test scores.[10] Sociodemographic controls were included in Model 2, and measures of parental involvement and investment were included as additional controls in Model 3.

RESULTS

Direct Effects of Maternal Education

Prior to replicating and extending Roksa and Potter's (2011) analysis, linear regression analyses were conducted to assess the direct effects of mother and maternal grandmother educational attainment on adolescent math and reading scores to obtain a baseline understanding of the relative impact of each (Warren and Hauser 1997). The results of these analyses are presented in Table 3. Not surprisingly, mother's educational attainment has a greater positive effect on both math and reading scores than grandmother's educational attainment, although both are significant even after controlling for factors such as adolescent's race and ethnicity, gender, age, family structure, family income and measures of parental involvement. Contrary to Warren and Hauser's (1997) conclusions, the effects of grandmother education on child educational

outcomes persist even when mother's education is accounted for. Household income had a slightly smaller effect than maternal education on math scores, but a greater effect than maternal education on reading scores in terms of standardized coefficients.

(Table 3 about here)

Replication of Roksa and Potter 2011

Table 4 presents Roksa and Potter's (2011) complete model examining the association between maternal educational background, parental involvement and academic outcomes (compare to Table 4 2011:310-311).[11] Generally speaking, the ELS:2002 results are similar to Roksa and Potter's (2011) findings: adolescents whose family background was classified as stable middle scored highest on math and reading assessments followed by new middle, new working, then with stable working (the reference group). Interestingly, although one would expect the new working group to fare worse in terms of academic outcomes since the classification is indicative of downwardly mobile mothers, in both Roksa and Potter's (2011) and the current analysis, children whose backgrounds were new working did better than their peers who were stable working. Overall, the effect of family background is tempered when sociodemographic and parental involvement controls are included in the analysis.

(Table 4 about here)

Relative Mobility: Difference in standardized scores

As discussed above, Roksa and Potter (2011) operationalized family background in terms of four groups determined by maternal educational mobility. However, it remains to be seen whether a continuous and therefore more precise measure of intergenerational maternal educational mobility indicates a similar association between mobility and academic outcomes. Figure 1 shows the difference in mean adolescent math and reading scores according to the

difference in standardized scores between a mother and her mother. As indicated by the graph, there is only a ten point difference (33 to 43 points) between students' whose mothers were the most downwardly mobile (-4.2 difference in standard deviations) and those whose mothers were the most upwardly mobile (3.0 difference in standard deviations). It is important to note the wide variation in test scores across differing levels of mobility. Although there appears to be an overall positive association between general maternal upward educational mobility and adolescent math scores, the effect of maternal upward intergenerational educational mobility does not appear to have a consistent association with math scores. For example, the mean score for adolescents whose mothers who were -3.2 standard deviations below their mothers in terms of educational attainment was 48.99, which is 6 points higher than the mean score for adolescents whose mothers were 3.0 standard deviations higher than their mothers in terms of educational attainment. The same overall pattern is true for maternal educational mobility and adolescent reading scores.

(Figure 1 about here)

In order to clarify the trend, I rounded the difference in standardized scores to whole numbers, yielding 8 as opposed to 15 scores.[12] Figure 2 shows the association between this rounded variable and math and reading scores. This figure reveals a dropping off of test scores between a 2 and 3 standard deviation increase of mother's educational attainment relative to maternal grandmother, indicating potential regression toward the mean at the highest degree of intergenerational maternal educational mobility. In other words, the children of mothers who were very highly educated relative to their generational cohort but whose mothers were the least educated relative to their generational cohort scored slightly lower than children whose mothers

and grandmothers were not quite as high achieving. The same phenomenon is true for reading scores, although the drop-off is slightly more severe.

(Figure 2 about here)

Cumulative Advantage: Additive measure of maternal educational attainment

In order to assess the association between maternal intergenerational educational mobility and test scores for adolescents whose mothers and maternal grandmothers were both highly educated, an additive measure was created by summing mother's and her mother's level of education. Figure 3 presents the association between the maternal additive measures of intergenerational family educational background and adolescent math and reading scores. If there was a perfect association between educational background and adolescent test scores based on class categorization, we would expect to see a stepwise, grouped relationship across measures of low, middle and high levels of maternal educational achievement. However, the association appears to be more gradational. The overall pattern is similar to relative mobility and math and reading scores, especially in terms of the apparent regression toward the mean for reading scores. However, the overall trend appears to be more consistently positive than the association between relative mobility and adolescent test scores.

(Figure 3 about here)

Regression Analyses: Additive and relative measures

Although the figures indicate a potentially small but positive association between intergenerational maternal educational background, regression analysis provides additional insight into the degree to which an intergenerational operationalizations of educational background are associated with adolescent academic outcomes after statistically controlling for sociodemographic and parental investment measures.

Table 5 shows the results of regression analyses of maternal measures of educational background on math scores. Model 1 includes both the additive measure of maternal educational background as well as the measure of relative maternal educational mobility.[13] Including both additive and relative measures in the analysis allows for identification of patterns of upward mobility regardless of mothers' point of origin. In other words, the model examined whether or not upward mobility in and of itself is beneficial in terms of promoting academic achievement. Unstandardized and standardized coefficients indicate that the additive measure of maternal educational background has a positive and slightly stronger association with adolescent math scores than the measures of relative mobility (1.200 compared to 1.092 unstandardized and 0.318 compared to 0.103 standardized, respectively). As predicted, upward mobility exerts a positive effect on adolescent math scores regardless of the degree to which a mother is upwardly mobile relative to her mother. Thus, any degree of maternalupward mobility is beneficial.

Including controls in the model reduced the standardized and unstandardized coefficients by almost half for both measures, although both remain significant at the $p<0.001$ level. Immigration status was included as a control variable in the analysis since research indicates a difference in educational mobility for immigrant and non-immigrant families (Cobb-Clark and Nguyen 2010). However, it did not have a significant impact on adolescent math scores when other controls were included in the model. Consistent with previous research, ethnic minorities score lower on math assessments than their Caucasian counterparts, with African-Americans scoring approximately 5 points lower than Caucasian counterparts which is indicative of likely cumulative disadvantage originating in disparities in school readiness partially attributable to class status (Farkas 2003). Females, on average scored 2 points lower on the math assessment than their male counterparts (Niederle and Vesterlund 2010). Not surprisingly, household income

was positively and significantly associated with adolescent math scores since students from higher socioeconomic strata typically attain higher levels of academic achievement than their counterparts from more financially disadvantaged backgrounds (Farkas 2003; Peterson 2012). However, even with the inclusion of household income, maternal education still had an effect indicating the importance of considering both education and income as important and distinct measures of family background. Interestingly, the standardized effect size of additive maternal education was slightly higher than the standardized effect size of household income. Mother's age was positively associated with adolescent math scores, consistent with previous research (Roksa and Potter 2011). Adolescent age was negatively associated with math scores, perhaps since all sample members are sophomores, and the negative association may represent students who have been held back. The association between two-parent household relative to other household structures and math scores is positive but not significant.

Including measures of parent-school contact, parent-school involvement, parent-child discussion and parent educational expectations reduce the effect of educational background, but not as severely as sociodemographic controls. Parent contact with the school has a negative and significant association with math test scores which may be indicative of the fact that parents may contact the school more if their child is having problems academicially. Consistent with previous studies (Fan and Chen 2001; Froiland et al. 2012), parent expectations had the greatest impact on adolescent math scores of the measures of parental investment and involvement. Overall, it appears that measures of parent involvement and investment may partially mediate the association between family educational background and adolescent academic outcomes, although factors such as gender and race appear to have a greater, moderating impact.

(Table 5 about here)

Table 6 presents the results of maternal educational background analysis with reading scores as the outcome variable. Model 1 indicates that maternal educational background has a smaller effect on reading than math scores. Again, the additive measure of maternal educational background seems to have a greater impact on reading scores than the measure of relative mobility (0.945 and 0.851 and 0.302 and 0.098 respectively). Similar to math scores, there appears to be a benefit resulting from maternal upward educational mobility. Inclusion of controls in Model 2 reduced both education measure coefficients although they remain significant. It is important to note that the effects of additive and relative measures of educational background on reading scores are quite small (standardized coefficients 0.182 and 0.063). Similar to math scores, race, gender and age measures appear to have the greatest effect on reading scores. Unlike math scores, females, on average, scored 0.75 points higher than their male counterparts on the reading assessments (Niederle and Vesterlund 2010). Including control variables increased explained math score variability from 0.107 to 0.214. Interestingly, the measures of maternal education independently explain about 11% of the variability in reading scores, similar to raw measures of mother and maternal grandmother education. Inclusion of parental involvement and investment measures in Model 3 further decrease the effect of family educational background on adolescent reading scores, but to a lesser degree than the inclusion of sociodemographic controls. Similar to math scores, parent expectations have the greatest effect on reading scores.[14]

(Table 6 about here)

DISCUSSION

Overall, consistent with Roksa and Potter's (2011) findings, family background operationalized across three generations in terms of maternal education exerts significant

positive effects on adolescent math and reading scores independent of demographic and social controls and measures of parental involvement and investment. Baseline analyses indicated that mother's and grandmother's educational attainment both have positive effects on adolescent academic achievement. The present study utilized Roksa and Potter's (2011) work as a framework for understanding the impact of a three-generational approach to operationalizing maternal educational mobility to then examine alternative operationalizations to further assess the merit of operationalizing educational background in terms of mobility with regards to adolescent academic achievement. Regression analyses indicate that additive measures of maternal education tend to have a greater effect on math and reading scores than measures of relative mobility. However, the measure of relative mobility is significant even when accounting for cumulative mother's and grandmother's education, suggesting that mobility does impact adolescent academic achievement beyond raw measures of maternal educational attainment. The positive coefficients in both the math and reading analyses signify that upward maternal educational mobility represents a benefit for adolescents in terms of math and reading cognitive assessments regardless of a mother's point of origin.

Although there is an overall positive effect of upwardly mobility, Figure 1 indicates that there is great variation in test scores across the distribution of the relative mobility measure. Roksa and Potter (2011) presented differences in parenting practices and consequently child academic achievement across class groups determined by whether or not mothers and grandmothers were highly educated. However, such a clear-cut association between downwardly mobile (difference score <0 standard deviations), static (difference score=0 standard deviations), and upwardly mobile (difference score>0 standard deviations) is not substantiated in the results of the present analysis. The alternative operationalization of utilizing a continuous measure of

relative mobility indicates a positive effect of upward mobility regardless of mother's point of origin but does not fully examine possible patterns of mobility, specifically downward mobility.

Model 3 results indicate that the effects of maternal educational background on adolescent academic achievement are less than one point in terms of IRT math and reading scores, which can be partially attributed to the age of the sample respondents. Previous research indicates a strong connection between family background and early academic achievement (Farkas 2003; Heckman 2008), but this connection understandably decreases over time as other factors become more salient predictors of achievement (e.g. the increasing importance of the school context as well as peer influences). It is important to note that, statistically adjusting for sociodemographic and parental involvement controls, the increase of one unit in either mother or grandmother educational attainment is associated with a 0.5 increase in math and reading scores, and one unit increase in the difference between mother's and maternal grandmother's relative educational position is associated with a 0.4 increase in math and reading scores are both significant, although other factors such as race, age, and income appear to have a greater impact on adolescent academic achievement.

Limitations and Directions for Future Research

There are a number of important limitations that should be addressed in future research. First, the measures of educational attainment used in the study are limited to ordered categories. A more precise analysis would include measures of educational attainment in terms of years of schooling completed. The present study focused on direct maternal lines, rather than mother-maternal grandfather, father-paternal grandmother or father-paternal grandfather lines although previous research indicates that father-son effects are more pronounced than father-daughter effects for status attainment (Buchanan and DiPrete 2006:533). However, it is conceivable that

individuals benefit from both their mother and their father's possession of human capital obtained through education. Additionally, the study does not adequately address gender-specific effects of the potential transmission of advantage from parent to child since it is beyond the scope of the purpose of the present study, although the issue deserves attention (Buchanan and DiPrete 2006).

A related limitation is "mother" refers to any maternal figure in the home which includes grandparents and other relatives in addition to biological or step-parents. Mother's age was included in the analyses to account for potential generational differences. However, it is important to clarify that maternal educational background refers generally to maternal figure rather than specifically to mother's background although there may be differences in the association between family background and adolescent academic outcomes contingent upon whether or not the maternal figure in the home is the adolescent's biological mother or an aunt or another female relative, for example.

The primary outcome of interest in the present study was academic achievement operationalized as performance on survey-specific math and reading assessments. However, previous research suggests a potentially greater impact of family educational background on educational attainment (e.g. college completion) rather than on academic performance, although the two are related (Buchanan and DiPrete 2006). Future research should examine how different methodological approaches to conceptualizing educational background in an intergenerational context impacts other academic outcomes beyond performance on cognitive assessments.

Another limitation is the lack of control for prior academic achievement which is an important predictor of later achievement (Farkas 2003). Prior achievement measures were not available for the ELS:2002, but their inclusion would help to better understand the effects of

background on academic achievement beyond initial impacts on achievement. Doing so would help account for and further examine the Matthew effect with relation to academic achievement (Bodovski and Farkas 2007).

As discussed above, although the results indicate a positive association between upward mobility and adolescent achievement, the presented analyses do not fully provide insight into mothers who may be downwardly mobile or fully explicate the differential impact of maternal educational mobility at the extremes. As Roksa and Potter (2011) discuss, downward mobility represents a unique and relatively unexplored mobility route. Although the purpose of the study was to provide alternative operationalizations of maternal educational background across three generations, specifically in terms of mobility, future research should more directly expand Roksa and Potter's (2011) approach in terms of classifying educational background through the use of more complete categorizations of the point of origin and point of destination to provide further insight into the differential impact of extreme mobility.

CONCLUSION

The results of the present analyses indicate the significant effect of maternal educational mobility, specifically the positive effect of upward maternal educational mobility, on adolescent academic achievement. As posited by Roksa and Potter (2011) and substantiated through the present analyses, operationalizing family background across three generations in terms of mobility appears to be productive beyond raw measures of mother and maternal grandmother's educational attainment. However, the conceptualization and operationalization of family background proves to be a complex process (Sewell and Hauser 1976) that is often conveniently simplified for the sake of analysis. In order to truly understand the association between family background and attendant child outcomes, it is necessary to move beyond convenient

categorizations of family background to try and account for the multidimensionality of the concept, especially with respect to those who are extremely upwardly or downwardly mobile. Although the use of categories such as middle and working class allows for more simplistic analyses, it is important to note the possibility of variation within groups to avoid the ecological fallacy, especially with regards to policy decisions. The present study attempted to provide a more precise operationalization of intergenerational educational mobility beyond Roksa and Potter's (2011) classification of social background through the use of a continuous measure of the difference between mother's and grandmother's relative educational attainment. Although the present study does not exhaust possible operationalizations of educational background across three generations, it attempts to illuminate the need for more thorough and precise measures of family background, especially in terms of educational attainment.

ENDNOTES

[1] Roksa and Potter (2011) also examined the highest level of parental education beyond just maternal relative position and found similar results (2011:304). However, both analyses only indicate a simplified measure of difference in relative position.

[2] Roksa and Potter's (2011) sample includes children between the ages of 6 and 14, but the average age was 9 years old.

[3] Maternal figure does not refer specifically to the mother but rather to the female parent figure in the household which includes grandmother, other female relative, foster mother, etc. However, in order to simplify interpretations, mother rather than maternal figure was used throughout the discussion.

[4] Ideally, given that the variables are discrete, polychoric factor analysis would be employed.

[5] The number of siblings in the home (categories from 0 to 7 or more) (Blau and Duncan 1967; Parcel and Dufur 2001), as well as a dummy variable indicating whether or not the mother was working (Parcel et al. 1996) were originally considered as additional controls. However, they were not significant in the analyses and a nested F-test indicated that they did not increase the predictive power of the models.

[6] Analyses were conducted using standardized scores for math and reading as a comparison. Doing so yielded similar results although the size of the education measures as well as control variables decreased slightly, and the effect was more pronounced for math rather than reading scores.

[7] Determined by the mean of the difference in z-scores between mothers and grandmothers.

[8] Mobility refers to difference in z-scores between mothers and grandmothers.

[9] Correlations were determined through use of the pwcorr command in Stata. Although the correlations were high, the vifs were below the recommended threshold of 10.

[10] Separate analyses were conducted for both additive and relative measures for maternal and paternal lines. Results were similar to the analyses presented in the tables.

[11] Social background was constructed using Roksa and Potter's (2011) cutoff of 0.4 standard deviations to determine whether or not mothers and grandmothers were "highly educated." Using a cutoff of one standard deviation was considered, but did not provide as much dispersion among groups. However, regression analyses were conducted using one standard deviation as the cutoff, and the results were similar: stable middle had the greatest positive effect followed by new middle and new working.

[12] Regression analyses for both math and reading scores were conducted using the non-rounded difference score, and results overall were similar. Additive coefficients were slightly greater in the models with the non-rounded difference score for math and reading scores. The non-rounded difference score coefficients were slightly greater than the rounded difference score coeffients.

[13] Since both the additive measure and relative measure utilize measures of mother/grandmother and father/grandfather education, I checked for multicollinearity by employing the vif postcommand in Stata. There did not appear to be an issue since none of the vif values approached the threshold of 10.

[14] Based on the distribution of math and reading scores across maternal additive and relative measures of educational background, additional analyses were conducted to assess potential quadratic effects for educational background measures given the apparent regression towards the mean. As predicted, there appears to be a significant quadratic effect for maternal additive measures and math and reading. Thus, it appears that greater cumulative educational attainment

provides a small benefit for adolescents in terms of test scores, but this benefit does not hold for those whose mothers and maternal grandmothers both achieved high levels of educational attainment. Partial residual plots for maternal relative measures and math and reading scores indicate a potential cubic effect, but this was not substantiated through regression analyses, although fourth-order maternal relative terms were significant and indicate an initial positive association between maternal relative mobility and math and reading scores followed by a slight negative association. For math scores, the inclusion of sociodemographic controls reduced the significance of the quadratic effect for the maternal relative measure ($p<0.001$ to $p<0.05$); the third and fourth order terms were not longer significant. The quadratic effect for the maternal additive measure was not significant once controls were added to the model. For reading scores, inclusion of controls reduced the quadratic effect significance of both the maternal additive as well as the maternal relative measures from $p<0.001$ to $p<0.01$; the third order term for relative maternal mobility was no longer significant when sociodemographic controls were included.

REFERENCES

Alm, Susanne. 2011. "Downward Social Mobility across Generations: The Role of Parental Moiblity and Education." *Sociological Research Online* 16(3):1-14. Retrieved 15 October 2012. (http://www.socresonline.org.uk/16/3/2.html).

Attewell, Paul and David Lavin. 2007. "How College Changes a Mother's Parenting and Affects Her Children's Educational Outcomes." Pp. 1-14 and 79-125 in *Passing the Torch*, edited by D. L. Andertson et al. New York, NY: Russell Sage Foundation.

Augustine, Jennifer March, Shannon E. Cavanagh, and Robert Crosnoe. 2009. "Maternal Education, Early Child Care and the Reproduction of Advantage." *Social Forces* 88(1):1-30.

Beller, Emily and Michael Hout. 2006. "Intergenerational Social Mobility: The United States in Comparative Perspective." *The Future of Children* 16(2):19-36.

Blau, Peter and Otis Dudley Duncan. 1967. "Occupational Structure and Mobility Process." Pp. 1-21 in *The American Occupational Structure*. New York, NY: John Wiley & Sons, Inc.

Bodovski, Katerina and George Farkas. 2007. "Mathematics Growth in Early Elementary School: The Roles of Beginning Knowledge, Student Engagement, and Instruction." *The Elementary School Journal* 108(2):115-130.

Bourdieu, Pierre. 1986. "The Forms of Capital." Pp. 241-258 in *Handbook of Theory and Research for the Sociology of Education*, edited by J. Richardson. New York, NY: Greenwood.

Bourdieu, Pierre and Jean-Claude Passeron. 1990. *Reproduction in Education, Society, and Culture.* Newbury Park, CA: Sage Publications.

Bowen, Gary L., Laura M. Hopson, Roderick A. Rose, and Elizabeth J. Glennie. 2012. "Students' Perceived Parental School Behavior Expectations and Their Academic Performance: A Longitudinal Analysis." *Family Relations* 61:175-191.

Bradley, Robert H. and Robert F. Corwyn. 2002. "Socioeconomic Status and Child Development." *Annual Review of Psychology* 53:371-399.

Brint, Steven. 2006. *Schools and Societies*. Stanford, CA: Stanford University Press.

Buchanan, Claudia and Thomas A. DiPrete. 2006. "The Growing Female Advantage in College Completion: The Role of Family Background and Academic Achievement." *American Sociological Review* 71(4):515-541.

Burnett, Kristin and George Farkas. 2009. "Poverty and Family Structure Effects on Children's Mathematics Achievement: Estimates from Random and Fixed Effects Models." *The Social Science Journal* 46:297-318.

Byrnes, James P. and Barbara A. Wasik. 2009. "Factors Predictive of Mathematics Achievement in Kindergarten, First and Third Grades: An Opportunity-Propensity Analysis." *Contemporary Educational Psychology* 24:167-183.

Carlson, Marcia J. and Paula England. 2011. "Social Class and Family Patterns in the United States." Pp. 1-20 in *Social Class and Changing Families in an Unequal America*, edited by M. J. Carlson and P. England. Stanford, CA: Stanford University Press.

Cheadle, Jacob E. 2008. "Educational Investment, Family Context, and Children's Math and Reading Growth from Kindergarten through the Third Grade." *Sociology of Education* 81:1-31.

Claessens, Amy, Greg Duncan, and Mimi Engel. 2009. "Kindergarten Skills and Fifth-Grade Achievement: Evidence from the ECLS-K." *Economics of Education Review* 28:415-427.

Cobb-Clark, Deborah A. and Trong-Ha Nguyen. 2010. “Immigration Background and Intergenerational Correlation in Education.” Institute for the Study of Labor. Bonn, Germany. Retrieved 13 May 2013. (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1618644).

Coleman, James S. 1988. "Social Capital in the Creation of Human Capital." *American Journal of Sociology* 94:S95-S120.

Condron, Dennis J. 2007. “Stratification and Educational Sorting: Explaining Ascriptive Inequalities in Early Childhood Reading Group Placement.” *Social Problems* 54(1):139-160.

Condron, Dennis J. 2009. “Social Class, School and Non-School Environments, and Black/White Inequalities in Children’s Learning.” *American Sociological Review* 74:683-708.Davis-

Davis-Kean, Pamela E. 2005. “The Influence of Parent Education and Family Income on Child Achievement: The Indirect Role of Parental Expectations and the Home Environment.” *Journal of Family Psychology* 19(2):294-304.

DiPrete, Thomas A. and Gregory M. Eirich. 2006. “Cumulative Advantage as a Mechanism for Inequality: A Review of Theoretical and Empirical Developments.” *Annual Review of Sociology* 32:271-297.

Domina, Thurston. 2005. “Leveling the Home Advantage: Assessing the Effectiveness of Parental Involvement in Elementary School.” *Sociology of Education* 78(3):233-249.

Downey, Douglas B., Paul T. von Hippel, and Beckett A. Broh. 2004. “Are Schools the Great Equalizer? Cognitive Inequality during the Summer Months and the School Year.” *American Sociological Review* 69(5):613-635.

Duncan, Greg J., Chantelle J. Dowsett, Amy Claessens, Katherine Magnuson, Aletha C. Huston, Pamela Klebanov, Linda S. Pagani, Leon Feinstein, Mimi Engel, Jeanne Brooks-Gunn, Holly Sexton, Kathryn Duckworth, and Crista Japel. 2007. "School Readiness and Later Achievement." *Developmental Psychology* 43(6):1428-1446.

Durham, Rachel E., George Farkas, Carol Scheffner Hammer, J. Bruce Tomblin, and Hugh W. Catts. 2007. "Kindergarten Oral Language Skill: A Key Variable in the Intergenerational Transmission of Socioeconomic Status." *Research in Social Stratification and Mobility* 25:294-305.

Dussaillant, Francisca. 2011. "The Intergenerational Transmission of Maternal Human Capital and the Gender Gap in Educational Attainment." *Economics Letters* 111:226-229.

Engle, Patrice L. and Maureen M. Black. 2008. "The Effect of Poverty on Child Development and Educational Outcomes." *Annals of the New York Academy of Sciences* 1136:243-256.

Entwisle, Doris R., Karl L. Alexander, and Linda Steffel Olson. 2000. "Summer Learning and Home Environment." Pp. 9-30 in *A Notion at Risk: Preserving Public Education as an Engine for Social Mobility*, edited by R.D. Kahlberg. New York City, NY: The Century Foundation Press.

Entwisle, Doris R, Karl L Alexander, and Linda Steffel Olson. 2005. "First Grade and Educational Attainment by Age 22: A New Story." *American Journal of Sociology* 110:1458-1502.

Epstein, Joyce L., Lucretia Coates, Karen Clark Salinas, Mavis G. Sanders, and Beth S. Simon. 1997. "A Comprehensive Framework for School, Family, and Community Partnerships." Pp. 1-25 in *School, Family, and Community Partnerships*. Thousand Oaks, CA: Corwin Press, Inc.

Erickson, Lance D., Steve McDonald, and Glen H. Elder, Jr. 2009. "Informal Mentors and Education: Complementary or Compensatory Resources?" *Sociology of Education* 82:344-367.

Fan, Xitao and Michael Chen.2001. "Parental Involvement and Students' Academic Achievement: A Meta-Analysis." *Educational Psychology Review* 13(1):1-22.

Farkas, George. 2003. "Racial Disparities and Discrimination in Education: What Do We Know, How Do We Know It, and What Do We Need to Know?" *Teachers College Record* 105(6):1119-1146.

Froiland, John Mark, Aubrey Peterson, and Mark L. Davison. 2012. "The Long-Term Effects of Early Parent Involvement and Parent Expectation in the USA." *School Psychology International* 34(1):33-50.

Gordon, Melissa S. and Ming Cui. 2012. "The Effect of School-Specific Parenting Processes on Academic Achievement in Adolescence and Young Adulthood." *Family Relations* 61:728-741.

Grimm, Kevin J., Joel S. Steele, Andrew J. Mashburn, Margaret Burchinal, and Robert C. Pianta. 2010. "Early Behavioral Associations of Achievement Trajectories." *Developmental Psychology* 46(5):976-983.

Guo, Guang. 1998. "The Timing of the Influences of Cumulative Poverty on Children's Cognitive Ability and Achievement." *Social Forces* 77(1):257-288.

Hackman, Daniel A., Martha J. Farah, and Michael J. Meany. 2010. "Socioeconomic status and the brain: mechanistic insights from human and animal research." *National Review of Neuroscience* 11(9):651-659.

Hall, Matthew and George Farkas. 2011. "Adolescent Cognitive Skills, Attitudinal/Behavioral Traits and Career Wages." *Social Forces* 89(4):1261-1285.

Haller, Archibald O. and Alejandro Portes. 1973. "Status Attainment Processes." *Sociology of Education* 46(1):51-91.

Haller, Emil J. and Sharon A. Davis. 1981. "Teacher Perceptions, Parental Social Status and Grouping for Reading Instruction." *Sociology of Education* 54(3):162-174.

Hao, Lingxin and Melissa Bonstead-Bruns. 1998. "Parent-Child Differences in Educational Expectations and the Academic Achievement of Immigrant and Native Students." *Sociology of Education* 71(3):175-198.

Hara, Steven R. and Daniel J. Burke. 1998. "Parent Involvement: The Key to Improved Student Achievement." *School Community Journal* 8(2):219-228.

Harding, David J., Christopher Jencks, Leonard M. Lopoo, and Susan E. Mayer. 2005. "The Changing Effect of Family Background on the Incomes of American Adults." Pp. 100-144 in *Unequal Changes,* edited by S. Bowles, H. Gintis, and M. O. Groves. New York, NY: Russell Sage Foundation.

Hauser, Robert M. and David L. Featherman. 1977. "Commonalities in Social Stratification and Assumptions about Status Mobility in the United States." Pp. 3-50 in *The Process of Stratification: Trends and Analyses*, edited by H. H. Winsborough. New York, NY: Academic Press, Inc.

Heckman, James J. 2007. "The Economics, Technology, and Neuroscience of Human Capability Formation." *Proceedings of the National Academy of Sciences of the United States of America* 104(33):13250-13255.

Heckman, James J. 2008. “Role of Income and Family Influence on Child Outcomes.” *Annals of the New York Academy of Sciences* 1136:307-323.

Hertz, Tom. 2006. “Understanding Mobility in America.” *Center for American Progress.* Retrieved on 15 January 2013. (http://www.americanprogress.org/kf/hertz_mobility_analysis.pdf).

Hout, Michael. 1996. “The Politics of Mobility.” Pp. 293-316 in *Generating Social Stratification: Toward a New Research Agenda*, edited by A.C. Kerckhoff. Boulder, CO: Westview Press, Inc.

Hsin, Amy and Yu Xie. 2012. “Hard Skills, Soft Skills: The Relative Roles of Cognitive and Non-cognitive Skills in Intergenerational Social Mobility.” Population Studies Center, University of Michigan Report 12-755.

Jeynes, William H. 2003. “A Meta-Analysis: The Effects of Parental Involvement on Minority Children’s Academic Achievement.” *Education and Urban Society* 35(2):202-218.

Kingston, Paul W. 1996. “Implications of Intergenerational Class Mobility for Class Theory: A Comment on Western.” *Social Forces* 75(1):323-327.

Kingston, Paul W. 2000. *The Classless Society.* Stanford, CA: Stanford University Press.

Kingston, Paul W. Ryan Hubbard, Brent Lapp, Paul Schroeder, and Julia Wilson. 2003. “Why Education Matters.” *Sociology of Education* 76(1):53-70.

Kline, Rex B. 1998. “SEM Family Tree.” Pp. 47-66 in *Principles and Practice of Structural Equation Modeling*. New York, NY: Guilford Press.

Lareau, Annette. 2003. *Unequal Childhoods: Class, Race, and Family Life*. Berkeley, CA: University of California Press.

Lareau, Annette and Dalton Conley. 2008. *Social Class: How Does it Work?"* New York, NY: Russell Sage Foundation.

Lee, Valerie E. and David T. Burkham. 2002. "Inequality at the Starting Gate: Social Background Differences in Achievement as Children Begin School." *Economic Policy Institute.*

Maxumder, Bhashkar. 2005. "The Apple Falls Even Closer to the Tree than We Thought: New and Revised Estimates of the Intergenerational Inheritance of Earnings." Pp. 80-99 in *Unequal Changes*, edited by S. Bowles, H. Gintis, and M. O. Gintis. New York, NY: Russell Sage Foundation.

McLanahan, Sara. 2004. "Diverging Destinies: How Children are Faring under the Second Demographic Transition." *Demography* 41(4):607-627.

McNeal, Ralph B., Jr. 1999. "Parental Involvement as Social Capital: Differential Effectiveness on Science Achievement, Truancy, and Dropping Out." *Social Forces* 78(1):117-144.

Morgan, Paul L., George Farkas, and Jacob Hibel. 2008. "Matthew Effects for Whom?" *Learning Disability Quarterly* 31(4):187-198.

National Center for Educational Statistics. 2004a. "Education Longitudinal Study of 2002 (ELS:2002) Overview: Purpose." Retrieved 12 November 2012. (http://nces.ed.gov/surveys/els2002/index.asp).

National Center for Educational Statistics. 2004b. "Education Longitudinal Study of 2002: Base Year Data File User's Manual." Retrieved 12 November 2012. (http://nces.ed.gov/pubs2004/2004405.pdf).

Niederle, Muriel and Lise Vesterlund. 2010. "Explaining the Gender Gap in Math Test Scores: The Role of Competition." *Journal of Economic Perspectives* 24(2):129-144.

Parcel, Toby L., Rebecca A. Nickoll, and Mikaela J. Dufur. 1996. "The Effects of Parental Work and Maternal Nonemployment on Children's Reading and Math Achievement." *Work and Occupations* 23(4):461-483.

Parcel, Toby L. and Mikaela J. Dufur. 2001. "Capital at Home and at School: Effects on Student Achievement." *Social Forces* 79(3):881-912.

Peterson, Paul E. 2012. "Neither Broad Nor Bold." *Education Next* 12(3). Retrieved on 23 May 2013. (http://educationnext.org/neither-broad-nor-bold/).

Roksa, Josipa and Daniel Potter. 2011. "Parenting and Academic Achievement: Intergenerational Transmission of Educational Advantage." *Sociology of Education* 84(4):299-321.

Romano, Elisa, Lyzon Babchishin, Linda S. Pagani, and Dafna Kohen. 2012. "School Readiness and Later Achievement: Replication and Extension Using a Nationwide Canadian Survey." *Developmental Psychology* 46(5):995-1007.

Roscigno, Vincent J. and James W. Ainsworth-Darnell. 1999. "Race, Cultural Capital, and Educational Resources: Persistent Inequalities and Achievement Returns." 72(3):158-178.

Sandefur, Gary D., Ann M. Meier, and Mary E. Campbell. 2006. "Family Resources, Social Capital, and College Attendance." *Social Science Research* 35:525-553.

Sewell, William H. and Robert M. Hauser. 1976. "Causes and Consequences of Higher Education: Models of the Status Attainment Process." Pp. 9-27 in *Schooling and Achievement in American Society*, edited by W. H. Sewell, R. M. Hauser, and D. L. Featherman. New York, NY: Academic Press, Inc.

The Pew Charitable Trusts. 2012. "Pursuing the American Dream: Economic Mobility Across Generations." Washington, DC. Retrieved 13 February 2013. (http://www.pewstates.org/research/reports/pursuing-the-american-dream-85899403228).

Warren, John Robert and Robert M. Hauser. 1997. "Social Stratification across Three Generations: New Evidence from the Wisconsin Longitudinal Study." *American Sociological Review* 62(4):561-572.

Wells, Ryan S., Tricia A. Seifert, Ryan D. Padgett, Sueuk Park, and Paul D. Umbach. 2011. "Why Do More Women than Men Want to Earn a Four-Year Degree? Exploring the Effects of Gender, Social Origin, and Social Capital on Educational Expectations."

Winne, Philip H. and John C. Nesbit.2010. "The Psychology of Academic Achievement." *Annual Review of Psychology* 61:653-78.

Xu, Jun and Gillian Hampden-Thomson. 2012. "Cultural Reproduction, Cultural Mobility, Cultural Resources, or Trivial Effect? A Comparative Approach to Cultural Capital and Educational Performance." *Comparative Education Review* 56(1):98-124.

Table 1 Factor Analysis for Parental Investment and Involvement

	Obliquely Rotated Factors			
	Factor 1 Parent School Involvement	Factor 2 Parent School Contact	Factor 3 Parent Child Discussion	Uniqueness
Parent contact school about program		0.5618		0.6687
Parent contact school about post-hs plans		0.7094		0.5093
Parent contact school about course selection		0.6713		0.5261
Parent contact school about good behavior		0.4441		0.8033
Parent contact school about records				0.8500
Parent contact school about volunteering	0.4989			0.6331
Parent attended school events with 10^{th} grader	0.4065			0.7741
Parent/spouse/partner belong to PTO	0.5929			0.6620
Parent/spouse/partner attend PTO meetings	0.5397			0.7111
Parent/spouse/partner take part PTO mettings	0.7205			0.5027
Parent/spouse/partner act as volunteer	0.6049			0.6169
How often discuss report card				0.9300
Provide advice about course selection			0.5271	0.7004
Provide advice about college entrance exams			0.7036	0.4993
Provide advice about post-HS school application			0.6496	0.5878
How often check hw				0.9380
How often help with hw				0.9464
How far in school parent expects child to go				0.9036

Table 2 Descriptive Statistics for Analytic Variables

	Mean	St. Dev.	Min	Max	n
Outcome					
IRT Math Scores	40.34	11.41	12.98	69.72	7782
IRT Reading Scores	32.10	9.29	10.20	49.09	7782
Explanatory					
Mother Education	4.04	1.95	1	8	7782
Grandmother Education	2.49	1.69	1	8	7782
Roksa and Potter Stable Middle	0.15	0.36	0	1	7782
Roksa and Potter New Middle	0.28	0.45	0	1	7782
Roksa and Potter New Working	0.06	0.24	0	1	7782
Roksa and Potter Stable Working (reference)	0.51	0.50	0	1	7782
Additive Maternal	6.42	3.03	2	16	7782
Diff Std Dev Maternal	-0.02	1.10	-4	3	7782
Controls					
Race and Ethnicity					
American Indian	0.01	0.08	0	1	7782
Asian	0.07	0.24	0	1	7782
Black	0.09	0.29	0	1	7782
Hispanic	0.20	0.32	0	1	7782
Multirace, non-Hispanic	0.05	0.21	0	1	7782
Caucasian (reference)	0.67	0.47	0	1	7782
Female	0.53	0.50	0	1	7782
Male	0.47	0.50	0	1	7782
Immigrant	0.07	0.26	0	1	7782
Age	16.42	0.58	15	19	7782
Two parent household	0.81	0.39	0	1	7782
Mom age	44.05	5.82	32	72	7782
Household income	8.51	0.08	0	12	7782
Parent School Contact					
Parent contact school about program	0.49	0.70	0	3	7782
Parent contact school about post-hs plans	0.24	0.53	0	3	7782
Parent contact school about course selection	0.31	0.56	0	3	7782
Parent contact school about good behavior	0.23	0.59	0	3	7782
Parent School Involvement					
Parent contact school about volunteering/fundraising	0.51	0.86	0	3	7782
Parent attend school events with 10th grader	3.05	1.06	1	4	7782
Parent belong to PTO past year	0.29	0.45	0	1	7782
Parent attend PTO meetings	0.36	0.48	0	1	7782
Parent participate in PTO activities	0.33	0.47	0	1	7782
Parent acts as volunteer at school	0.34	0.47	0	1	7782
Parent Child Discuss					
Parent provides advice about selecting courses	2.44	0.64	1	3	7782
Parent provides advice about entrance exams	2.17	0.75	1	3	7782
Parent provides advice about apply to college/school after HS	2.15	0.77	1	3	7782
How far in school parent wants student to go	5.46	1.18	1	7	7782

Table 3 Direct Effects of Maternal Education on Adolescent Math and Reading Scores

	Math			Reading		
	Coef.	St. Error	Beta	Coef.	St. Error	Beta
Educational Background						
Maternal education	0.789***	0.082	0.132	0.669***	0.071	0.137
Maternal grandmother education	0.292**	0.085	0.043	0.253**	0.073	0.045
Demographic and controls						
Race and Ethnicity						
American Indian	-5.256***	1.462	-0.039	-3.956**	1.187	-0.036
Asian	-0.153	0.671	-0.002	-1.967***	0.505	-0.035
Black	-9.099***	0.444	-0.237	-6.406***	0.395	-0.204
Hispanic	-6.013***	0.445	-0.176	-4.776***	0.376	-0.171
Multirace, non-Hispanic	-2.930***	0.725	-0.050	-2.001***	0.568	-0.042
Female	-2.345***	0.263	-0.102	0.347	0.222	0.018
Immigrant	-0.239	0.602	-0.005	-0.763	0.509	-0.019
Adolescent age in 2002	-2.090***	0.239	-0.105	-1.257***	0.198	-0.077
Mother age in 2002	0.117***	0.024	0.060	0.115***	0.020	0.072
Two parent household	0.880*	0.378	0.031	0.432	0.315	0.018
Household income	0.736***	0.077	0.141	0.520***	0.067	0.122
Parental Involvement						
Parent School Contact	-0.885***	0.177	-0.066	-0.677***	0.158	-0.061
Parent School Involvement	0.621**	0.178	0.045	0.360*	0.154	0.032
Parent Child Discussion	0.125	0.200	0.009	0.266	0.164	0.024
Parent expectations	2.317***	0.128	0.243	1.795***	0.105	0.230
N	7782			7782		
R-Sq	0.320			0.270		

*p<0.05 **p<0.01 ***p<0.001

Table 4 Roksa and Potter Replication

	Math			Reading		
	Coef.	St. Error	Beta	Coef.	St. Error	Beta
Educational Background						
(Stable working as reference)						
Stable middle	3.656***	0.435	0.111	3.040***	0.357	0.113
New middle	2.346***	0.335	0.089	2.347***	0.282	0.109
New working	1.585**	0.522	0.035	1.951***	0.466	0.052
Sociodemographic controls						
Race and Ethnicity						
American Indian	-5.478***	1.511	-0.041	-4.129**	1.205	-0.038
Asian	-0.210	0.672	-0.003	-2.036***	0.503	-0.036
Black	-9.151***	0.445	-0.239	-6.462***	0.394	-0.206
Hispanic	-6.336***	0.442	-0.186	-5.032***	0.376	-0.180
Multirace, non-Hispanic	-2.949***	0.724	-0.050	-2.044***	0.568	-0.043
Female	-2.408***	0.263	-0.105	0.301	0.221	0.016
Immigrant	-0.234	0.602	-0.005	-0.760	0.508	-0.019
Adolescent age in 2002	-2.172***	0.240	-0.109	-1.319***	0.198	-0.081
Mother age in 2002	0.127***	0.024	0.065	0.124***	0.020	0.077
Two parent household	0.724	0.378	0.025	0.322	0.314	0.014
Household income	0.843***	0.075	0.161	0.600***	0.065	0.140
Parental Involvement						
Parent School Contact	-0.850***	0.178	-0.063	-0.646***	0.158	-0.059
Parent School Involvement	0.674***	0.180	0.049	0.401**	0.154	0.036
Parent Child Discussion	0.172	0.200	0.012	0.297	0.163	0.026
Parent expectations	2.358***	0.127	0.247	1.826***	0.105	0.234
N	7782			7782		
R-Sq	0.315			0.266		

*p<0.05 **p<0.01 ***p<0.001

Table 5 Maternal Educational Background and Adolescent Math Scores

	Model 1			Model 2			Model 3		
	Coef.	St. Error	Beta	Coef.	St. Error	Beta	Coef.	St. Error	Beta
Educational Background									
Maternal ed + maternal grandmother ed	1.200***	0.050	0.318	0.679***	0.053	0.177	0.547***	0.051	0.143
Difference in mother and maternal grandmother standard deviation	1.092***	0.137	0.103	0.657***	0.127	0.062	0.456***	0.122	0.043
Sociodemographic									
Race and Ethnicity									
American Indian				-5.358***	1.520	-0.040	-5.273***	1.457	-0.039
Asian				0.797	0.707	0.012	-0.144	0.670	-0.002
Black				-7.810***	0.445	-0.204	-9.102***	0.443	-0.237
Hispanic				-5.301***	0.455	-0.155	-5.993***	0.445	-0.175
Multirace, non-Hispanic				-2.914***	0.725	-0.050	-2.930***	0.725	-0.050
Female				-1.824***	0.275	-0.079	-2.350***	0.263	-0.102
Immigrant				0.557	0.602	0.011	-0.227	0.602	-0.005
Adolescent age in 2002				-2.596***	0.245	-0.130	-2.093***	0.239	-0.105
Mother age in 2002				0.131***	0.025	0.067	0.118***	0.024	0.060
Two parent household				0.711	0.396	0.025	0.872*	0.378	0.030
Household income				0.913***	0.080	0.174	0.739***	0.077	0.141
Parental Involvement									
Parent School Contact							-0.885***	0.177	-0.066
Parent School Involvement							0.618**	0.178	0.045
Parent Child Discussion							0.120	0.200	0.009

Parent expectations			2.319***	0.128	0.243
N	7782	7782	7782		
R-Sq	0.116	0.259	0.320		

*p<0.05 **p<0.01 ***p<0.001

Table 6 Maternal Educational Background and Adolescent Reading Scores

	Model 1			Model 2			Model 3		
	Coef.	St. Error	Beta	Coef.	St. Error	Beta	Coef.	St. Error	Beta
Educational Background									
Maternal ed + maternal grandmother ed	0.945***	0.041	0.302	0.570***	0.044	0.182	0.466***	0.043	0.149
Difference in mother and maternal grandmother standard deviation	0.851***	0.113	0.098	0.547***	0.108	0.063	0.386***	0.106	0.045
Sociodemographic controls									
Race and Ethnicity									
American Indian				-4.025**	1.276	-0.037	-3.970**	1.185	-0.036
Asian				-1.207*	0.545	-0.021	-1.962***	0.505	-0.035
Black				-5.357***	0.392	-0.171	-6.409***	0.394	-0.205
Hispanic				-4.197**	0.389	-0.150	-4.760***	0.376	-0.171
Multirace, non-Hispanic				-1.973**	0.567	-0.041	-2.002***	0.567	-0.042
Female				0.754**	0.230	0.040	0.343	0.221	0.018
Immigrant				-0.172	0.511	-0.004	-0.754	0.509	-0.019
Adolescent Age in 2002				-1.661***	0.204	-0.102	-1.260***	0.198	-0.077
Mother age in 2002				0.124***	0.021	0.077	0.115***	0.020	0.072
Two parent household				0.294	0.327	0.012	0.426	0.315	0.018
Household income				0.658***	0.069	0.154	0.522***	0.066	0.122
Parental Involvement									
Parent School Contact							-0.677***	0.156	-0.061
Parent School Involvement							0.358*	0.154	0.032
Parent Child Discussion							0.262	0.164	0.023

Parent expectations			1.796***	0.105	0.231
N	7782	7782	7782		
R-Sq	0.107	0.214	0.270		

*p<0.05 **p<0.01 ***p<0.001

Figure 1 Difference in maternal z-scores

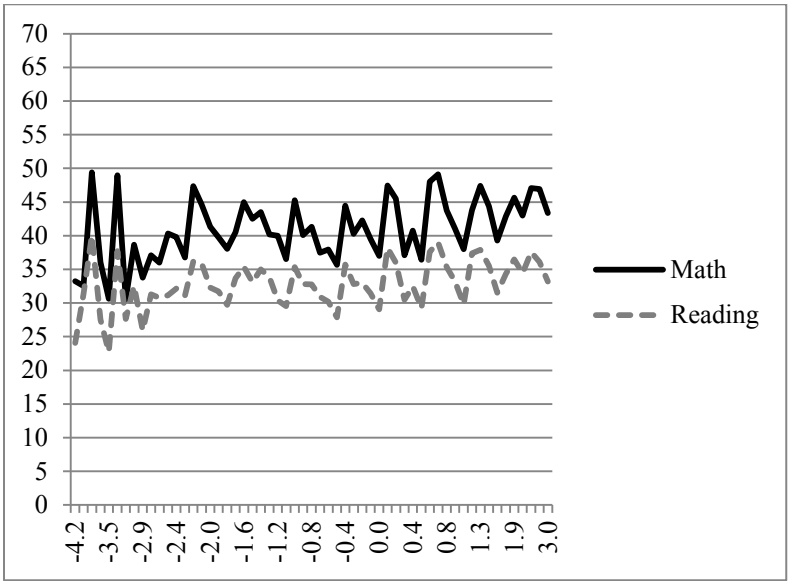

Figure 2 Rounded difference in maternal z-scores

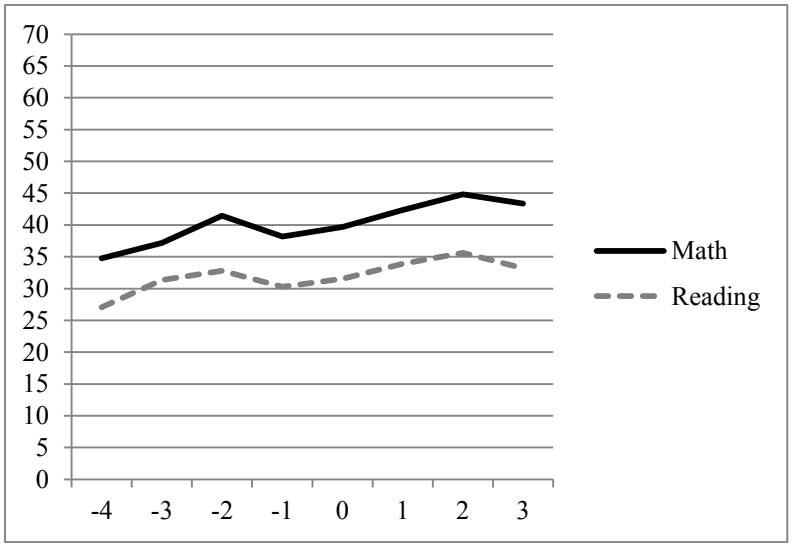

Figure 3 Additive maternal education