Variation in the Trajectories of Cognitive Development between Immigrants and Native Born Children: Comparisons of Australia, United Kingdom, and the United States

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Globalization has given rise to unprecedented levels of international migration. In 2010, 214 million individuals, 3.1 percent of the world's population, are projected to reside outside their country of birth (UN Projections 2009). Because international migration often involves the movement of individuals of working ages from developing to developed regions of the world, the foreign-born population in developed countries has increased at an especially rapid pace. Today, approximately 10 percent of the inhabitants in developed countries are foreign-born (UN Projections 2009), a proportion that is expected to rise even further given the higher fertility rates of immigrants compared to the native born (Jonsson and Rendall 2004). As a result of the growing demographic relevance and the economic importance of the immigrant population, interest in the socioeconomic adaptation of immigrants and their children has surged among scholars and policymakers in many developed countries.

Because education is a key determinant of socioeconomic wellbeing across the life-course, researchers often gage the speed and outcome of immigrant adaptation by comparing the educational attainment of various groups (Glick and Marriott 2004; Feliciano 2005; Kao 2004). Many researchers argue that how immigrant children fare educationally depends on: (1) the amount of resources, including human capital, that either they themselves or their parents bring from their country of origin; (2) the social, economic, and political conditions in the country of origin that motivate their migration; and (3) the social, economic and political conditions that immigrants face in their host societies –their context of incorporation (Portes and Zhou 1993; Telles and Ortiz 2008; Zhou 1997). Because the size and composition of the flows of migration and context of immigrant reception vary greatly across countries and change over time, the educational outcomes of immigrants are extremely diverse. While immigrant children from some groups systematically outperform their native-born peers, immigrant children from other groups fare considerably worse (Kao and Tienda 1995; Portes and Zhou 1993).

Although much has been written on educational differentials by nativity status, the majority of existing studies focus on educational performance at the secondary and postsecondary levels (Feliciano 2005; Glick and White 2004). As a result, despite the cumulative nature of instruction and learning, there is very little research documenting differences in early school performance between immigrant children[1] and their native born counterparts (Crosnoe and Turley 2010; De Feyter and Winsler 2009). Moreover, the few studies on educational disparities at earlier stages usually measure differences at a single point in time (Glick and Marriott 2007; Magnuson et al. 2006). By design, these studies cannot decipher "when the disparities emerge" and "whether they converge or diverge over time". This understanding, however, is essential in ascertaining what

[1] For simplicity of presentation, this paper uses the term "immigrant children" to represent both: (1) children who are immigrants and (2) children with immigrant parents. The term "native born" children refer to the children whose parents are born in the host country.

mechanisms give rise to educational disparities, how the relative importance of individual mechanisms changes over time, and which mechanisms exacerbate (or reduce) educational differences between immigrant and native born children. These insights, in turn, are essential for devising effective policy interventions aimed at reducing the educational inequality between immigrant and native groups. Researchers should, therefore, make efforts to examine differences in the trajectories of immigrant and native born children over time rather than focusing on differences at one point in time. A second limitation of existing research is that studies are typically country-specific. Because immigration policies are often created and enforced at the national level, these analyses are ill-suited for examining how immigration policy shapes the socioeconomic adaptation of immigrant children. To ascertain the role of laws and institutions in shaping immigrant children's adaptation in host countries, we need more cross-national studies comparing the educational experiences of immigrants in various contexts of reception.

Our paper extends existing literature by comparing the trajectories of cognitive development in early and middle childhood of immigrant and native born children in three countries: Australia, the United Kingdom, and the United States. We begin by ascertaining how the cognitive skills of immigrant children of various groups compare to those of native born children in early childhood – age 3. Next, we assess whether cognitive differences between immigrant and native born children persist (or subside) at the time children into elementary school and into middle childhood. Third, we investigate whether and why immigrant and native born children have distinct trajectories of cognitive development. And finally, we examine how the cognitive trajectories of immigrant and native born children differ across the three host societies as a first step in assessing how differences in host country policies affect children's cognitive development. These analyses will use data from the four national birth cohorts studies described in greater detail below.

Our extended abstract consists of four parts. The next section briefly discusses possible explanations for why trajectories of cognitive development among immigrant children differ from those of their native-born peers. This discussion is followed by a description of our data and methods. We then present preliminary results and conclude with a description of our next steps.

Background

How immigrants fare educationally compared to their native peers has been the subject of many empirical studies. This body of work reveals that there is no single, coherent story to tell with regards to the educational achievement of immigrant children (De Feyter and Winsler 2009). While some groups of immigrants outperform their native-born peers across all domains, others have considerably worse educational outcomes (Portes and Zhou 1993). Immigrant children face numerous difficulties that put them at risk for low academic achievement, but they also have numerous protective factors that help them excel (De Feyter and Winsler 2009). In this section, we briefly discuss some of the "protective" and "high risk" factors that contribute to the differential trajectories of cognitive development among the native born and the immigrant children of various groups.

(A) Protective factors

Host countries often have visa programs or settlement support in place to attract highly skilled migrants for industries with labor shortages. As a result, a segment of the legal migrant population will have considerably higher levels of education compared to the native born. Thus, one possible explanation for why some immigrant children outperform their native-born peers is that their parents are more educated than native born parents. Not only do highly educated parents have access to greater financial resources, they also interact with and socialize their children in ways that promote educational success (Guo and Harris 2000; Fuligni 1998; Lareau 1993).

Another possible explanation for why immigrant children outperform their native-born peers is that immigrant parents assign greater value to education. Prior work has found that foreign-born parents tend to place great importance on school achievement regardless of their ethnic or education backgrounds (Fuligini 1998). Immigrant families may view education as the best way for their families to succeed in destination countries, where they have limited social capital and may face discrimination as racial minorities (Fuligini 1998). The heavy emphasis on education, in turn, will lead to heavier parental investment – financial or otherwise. This, in turn, will result in better educational outcomes among immigrant children compared to the native born.

A third explanation for why immigrant children excel in school is their health. Immigrant children in various contexts of reception are healthier than their native-born peers (Jackson et al. 2009). Past empirical work has consistently shown that poor health gives rise to low school performance (Boardman et al. 2002; Palloni 2006; Jackson 2009). Certain health conditions, such as anemia and lead poisoning, adversely affect brain development (Guo and Harris 2000). Struggling with ill health may also cause children to miss days of school and fall behind academically (Boardman 2002; Jackson 2009). Thus, a healthier disposition will put immigrants in an advantageous position to perform better in school compared to their native peers.

(B) Risk factors

Many of the difficulties immigrants face in host countries are associated with low socioeconomic status. Immigrants often fill positions in the secondary labor market sector, which tends to have low paying jobs that offer little job security (Piore 1978). Low wages, in turn, prevent immigrant parents from purchasing the material goods necessary for their children's educational success (Hanson, McLanahan, and Thomson 1997). Family income also affects the type of neighborhood in which a family lives. Children in lower income communities are more likely to attend lower quality schools, have less informal information about educational opportunities, and be exposed to negative peer influences that discourage achievement (Choi et al. 2008; McLanahan & Sandefur, 1994; Datcher 1982). Economic stress may also diminish parents' ability to effectively respond to their children's needs, which lowers the general quality of parent-child interactions with adverse effects on children's development and educational performance (Guo and Harris 2000).

Another factor placing immigrant children at risk of low educational performance is their parents' limited knowledge of the school systems in the host country. Due to linguistic barriers, lack of familiarity with local institutions, and often lower levels of education, immigrant parents are often less knowledgeable of the educational options and resources available to their children

in the host country. As a result, some immigrant parents will be less able to help their children successfully navigate their way in the educational system.

Data and Methods

To ascertain how the trajectories of cognitive development differs among native born and immigrant children of various groups, we use data from four birth cohort studies: (1) the American Fragile Families and Child Wellbeing Study (FFCWS); (2) the American Early Childhood Longitudinal Study –Kindergarten Cohort (ECLS-K); (3) the U.K. Millennium Cohort Study (MCS); and the (4) Longitudinal Study of Australian Children – Kindergarten Cohort (LSAC-K). For the United States, we pool data from the FFCWS and ECLS-K to ensure a large enough sample of immigrants from different countries of origin. We recalibrate the weights to provide the results obtained from each survey equal weights.

The FFCWS is a national birth cohort study that follows 4,898 children born in large U.S. cities between 1998 and 2000 (Reichman et al. 2001). The study, which contains a large sample of racial minorities and children of immigrants (approximately 20 percent), include detailed information on parent's socio-demographic characteristics, family resources, and children outcomes. Follow-up interviews were conducted at ages 9 months, 3, 5, and 9 and consisted of telephone surveys and in-home surveys. Child assessments were collected during the in-home surveys at ages 3, 5, and 9.

The ECLS-K[2] is a national study that follows 21,409 children who enrolled in kindergarten programs in the U.S. in the fall of 1998. The study, which contains a large sample of racial minorities and children of immigrants (approximately 20 %), includes detailed measures of socio-demographic profiles of parents, availability of educational resources at home and in school, and educational outcomes. Follow-up interviews were conducted in the spring of 1999, spring of 2000, spring of 2002, spring of 2004, spring of 2007, and for a subsample, fall of 1999. These years roughly correspond to data collection at ages 5, 6, 7, 9, 11, and 14. Assessments in math and reading were collected in all waves.

The MCS[3] is a national birth cohort study that follows 18,818 children born in the U.K between 2000 and 2001. The study, which oversamples families living in areas with high rates of child poverty and high proportions of ethnic minority populations (approximately 13 %), have detailed information on child outcomes, families resources, and neighborhood characteristics. Mothers were first interviewed with their child was 9 months old, and follow-up interviews were conducted at ages 3, 5 and 7 years. Child assessments were collected in each following up interview.

The LSAC is a nationally representative study that follows approximately 5,000 children born between March 1999 and February 2000 and living in Australia in 2004 (Gray and Smart 2008). The study includes detailed measures about children's home environments and children outcomes. Follow-up interviews were collected at ages 5, 7, 9, and 11. Child assessments were collected in all follow-up interviews.

[2] http://nces.ed.gov/ecls/
[3] http://www.cls.ioe.ac.uk/text.asp?section=000100020001

All four studies are well-suited for our purposes here because they collected child assessments in 3 or more waves of data. Second, these studies also include detailed information on parent's socio-demographic characteristics, including mother's region of birth, and educational resources available at home, which have been identified by prior work as key determinants of cognitive development. Each (set of) dataset is representative of the three contexts of receptions that this study wishes to examine.

Key Measures

Mother's region of birth. We use mother's own reports of region/country of birth to distinguish children whose mothers were born in the U.S., Latin America, Asia, and Other regions. If sample size across the datasets permit, we will make efforts to create more fine grained measures of mother's region of birth.

Children's Cognitive Scores at ages 3, 5, and 9 (or 7). The cognitive scores at each stage are treated as a measure for the intellectual ability of the child as well as standardized test scores capturing the school performance of children. Our measure of cognitive score is constructed using the PPVT standardized scores from FFCWS and LSAC, reading assessment scores from ECLS-K, and the British vocabulary assessment scores from MCS. To ensure comparability, each measure was standardized.

We also plan to include a rich set of measures of children's socioeconomic environments, preschool attendance, and psycho-social development levels throughout childhood, which are known determinants of cognitive development and educational performance. An abridged list of additional variables can be found in Table 1.

Analytical Plan

Our analyses will consist of two parts. In the first part, we estimate a series of ordinary least squares regression models to explore how cognitive scores vary by mother's region of birth and children's country of residence. Each series will be comprised of six ordinary least squares models. Model 1 will presents the zero order association between standardized cognitive scores and each independent or control variable. Model 2 will regress children's cognitive scores at age 9 on mother's region of birth and children's characteristics. Model 3 will add mother's socioeconomic characteristics. Model 4 will include controls for preschool attendance and cognitive stimulation to gage how differential investment in education prior to school entrance affect school performance and intellectual development. Model 5 will add non-cognitive and cognitive skills at age 5. This model will assess how cognitive and non-cognitive skills at earlier ages influence cognitive development at later ages. And model 6 will add interaction terms between mother's region of birth and child's country of residence. The purpose of the interaction terms is to compare the educational performance of children whose mothers originate from the same region, but are situated in distinct contexts of reception. We lag all time-varying independent and control variables to be able to make a stronger case for causal relationships.

In the second part of the paper, we use latent growth curve modeling to explore how the cognitive scores of native born and immigrant children of various groups differ in early childhood, and whether the size of the cognitive differences remain the same, diminishes, or

augments over time. An unconditional latent growth curve model, which is termed "unconditional" because it does not include covariates that affect the trajectory, predicts child-specific (i) and time-specific (t) trajectory of cognitive scores (y) to be a function of a child-specific intercept ($\propto$) and child and time specific slopes (β) and errors (ε) (Bollen and Cullan 2006; Jackson et al. 2009; Meadows et al. 2008). Thus, the level one equation for the unconditional model can be written as follows:

$$y_{it} = \alpha_i + \gamma_t \beta_i + \varepsilon_{it} \quad (1)$$

This equation represents within-individual (i) change over time (t). To incorporate time varying covariates affecting children's cognitive development into our model, we modify Equation 1 as follows:

$$y_{it} = \alpha_i + \gamma_t \beta_i + \delta_t w_{it} + \varepsilon_{it} \quad (2)$$

where $\delta_t w_{it}$ represents the effect of various time-varying covariates that affect cognitive scores.

The second level of this model allows children's trajectories of cognitive development allows the random intercept α_i and slopes β_i to vary across individuals but not within individuals (i.e. over time). The level 2 equation can be written as follows:

$$\alpha_i = \alpha_0 + \alpha_1 x_{i1} + \alpha_2 x_{i2} + \alpha_3 x_{i3} + \cdots . + \alpha_k x_{ik} + \varepsilon_{it} \quad (3)$$
$$\beta_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \cdots . + \beta_k x_{ik} + \varepsilon_{it} \quad (4)$$

where the x's represents the effect of various time-invariant covariates, including mother's region of birth and child's country of residence, that predict differences at the initial measurement (α) and rate of change (β).

Preliminary Analyses and Future Plans

We present some preliminary results for children in the U.S. obtained by pooling data from FFCWS and ECLS-K. Figure 1 shows that children whose mothers were born in Latin America average far lower scores than children of mothers born in the U.S.; whereas, those whose mothers were born in Asian have considerably higher scores. This finding is consistent with prior work.

Results from our ordinary least square models, presented in Table 2, reveal that in large part, the variation in children's test scores is due to educational differentials in mother's education. Although not statistically significant, differences in mother's region of birth remain after we include controls for children's and mother's characteristics, preschool attendance, and cognitive stimulation. Differences by mother's region of birth only disappear when non-cognitive and cognitive skills at age 5 are added into our model, suggesting that the immigrant gap in cognitive skill by mother's region of birth emerges before age 9.

In our ongoing work, we plan to decipher exactly when these differences emerge and how the magnitude of these differences changes over time. We also plan to investigate why these disparities emerge and why they remain, subside, or increase over time. Lastly, we will compare the differences in trajectories of cognitive development among native born and immigrant children in the three host countries.

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TABLE 1.
SOCIO-DEMOGRAPHIC CHARACTERISTICS OF SAMPLED RESPONDENTS BY MOTHER'S REGION OF BIRTH

	U.S.-Born	Latin Am.	Asia	Other	Total
	(10,376)	(1,099)	(683)	(435)	**(12,593)**
A. Children's Characteristics					
Child's Year of Birth (%)					
1992	16	9	7	17	14
1993	36	35	22	56	36
1999	3	0	3	2	3
2000	45	56	68	25	47
Total	100	100	100	100	100
Child's Age (%)					
9	82	88	91	83	83
10	16	11	8	17	15
Missing	1	1	1	0	1
Total	100	100	100	100	100
Child's Birth Weight (%)					
Low Birth	7	4	3	7	6
Child's Health (%)					
Good or less	11	25	12	19	13
Very Good	27	27	23	28	27
Excellent	61	43	65	52	59
Missing	1	5	0	0	1
Total	100	100	100	100	100
B. Mother's Characteristics					
Mother's race/ethnicity (%)					
White	61	1	6	35	51
Black	22	0	0	36	19
Hispanic	14	98	12	12	22
Asian	0	0	49	7	3
Other	3	0	32	10	4
Total	100	100	100	100	100
Mother's Education (%)					
Less than 12	16	54	5	8	19
12	32	27	25	31	31
13 to 15	28	13	9	31	26
16+	24	6	60	27	24
Missing	1	0	1	3	1
Total	100	100	100	100	100
Mother married to biological father (%)					
Not married	39	35	6	27	37
Married	59	62	92	70	61
Missing	2	3	3	4	2
Total	100	100	100	100	100
C. Child care (%)					
No preschool	15	18	12	13	15
Center	74	57	78	70	72
Missing	12	25	10	18	13
Total	100	100	100	100	100

TABLE 1 (CONTINUED)

	U.S.-Born		Latin America		Asia		Other		Total	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Mother's Age	36.1	6.0	36.1	5.8	39.8	4.5	38.1	5.3	36.3	6.0
Number of Siblings	2.0	1.2	2.1	1.2	2.1	1.0	1.7	1.2	2.0	1.2
Std. Cognitive Scores -- 5	0.1	1.0	-0.7	1.2	0.6	1.1	0.1	1.1	0.0	1.0
Std. Cognitive Scores -- 9	0.2	1.0	-0.5	1.0	0.8	1.6	0.1	1.0	0.2	1.1
Scales										
Externalizing Behavior	0.6	0.3	0.5	0.3	0.5	0.3	0.7	0.3	0.6	0.3
Internalizing Behavior	0.8	0.1	0.8	0.1	0.7	0.1	0.8	0.1	0.8	0.1
Parental Stress	0.8	0.2	0.8	0.3	0.7	0.3	0.9	0.2	0.8	0.2
Cogntive Stimulation	0.7	0.2	0.7	0.2	0.7	0.2	0.7	0.2	0.7	0.2

Notes:

(1) Weighted percentages and means; Unweighted Ns.
(2) Weights were recomputed to assign equivalent weight to the two data sources
(3) Cognitive Scores are standardized. Externalizing, Internalizing, Parental Stress, and Cognitive Stimulation are all scales constructed using factor analyses. They were later standardized and recalibrated so that they range from 0 to 1.

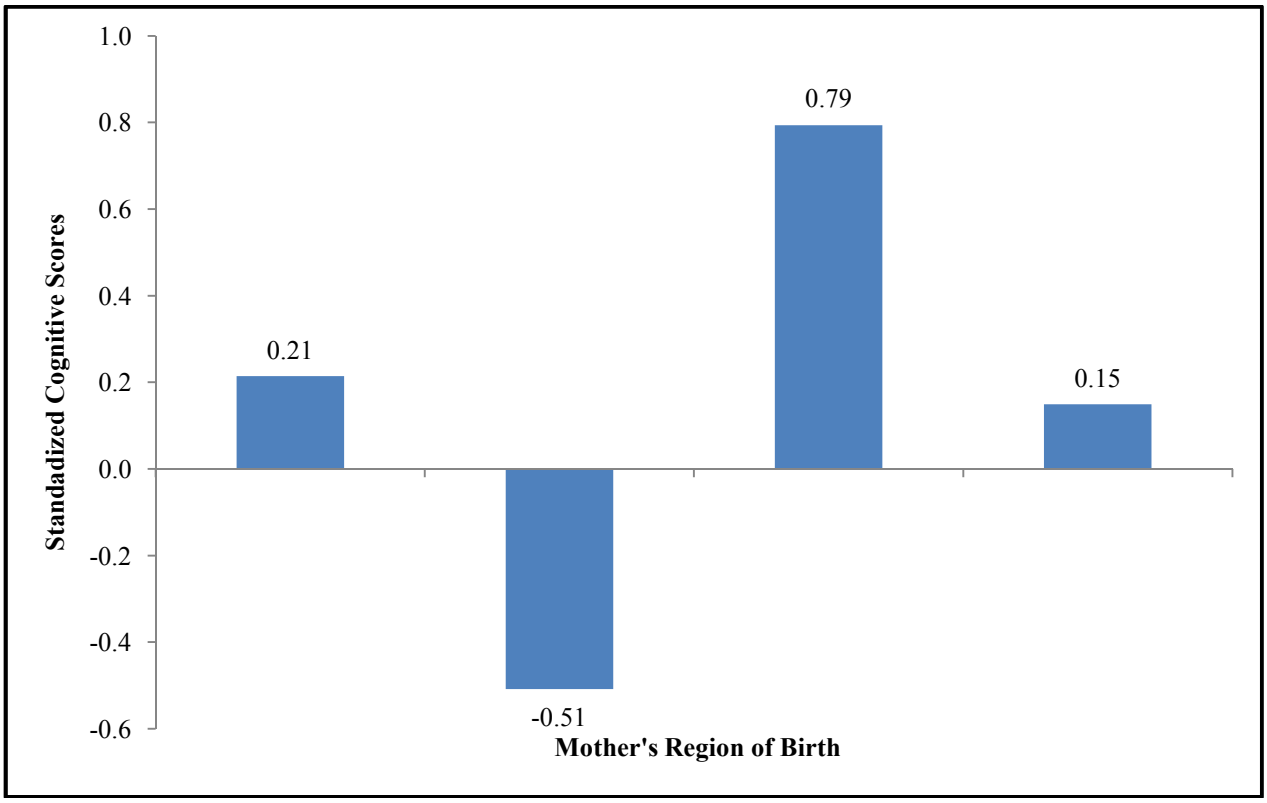
Source:
Fragile Families and Child Wellbeing Study and Early Longitudinal Study (ECLS)- Kindergarten Cohort

Table 2. Ordinary Least Squares Model Predicting Cognitive Scores at Year 9

	Model 1		Model 2		Model 3		Model 4		Model 5	
	β	β/se	β	β/se	β	β/se	β	β/se	β	β/se
Mom's Region of Birth (United States)										
Latin America	-0.72	-7.57	-0.67	-6.66	-0.11	-1.02	-0.11	-0.98	0.11	1.00
Asia	0.58	1.39	0.51	1.28	0.49	1.30	0.49	1.29	0.10	0.50
Other	-0.06	-0.80	0.02	0.26	0.10	1.23	0.10	1.27	0.06	0.84
Child's Sex										
Female	0.07	0.87	0.08	1.19	0.09	1.76	0.09	1.72	0.10	2.55
Child's Birth weight										
Low birth weight (<2500 g)	-0.23	-2.75	-0.22	-2.75	0.00	-0.02	0.00	-0.05	0.01	0.27
Child's Health (Good or less)										
Very Good	0.31	3.13	0.23	2.31	0.10	1.23	0.10	1.24	0.06	0.96
Excellent	0.56	5.88	0.40	4.62	0.16	2.44	0.16	2.44	0.08	1.43
Missing	-0.18	-0.41	-0.14	-0.48	-0.13	-0.52	-0.08	-0.30	-1.08	-4.20
Mother's Age										
Mother's Age	0.04	7.77			0.01	1.40	0.01	1.44	0.01	1.70
Mother's Race (White)										
Black	-0.76	-12.64			-0.53	-7.63	-0.53	-7.86	-0.33	-6.23
Hispanic	-0.77	-9.90			-0.44	-4.67	-0.44	-4.71	-0.19	-2.40
Asian	-0.14	-0.34			-0.66	-1.57	-0.66	-1.57	0.22	1.15
Other	0.04	0.09			-0.24	-1.09	-0.24	-1.10	-0.29	-2.76
Mother's Education (Less than 12)										
12	0.50	4.95			0.31	3.61	0.31	3.55	0.31	4.74
13-15	0.70	8.24			0.46	5.49	0.45	5.28	0.33	4.86
16+	1.42	13.02			0.88	8.53	0.86	8.19	0.48	5.93
Missing	0.31	2.49			0.34	2.39	0.33	2.33	0.23	1.47
Marital status of Parents Yr 5 (Not Married)										
Married Biological Parents	0.02	1.42			0.00	-0.07	0.00	-0.05	-0.01	-0.46
Household income in Year 5 (≤ 25,000)										
25,001-50,000	0.49	21.60			0.28	4.32	0.28	4.33	0.13	2.76
50,001-75,000	0.82	31.99			0.50	5.59	0.50	5.60	0.19	2.99
75,000+	1.05	43.45			0.41	4.28	0.40	4.23	0.15	1.90
Missing	0.22	6.09			0.12	1.00	0.12	1.06	0.11	1.24
Preschool (Did not attend)										
Attended	0.15	1.30					0.04	0.43	-0.17	-2.24
Missing	-0.33	-2.79					-0.03	-0.27	-0.18	-2.47
Cogntive Stimulation										
Cognitive Stimulation by Parent	0.52	3.45					0.01	0.06	0.01	0.19
Cognitive Scores in Year 5										
Standardized cognitive scores									0.46	20.63
Non-cognitive outcomes in Year 5										
Externalizing behaviors	-0.67	-5.20							-0.19	-0.93
Internalizing behaviors	-1.81	-3.33							-1.56	-4.76
Survey (FFCWS)										
ECLS-K	-0.31	-4.11	-0.27	-4.27	-0.54	-8.00	-0.53	-7.50	0.16	1.25
Intercept	-	-	0.03	0.28	-0.42	-2.21	-0.45	-2.29	0.86	3.34

Note: For categorical variables, reference categories are listed inside the parentheses.

Figure 1. Cognitive Scores at Age 9 by Mother's Region of Birth, Pooled U.S. Data from ECLS-K and Fragile Families



Notes:
Analyses are weighted.
Cognitive scores are standardized using means and standard deviation for the entire U.S. population.