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ABSTRACT

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While childhood obesity has become a significant public health concern over the last few decades, knowledge concerning the origins of or persistence in childhood anthropometric measures is incomplete. Here, we utilize several nonparametric measures of mobility to assess the evolution of weight, height, and body mass index during early childhood. We find that mobility is quite high *prior to* primary school and then declines noticeably. However, there are important sources of heterogeneity, including race, gender, and age, that should prove insightful to researchers and policymakers.

JEL Classification: C23, I12, I18

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1 Introduction

The prevalence of overweight adolescents has tripled in the last thirty years; it has more than doubled for younger children. Defined as having an age- and sex-adjusted body mass index (BMI) above the 95^{th} percentile, the prevalence of overweight children increased from 5% to 12.4% for 2-5 year old children and from 5% to 17.6% for 12 to 19 year-olds between 1976 and 2006 (Ogden et al. 2008). In addition, vast differences in the time trends of BMI increases have been documented: the incidence of overweight among white girls aged 12-19 has increased from 7.4% to 14.5% between 1988 and 2006, whereas the corresponding figures for African-American girls are 13.2% and 27.7% (Ogden et al. 2002; Ogden et al. 2008). Deckelbaum and Williams (2001, p. 242S) conclude that "childhood obesity is increasing at epidemic rates, even among pre-school children..." More recently, Brisbois et al. (2012, p. 347) state: "Obesity is considered to be a worldwide epidemic with little evidence that its incidence is declining or that it has even reached a plateau."

As childhood obesity has received greater attention, its consequences have becoming increasingly well-documented. Obesity burdens individuals with severe physical, economic, and emotional suffering, and puts children and adolescents at risk for a number of health problems such as those affecting cardiovascular health, the endocrine system, and mental health (Deckelbaum and Williams 2001; Krebs and Jacobson 2003). However, perhaps the largest cost of childhood obesity comes from its impact on adult obesity. Currently, 60% of the total U.S. population is overweight or obese and 50% is expected to be obese in 2030 at the current rate (Dor et al. 2010). Aside from the health costs of adult obesity, adult obesity results in lower wages, productivity, and self-esteem (Mocan and Tekin 2011). In the U.S., the total cost attributable to obesity was over $75 billion in 2000 according to Finkelstein et al. (2004). More recent estimates put the cost over $200 billion (Cawley and Meyerhoefer 2012).

While the changes in childhood and adult obesity rates across cohorts, as well as the consequences of these increases, are well-documented, much less is known about how anthropometric measures evolve over the life cycle for a given individual. How persistent is childhood obesity? Does this persistence vary by age, race, gender, or location? Are there periods of relatively greater mobility of children within the distributions of weight or height? These are fundamentally important questions for researchers as well as policymakers. If weight is persistent, then early intervention is preferable to waiting until adolescence or beyond. However, if persistence varies by age, then the optimal timing of policy interventions may be further refined such that child weight is reduced prior to the degree of persistence becoming elevated.

For instance, an article in the *New York Times* on March 22, 2010 states that some evidence now suggests that children may become entrenched "on an obesity trajectory" even before kindergarten; however, the evidence is not "ironclad."[1] Public health officials tend to advocate school-based reforms in light of the near universal enrollment, yet others stress the importance of preschool interventions (e.g., Frisvold and Giri 2013; Dietz and Gortmaker 2001; Davis and Christoffel 1994). Eriksson et al. (2001, p. 735) conclude that "obesity is initiated early in life."

To shed light on these fundamental questions, we apply nonparametric measures of mobility to data from the Early Childhood Longitudinal Survey – Kindergarten Cohort (ECLS-K). The ECLS-K is a nationally representative longitudinal survey of children entering kindergarten in Fall 1998. In addition to providing information on birthweight,

[1] See `http://www.nytimes.com/2010/03/23/health/23obese.html`.

anthropometric data is collected at several points in time between kindergarten and eighth grade. Thus, our focus here is on anthropometric mobility from infancy through adolescence. This spans two of the three 'critical' periods of development as it relates to obesity: the so-called age of adiposity rebound (roughly ages four to six) and the transition to adolescence (Dietz 1997).[2]

Our findings are striking. In particular, we obtain three key findings. First, while anthropometric mobility is relatively high over the period spanning birth to entry into kindergarten, weight, height, and BMI are *highly persistent* from kindergarten through middle school. However, there are periods of relatively greater mobility; anthropometric mobility is higher in periods corresponding to the two post-natal, critical periods posited in Dietz (1997). Specifically, we find that mobility is greatest at the start of kindergarten (typically age five) and during the transition from elementary to middle school (typically ages 11 to 14). As these periods coincide with movements to new schools for the majority of children, this suggests that interventions synced with transitions to new schools and new routines are likely to be more effective. That said, interventions prior to primary school are likely to be more effective (although not necessarily as cost-effective).

Second, heterogeneity is important. Consequently, a singular approach to the obesity epidemic is unlikely to be successful. Important sources of heterogeneity include: demographics, initial conditions, outcome measure, age range, and metric used to measure persistence. Third, non-whites and girls generally exhibit more anthropometric mobility and lower persistence prior to kindergarten entry; the reverse holds after kindergarten entry. As such, non-whites and female children are more likely to find themselves on an "obesity trajectory" earlier in life. The remainder of the paper is organized as follows. Section 2 provides a brief overview of the prior literature. Section 3 presents the empirical methodology and description of the data. Section 4 discusses the results. Section 5 concludes.

2 Related Literature

The persistence of childhood overweight status into adulthood has been documented in a number of studies. Whitaker et al. (1997) found that the probability of an overweight six year-old child becoming an obese adult is 50% compared to 10% for a non-overweight child. In addition, the risk of becoming obese in adulthood is exacerbated by having an obese parent. Eriksson et al. (2001) found that individuals were three times more likely to be obese as an adult if they had a BMI greater than 16, as opposed to below 14.5, at age seven. Nader et al. (2007) find that children who were overweight prior to age of five are five times as likely to be overweight at 12 relative to children who were not overweight prior to age of five.

Freedman et al. (2001) also report a strong relationship between overweight status in childhood and adult BMI. In a later study, Freedman et al. (2005) document significant differences in the transmission of BMI from childhood to adulthood along racial lines. The authors find that not only are overweight black children more likely to become obese adults, but also that "relatively thin (BMI $\leq$ 50th percentile) white boys were more likely to become overweight adults than were their black counterparts" (p. 928). Thus, anthropometric mobility, both upward and downward, is greater for white children. Gable et al. (2008) analyze the relationship between socioeconomic status,

[2] The third 'critical' period represents the period of fetal development *in utero*.

overweight persistence, and school outcomes. The authors find that family socioeconomic status is predictive of both the probability of a child being overweight and the probability of persistence of overweight status. Van Cleave et al. (2010) find that prevalence of obesity is increasing and is highly persistent over time. Deckelbaum and Williams (2001, p. 239S) conclude: "Disturbingly, obesity in childhood, particularly in adolescence, is a key predictor for obesity in adulthood." Similarly, Dietz and Gortmaker (2001, p. 340) state: "The best evidence suggests that the majority of overweight adolescents go on to be overweight adults." Iughetti et al. (2008) provide an excellent summary of the literature on persistence in obesity.

In light of these relationships, Dietz and Robinson (2005, p. 2102) suggest that "treatment to achieve weight maintenance is recommended" for two to six year-old overweight children. In January 2010, the U.S. Preventive Services Task Force have issued new guidelines suggesting that doctors regularly screen the weight of children aged six and over and refer children to specialized weight management programs if needed.[3]

3 Empirics

3.1 Mobility Measures

To examine anthropometric mobility from birth through adolescence, we use several metrics commonly used to measure income mobility. Applying these metrics to different subgroups of the data, we are also able to analyze differences in mobility across demographic groups, as well as across stages of childhood.

To proceed, define the following notation. Let y_i^t, denote an anthropometric measure for child i, $i = 1, ..., N$, in period t, $t = 1, ..., T$. Further, let $F_{t_0,t_1}(y^{t_0}, y^{t_1})$ denote the joint (bivariate) cumulative distribution function (CDF) for two distinct periods, t_0 and t_1, where $t_0 < t_1$ and $y^t \equiv [y_1^t \cdots y_N^t]$.

While movement through the distribution from an initial period, t_0, to a subsequent period, t_1, is completely captured by $F_{t_0,t_1}(y^{t_0}, y^{t_1})$, this is not practical. One method by which to summarize this joint distribution is via a $K \times K$ transition matrix, P_{t_0,t_1}, with representative element

$$p_{kl}^{t_0,t_1} = \frac{\Pr(\zeta_{k-1}^{t_0} \leq y^{t_0} < \zeta_k^{t_0},\ \zeta_{l-1}^{t_1} \leq y^{t_1} < \zeta_l^{t_1})}{\Pr(\zeta_{k-1}^{t_0} \leq y^{t_0} < \zeta_k^{t_0})} \qquad k, l = 1, ..., K, \tag{1}$$

where $0 < \zeta_1^s < \zeta_2^s < \cdots < \zeta_{K-1}^s < \infty$, $\zeta_0^s = 0$, and $\zeta_K^s = \infty$, $s = t_0, t_1$, are cutoff points between the K classes.[4] Thus, $p_{kl}^{t_0,t_1}$ gives the fraction of children in class k in period t_0 who are in class l in period t_1. Note, inclusion of the denominator in (1) standardizes elements of the transition matrix such that each row and column sums to unity. A complete lack of mobility implies $p_{kl}^{t_0,t_1}$ equals unity if $k = l$ and zero otherwise. Finally, we can define *conditional* transition matrices computed using sub-samples with $X = x$, where X denotes a vector of individual attributes. Denote the conditional transition matrix as $P_{t_0,t_1}(x)$, with representative element

$$p_{kl}^{t_0,t_1}(x) = \frac{\Pr(\zeta_{k-1}^{t_0} \leq y^{t_0} < \zeta_k^{t_0},\ \zeta_{l-1}^{t_1} \leq y^{t_1} < \zeta_l^{t_1} | X = x)}{\Pr(\zeta_{k-1}^{t_0} \leq y^{t_0} < \zeta_k^{t_0} | X = x)} \qquad k, l = 1, ..., K. \tag{2}$$

Implicit in this definition is the assumption that X are time invariant attributes.

[3] See `http://www.ahrq.gov/clinic/uspstf/uspschobes.htm`.

[4] For example, if $K = 10$, then the cutoff points might correspond to deciles within the two marginal distributions of y^{t_0} and y^{t_1}.

The shortcoming of transition matrices stems from the fact that they do not capture movements *within* classes. Recently, Bhattacharya and Mazumder (2011) present an alternative characterization of the joint distribution $F_{t_0,t_1}(y^{t_0}, y^{t_1})$ to better assess *upward* and *downward* mobility. Their measure of upward mobility is defined as

$$\upsilon_{kl}^{t_0,t_1}(\delta) = \frac{\Pr(\zeta_{k-1}^{t_0} \leq y^{t_0} < \zeta_k^{t_0},\ F_{t_1}(y^{t_1}) - F_{t_0}(y^{t_0}) > \delta)}{\Pr(\zeta_{k-1}^{t_0} \leq y^{t_0} < \zeta_k^{t_0})} \qquad k, l = 1, ..., K, \tag{3}$$

where $F_t(y^t)$ denotes the marginal distribution of y in period t and $\delta \in [0, 1 - F_0(\zeta_k^{t_0})]$ is a predefined constant representing the threshold defining upward mobility. In words, (3) captures the probability of an individual in the terminal period exceeding his or her initial percentile by at least δ, conditional on being located between $\zeta_{k-1}^{t_0}$ and $\zeta_k^{t_0}$ in the initial period. The corresponding measure of downward mobility is given by

$$\varpi_{kl}^{t_0,t_1}(\delta) = \frac{\Pr(\zeta_{k-1}^{t_0} \leq y^{t_0} < \zeta_k^{t_0},\ F_{t_1}(y^{t_1}) - F_{t_0}(y^{t_0}) < -\delta)}{\Pr(\zeta_{k-1}^{t_0} \leq y^{t_0} < \zeta_k^{t_0})}, \tag{4}$$

where $\delta \in [0, F_{t_0}(\zeta_{k-1}^{t_0})]$. In words, (4) captures the probability of an individual in the terminal period reducing his or her initial percentile by at least δ, conditional on being located between $\zeta_{k-1}^{t_0}$ and $\zeta_k^{t_0}$ in the initial period. Finally, we can compute *conditional* measures of upward and downward mobility by conditioning on $X = x$ as in (2). In the analysis, we set $\delta = 0.10$; mobility is defined as changing one's place in the distribution by at least ten percentile points.

While transition matrices, and the corresponding measures of upward and downward mobility, have the advantage of discretizing the continuous CDF, $F_{t_0,t_1}(y^{t_0}, y^{t_1})$, they may not yield unambiguous rankings of the degree of mobility across different samples (e.g., comparing $\upsilon_{kl}^{t_0,t_1}$ across whites and non-whites for different combinations of k and l or comparing $\upsilon_{kl}^{t_0,t_1}$ with $\upsilon_{kl}^{t_1,t_2}$). Consequently, several *summary* measures, designed to capture the overall extent of mobility, have been proposed. Here, we analyze five such measures.

The first measure is due to Bartholomew (1982) and is a scalar computed using the elements of the transition matrix, P, with representative element given in (1). Formally, the measure is given by

$$M(P_{t_0,t_1}) = \frac{1}{K(K-2)} \sum_{k=1}^{K} \sum_{l=1}^{K} p_{kl}^{t_0,t_1} |k - l|. \tag{5}$$

The Bartholomew (1982) measure captures the average number of classes crossed by all observations (Formby et al. 2004). As such, the measure takes into account not only whether children change class, but also the distance moved by children. However, the measure captures *relative* mobility only; absolute changes in anthropometric outcomes alone do not show up as mobility. The measure is normalized and is bounded between zero and one, with higher values representing greater mobility (Buchinsky and Hunt 1999).

The second measure is based on the correlation between anthropometric outcomes in periods t_0 and t_1. Here, we use the Spearman rank correlation coefficient. Upon computation of the correlation coefficient, the measure of mobility is given by

$$M(\rho_{t_0,t_1}) = 1 - \rho_{t_0,t_1}, \tag{6}$$

where ρ_{t_0,t_1} is the rank correlation. As with the first measure, the measure is bounded between zero and one with higher values representing greater mobility as ρ equals zero in both cases when the data are time independent (Fields

2000). Moreover, like the Bartholomew (1982) measure, the correlation-based measure also captures relative mobility only.

The next measure is based on the notion that, with greater mobility, outcomes aggregated over multiple periods should be more equal than outcomes from any individual period. Formally, the measure proposed in Shorrocks (1978) is given by

$$M_S = 1 - \frac{I\left(\overline{y}\right)}{\frac{1}{t_1 - t_0 - 1}\sum_{t=t_0}^{t_1} \frac{\mu^t}{\mu^{t_0,t_1}} I(y^t)}, \tag{7}$$

where $I(\cdot)$ is some measure of inequality, $\overline{y}$ is a vector of anthropometric outcomes averaged over the periods t_0 to t_1, μ^t is the mean outcome in period t, and μ^{t_0,t_1} is the mean outcome over the entire period spanning from t_0 to t_1. The numerator of the ratio in (7) is the level of inequality in observation-specific mean outcomes, where the means are computed over the period t_0 to t_1. The denominator represents a weighted average of inequality computed for each period from t_0 to t_1. With a complete lack of mobility, the inequality of average outcomes is equal to the (weighted) average of per period inequality; thus, $M_S = 0$. With 'perfect' mobility, there is lots of inequality in any given period (i.e., the denominator in (7) is non-zero), but average outcomes are identical (i.e., the numerator is zero); thus, $M_S = 1$. Again, the measure is bounded between zero and one with higher values indicating greater mobility. It is also a relative measure only if the inequality measure is invariant to absolute changes that are rank-preserving. In the analysis, we use Theil's measure of inequality when computing (7), given by

$$I(x_1, ..., x_N) = \frac{1}{N}\sum_i \left[\frac{x_i}{\overline{x}} \cdot \ln\left(\frac{x_i}{\overline{x}}\right)\right],$$

where x represents some variable.

The final two measures come from Cowell and Flachaire (2011). Both measures can be expressed as

$$M_{CF}^{\alpha} = \begin{cases} \frac{1}{\alpha(\alpha-1)}\left[\frac{\frac{1}{N}\sum_i \left(x_i^{t_0}\right)^{\alpha}\left(x_i^{t_1}\right)^{1-\alpha}}{\left(\mu^{t_0}\right)^{\alpha}\left(\mu^{t_1}\right)^{1-\alpha}} - 1\right] & \alpha \neq 0, 1 \\ \frac{\frac{1}{N}\sum_i x_i^{t_1}\log(x_i^{t_1}) - \frac{1}{N}\sum_i x_i^{t_1}\log(x_i^{t_0})}{\mu^{1}} + \log\left(\frac{\mu^{t_0}}{\mu^{t_1}}\right) & \alpha = 0 \\ \frac{\frac{1}{N}\sum_i x_i^{t_0}\log(x_i^{t_0}) - \frac{1}{N}\sum_i x_i^{t_0}\log(x_i^{t_1})}{\mu^{t_0}} + \log\left(\frac{\mu^{t_1}}{\mu^{t_0}}\right) & \alpha = 1, \end{cases} \tag{8}$$

where a large, positive (negative) value of α produces an index that is particularly sensitive to downward (upward) movements. To operationalize M_{CF}^{α} for a given value of α, x^{t_0} and x^{t_1} must be defined. In the first case, we set $x_i^s = y_i^s$, $s = 1, ..., T$. In the second case, we set $x_i^s = F_s(y_i^s)$, where $F_s(\cdot)$ is the marginal CDF of y^s, $s = 1, ..., T$. Cowell and Flachaire (2011) refer to the second case as capturing rank (relative) mobility; the first case measures absolute and relative mobility. In practice, this second measure is implemented by replacing $F_s(\cdot)$ with its empirical counterpart, defined as

$$\widehat{F}_s(y) = \frac{1}{N}\sum_i \mathbf{1}(y_i^s \leq y), \tag{9}$$

where $\mathbf{1}(\cdot)$ is the indicator function. In the analysis, we set $\alpha = 0$.

3.2 Data

We utilize data from the restricted version of the ECLS-K. Collected by the U.S. Department of Education, the ECLS-K surveys a nationally representative cohort of children throughout the U.S. in fall and spring kindergarten, fall and spring first grade, spring third grade, spring fifth grade, and spring eighth grade. The sample includes data on over 20,000 students who entered kindergarten in roughly 1,000 schools during the 1998-99 school year. In addition to family background information, height and weight measures are available from children in each round, as well as information on birth weight.

Our final sample consists of children for whom we have valid measures of age, gender, height, and weight.[5] From the information on height and weight of the children, we create z-scores for weight, height, and BMI. Since negative values create problems in the use of the measures in (7) and (8), we convert z-scores to percentiles. Note that z-scores and percentiles are based on CDC 2000 growth charts; these are age- and gender-specific, are adjusted for normal growth, and are based on the underlying reference population.[6] Moreover, whereas percentiles for weight at birth are available, they are not for height and BMI. Finally, to assess heterogeneity in anthropometric mobility, we compute the various mobility measures for the full sample as well as subsamples defined on the basis of race (white vs. non-white), gender (male vs. female), and socioeconomic status (low vs. high SES).

4 Results

4.1 Percentile Weight

Tables 1-3 display the results for percentile weight. Table 1 reports the five summary measures of mobility; Tables 2 and 3 report the results for upward and downward mobility, respectively. In each table, Panel I contains the full sample results, Panels II and III contain the results disaggregated by race, Panels IV and V contain the results disaggregated by gender, and Panels VI and VII contain the results disaggregated by SES status. Within each panel, we report the mobility measures computed over several time periods, including the full sample period from birth through spring eighth grade, as well as the sub-periods from birth through fall kindergarten, fall kindergarten through spring eighth grade, fall kindergarten through spring first grade, spring first grade through spring third grade, spring third grade through spring fifth grade, and spring fifth grade through spring eighth grade. Finally, each table reports standard errors computed by simple, nonparametric bootstrap with 250 repetitions clustered at the child-level.

Turning to the summary measures of mobility in Table 1 for the full sample, two findings stand out. First, there exists a clear pattern: mobility follows a U-shaped pattern, being greatest between birth and kindergarten entry and lowest between spring third and fifth grades. For example, using Shorrocks' (1978) measure, mobility is 0.557 over the period spanning birth to fall kindergarten, 0.134 over the period spanning fall kindergarten to spring first grade, 0.108 over the period spanning spring first to spring third grade, 0.072 over the period spanning spring third to spring fifth grade, and 0.149 over the period spanning spring fifth to spring eighth grade. The estimates are very precise. Given the structure of schooling faced by most children in the U.S., this suggests that mobility is relatively high during infancy as well as during times of transition (i.e., at the start of primary school and then again at the start of

[5] The initial sample size of the ECLS-K is 21,260. After cleaning age, weight, and height as described in Millimet and Tchernis (2013, Appendix C), and due to sample attrition, the sample size falls to 9,360 in the final wave of the data. Restricting the sample to a balanced panel reduces the sample size to approximately 9,160. Restricting the sample to those with valid birth weight reduces the sample size per wave to roughly 8,370. Note, all sample sizes are rounded to the nearest 10 per NCES restricted data regulations.

[6] z-scores and their percentiles are obtained using the -*zanthro*- command in Stata.

middle school). This timing also coincides with two of the three 'critical' periods for the onset of childhood obesity; namely, the period of so-called adiposity rebound, typically occurring between ages four and six, and the transition into adolescence (Dietz 1997). In terms of policy advice, this suggests that interventions prior to kindergarten may have the greatest potential to influence future weight. Once children reach kindergarten age, mobility peaks during times of transition to a new school: kindergarten entry and the transition to middle school. Thus, interventions for school-age children have the potential to be more effective if they occur at a time when children are developing new routines in new school environments.

Second, the various measures generally agree as it relates to changes in the degree of mobility across time periods. However, the amount of mobility between fall kindergarten and spring first grade as compared with between spring fifth and eighth grade depends on the measure utilized. Whereas the Bartholomew (1982) and Shorrocks (1978) measures point to greater mobility during the transition to middle school, the other measures indicate greater mobility at the start of kindergarten.

Examining upward and downward mobility in Tables 2 and 3 permits a more detailed examination of mobility patterns. Specifically, the figures in the tables represent the probability of moving up or down by more than ten percentile points from the initial period to the terminal period conditional on the quintile the child belongs to in the initial period. In terms of upward mobility in Table 2, three noticeable patterns emerge. First, there is a negative, monotonic relationship across the quintiles when examining changes from birth through spring eighth grade, birth through fall kindergarten, and fall kindergarten through spring eighth grade. For example, the probability of moving up at least ten percentile points in the distribution from fall kindergarten to spring eighth grade is 0.457 for children initially in the first quintile in fall kindergarten, 0.398 for the second quintile, 0.314 for the third quintile, 0.194 for the fourth quintile, and 0.038 for the top quintile. While it is understandable that upward mobility is lowest for children initially in the fifth quintile (since only those below the 90^{th} percentile have the ability to move up at least ten percentile points), there is nothing that guarantees that upward mobility must decline as one moves up the distribution in the initial period.

Second, despite upward mobility declining monotonically across the initial distribution when examining the period spanning fall kindergarten to spring eighth grade, when we assess upward mobility across different sub-periods during primary school, we find mobility is greatest for those initially in the second quintile. Finally, we continue to find strong evidence of a U-shaped relationship in mobility across time periods, consistent with the 'critical' periods of child development discussed earlier. In particular, upward mobility is lowest over the period spanning spring third to spring fifth grades. For example, the probability of moving up at least ten percentile points in the distribution for a child in fourth quintile in the initial period is 0.227 over the period from birth through kindergarten entry, 0.120 over the period spanning fall kindergarten to spring first grade, 0.112 over the period spanning spring first to spring third grade, 0.105 over the period spanning spring third to spring fifth grade, and 0.158 over the period spanning spring fifth to spring eighth grade. Thus, children in this category are about 50% more upwardly mobile during the transition to middle school than during the middle years of elementary school.

Examining downward mobility in Table 3, three patterns are noticeable. First, downward mobility is strictly increasing across the distribution over the periods spanning birth through spring eighth grade, birth through kindergarten entry, and fall kindergarten through spring eighth grade. However, there is an inverted U-shaped relationship across the quintiles, peaking at the fourth quintile, when examining mobility from fall kindergarten to spring eighth grade. For example, the probability of moving down at least ten percentile points in the distribution is 0.062 for children initially in the first quintile, 0.287 for the second quintile, 0.374 for the third quintile, 0.479 for the fourth quintile, and 0.390 for the top quintile. Second, despite downward mobility peaking at the fourth quintile when examining the period from fall kindergarten through spring eighth grade, downward mobility tends to be largest at the third quintile when we examine later sub-periods. Specifically, downward mobility is greatest for those initially in the fourth quintile during early primary school and greatest for those initially in the third quintile during later primary and middle school.

Finally, as with the prior mobility measures, we find strong evidence of a U-shaped relationship in downward mobility across time periods for most quintiles. In particular, for all quintiles downward mobility is lowest over the period spanning spring third to spring fifth grades. For example, the probability of moving down at least ten percentile points for a child in the highest quintile in the initial period is 0.700 over the period from birth through kindergarten entry, 0.108 over the period spanning fall kindergarten to spring first grade, 0.091 over the period spanning spring first to spring third grade, 0.067 over the period spanning spring third to spring fifth grade, and 0.140 over the period spanning spring fifth to spring eighth grade. Thus, children in this category are more than twice as downwardly mobile during the transition to middle school than during the middle years at elementary school. As stated above, the fact that mobility during primary school tends to be the greatest at the start of kindergarten and then over the period most likely spanning the start of middle school suggests that interventions coinciding with transitions in schooling, which also coincide with critical periods of biological development, are likely to have the greatest efficacy. However, mobility between birth and entry into kindergarten is much higher than during primary school suggesting the potential for greater impacts from interventions prior to elementary school.

Next, we turn to the results for different demographic groups. In the interest of brevity, we highlight a few salient findings. First, the patterns of mobility are quite distinct for whites and non-whites. All summary measures in Table 1 indicate *greater* mobility for non-whites over the period from birth to kindergarten entry and *less* mobility over the period from fall kindergarten through spring eighth grade. For example, the first Cowell and Flaichaire (2011) measure, $CF(0)$, is 0.537 (0.417) for non-whites (whites) prior to kindergarten entry, but 0.133 (0.154) during primary school. Tables 2 and 3 provide greater insights into this pattern. Specifically, the greater mobility prior to kindergarten is driven predominantly by greater *upward* mobility by those initially in the first and second quintiles (Table 2). The lower mobility during elementary school holds across nearly the entire distribution as non-whites have lower *upward* and *downward* mobility over this time period.

Second, a similar pattern emerges when comparing boys to girls. All summary measures indicate *greater* mobility for girls prior to kindergarten; the reverse holds during primary school (Table 1). Tables 2 and 3 indicate that this is due to greater *upward* mobility by girls between birth and kindergarten entry, whereas boys have greater *upward* and *downward* mobility across the majority of quintiles during primary school. Finally, there is little definitive pattern to the results when we differentiate by SES status.

4.2 Percentile Height

Tables 4-6 present the analogous results for percentile height. Turning to the summary measures of mobility in Table 4 for the full sample, there exists a clear pattern that is distinct from that for weight: mobility is relatively constant over time between kindergarten and spring fifth grade. Mobility then roughly doubles over the period spanning spring fifth to eighth grade. For example, using Shorrocks' (1978) measure, mobility is 0.062 over the period spanning fall kindergarten to spring first grade, 0.072 over the period spanning spring first to spring third grade, 0.088 over the period spanning spring third to spring fifth grade, and 0.172 over the period spanning spring fifth to spring eighth grade. This spike in mobility during the transition to middle school coincides with the spike in weight mobility found in Table 1. As before, the estimates are very precise.

Examining upward and downward mobility in Tables 5 and 6 permits a more detailed examination of mobility patterns. In terms of upward mobility in Table 5, again two noticeable patterns emerge. First, there exists an inverted U-shaped relationship across the distribution within any given time period. For example, upward mobility over the period spanning spring fifth to spring eighth grade is 0.304 for the first quintile, 0.404 for the second quintile, 0.355 for the third quintile, 0.260 for the fourth quintile, and 0.044 for the fifth quintile. Second, as in Table 4, upward mobility tends to be relatively constant across time periods within a quintile until peaking during the period from spring fifth to spring eighth grade. For instance, for the fourth quintile, the probability of moving up at least ten percentile points in the distribution is 0.122 over the period spanning fall kindergarten to spring first grade, 0.104 over the period spanning spring first to spring third grade, 0.136 over the period spanning spring third to spring fifth grade, and 0.260 over the period spanning spring fifth to spring eighth grade. Thus, children in this category are about 50% more upwardly mobile during the transition to middle school than during the middle years of elementary school.

Examining downward mobility in Table 6, we point to two main findings. First, downward mobility is strictly increasing across the distribution over the periods spanning fall kindergarten through spring eighth grade. However, there is an inverted U-shaped relationship across the quintiles, peaking at the fourth quintile, when examining downward mobility over the earlier sub-periods in the sample. For example, the probability of moving down at least ten percentile points in the distribution over the period spanned by spring third to spring fifth grade is 0.011 for children initially in the first quintile, 0.131 for the second quintile, 0.212 for the third quintile, 0.215 for the fourth quintile, and 0.118 for the top quintile. Second, as with upward mobility, downward mobility tends to be relatively constant across time periods within a quintile until peaking during the period from spring fifth to spring eighth grade. For instance, for the fourth quintile, the probability of moving down at least ten percentile points in the distribution is 0.185 over the period spanning fall kindergarten to spring first grade, 0.178 over the period spanning spring first to spring third grade, 0.215 over the period spanning spring third to spring fifth grade, and 0.333 over the period spanning spring fifth to spring eighth grade.

Next, we turn to the results for different demographic groups. In the interest of continued brevity, we focus on a few key results. First, there is little difference in the summary mobility measures, or upward and downward mobility, along racial lines over the period spanning fall kindergarten to spring eighth grade. However, the summary mobility measures in every sub-period, and upward and downward mobility in many sub-periods for many quintiles, are higher for non-whites. This pattern could materialize for two reasons. On the one hand, (relative) height may be much more volatile over short intervals for non-whites, although not over long intervals. On the other hand, height may be more noisy from one period to the next due to greater measurement error.

Second, there are large differences in mobility along gender lines. Specifically, mobility over the period from spring fifth to spring eighth grade is much *greater* for girls. For example, the summary measures are about 50 -80% higher for girls over this time period (Table 4). This is driven mainly by differential upward mobility, which is about 10 percentage points higher for girls across the bottom four quintiles (Table 5). However, girls initially in the top quintile as of spring fifth grade are also much more likely to experience downward mobility between spring fifth and spring eighth grade (Table 6). The greater mobility for girls over this time period is presumably due to variation in the onset of puberty, which may begin earlier for girls than boys (Herman-Giddens 2006). It is also consistent with the period of transition into adolescence being of greater biological significance for girls' height. Finally, as with weight, there is little definitive pattern to the results when we differentiate by SES status.

4.3 Percentile BMI

Tables 7-9 present the final set of results for percentile BMI. Mobility in BMI reflects differential mobility of weight and height and is of more direct relevance due to the costs mentioned previously associated with obesity. Turning to the summary measures of mobility in Table 7 for the full sample, two findings stand out. First, as with weight, mobility follows a U-shaped pattern. For example, using Shorrocks' (1978) measure, mobility is 0.437 over the period spanning fall kindergarten to spring first grade, 0.313 over the period spanning spring first to spring third grade, 0.170 over the period spanning spring third to spring fifth grade, and 0.230 over the period spanning spring fifth to spring eighth grade. However, unlike with weight, all measures agree that mobility is greater over the period spanning fall kindergarten to spring first grade than over the period spanning spring fifth grade to spring eighth grade. Second, there is greater mobility in terms of BMI than for either weight or height alone. For example, over the period spanning kindergarten entry to spring eighth grade, the first Cowell and Flaichaire (2011) measure, $CF(0)$, is 0.221 for BMI, but only 0.146 and 0.111 for weight and height, respectively.

Examining upward mobility in Table 8, we notice two patterns. First, as with weight, there is a negative, monotonic relationship across the quintiles when examining changes from fall kindergarten through spring eighth grade, as well as during the first two sub-periods. For example, the probability of moving up at least ten percentile points in the distribution from fall kindergarten to spring eighth grade is 0.543 for children initially in the first quintile in fall kindergarten, 0.409 for the second quintile, 0.311 for the third quintile, 0.189 for the fourth quintile, and 0.032 for the top quintile. Upward mobility is greatest for those initially in the second quintile for the final two sub-periods. Second, we continue to find strong evidence of a U-shaped relationship in mobility across time periods, consistent with the 'critical' periods of child development discussed earlier. In particular, upward mobility is lowest over the period spanning spring third to spring fifth grades. Moreover, upward mobility is roughly equal in the first and final sub-periods with the exception of the first quintile; here, mobility is greatest between fall kindergarten and spring first grade.

Turning to downward mobility in Table 9, three patterns are noticeable. First, as with weight, downward mobility follows an inverted U-shaped relationship across the quintiles, peaking at the fourth quintile, when examining mobility from fall kindergarten to spring eighth grade. For example, the probability of moving down at least ten percentile points in the distribution is 0.052 for children initially in the first quintile, 0.311 for the second quintile, 0.417 for the third quintile, 0.513 for the fourth quintile, and 0.410 for the top quintile. Second, again consistent with weight, downward mobility tends to be largest at the third quintile when we examine later sub-periods. Finally, as with the prior mobility measures, we find strong evidence of a U-shaped relationship in downward mobility across time periods for most quintiles. In particular, for all quintiles downward mobility is lowest over the period spanning spring third to spring fifth grades. For example, the probability of moving down at least ten percentile points for a child in the highest quintile in the initial period is 0.186 over the period spanning fall kindergarten to spring first grade, 0.117 over the period spanning spring first to spring third grade, 0.090 over the period spanning spring third to spring fifth grade, and 0.142 over the period spanning spring fifth to spring eighth grade.

Lastly, we turn to the results for different demographic groups. When splitting the sample along racial lines, all summary measures in Table 7, except Shorrocks (1978) measure, indicate *greater* mobility for whites over the period from fall kindergarten through spring eighth grade. Specifically, the greater mobility is driven predominantly by greater *upward* mobility throughout the distribution, becoming somewhat more pronounced during the transition to middle school (Table 2). Whites also experience greater downward mobility, but here the effects tend to be concentrated at the upper quintiles.

The differences are not so stark when we split the sample by gender. Now, while all summary measures indicate *greater* mobility for boys over the full period spanning kindergarten entry to spring eighth grade, the results vary by sub-period. Boys (Girls) are more mobile according to all measures over the first (last) two sub-periods. This is consistent with the period of adiposity rebound being more critical for determining future BMI for boys, whereas the transition into adolescence is more critical for girls. Tables 8 and 9 indicate that this mobility pattern is due primarily to greater *downward* mobility by boys over the first two sub-periods and greater *upward* and *downward* mobility by girls over the last two sub-periods. As with weight and height, there is little definitive pattern to the results when we differentiate by SES status.

5 Conclusion

Concern over childhood obesity has risen dramatically over the past decade. However, our knowledge has not kept pace with this concern. In particular, our knowledge over how health evolves over time is sorely lacking. Our analysis here borrows several commonly used nonparametric measures of mobility to assess anthropometric mobility during early childhood using longitudinal data from the ECLS-K.

We arrive at three main takeaway points. First, while there is significant mobility in terms of weight between birth and the start of primary school, there is much less mobility once children are of primary school age. The greater mobility over the period spanning birth to kindergarten entry is consistent with the notion that birth weight alone is not a great indicator of future weight status. As noted in the medical literature, superior measures must account for weight relative to gestation age, head circumference, and other anthropometric indicators (e.g., Brisbois et al.

2012).

Second, heterogeneity is very important. There is no universal measure of persistence or mobility; no single measure can capture the complex movements that occur throughout a given distribution over time. The analysis points to three primary sources of heterogeneity: initial quintile, age range, and demographic group. By initial quintile we mean that where a child starts in the distribution leads to differences in mobility patterns even conditional on the time period over which one is assessing mobility and conditional on the demographic group to which the child belongs. By age range we mean that mobility patterns vary depending on the time period one is assessing mobility, even holding constant a child's initial place in the distribution and demographic group. Finally, by demographic group, we mean that mobility patterns vary across demographic groups, even conditional on a child's initial place in the distribution and the time period. As discussed above, perhaps the most intriguing finding is the relative amounts of mobility occurring at the start of primary school (i.e., between fall kindergarten and spring first grade) and between the final two waves in the data (i.e., spring fifth to spring eighth grade). Thus, interventions aimed at encouraging new, healthy behaviors are perhaps most likely to be effective when implemented during key transition periods such as entry into elementary and middle school, particularly when those transitions also coincide with evidence from the medical literature indicating these as critical periods of biological development. That said, when examining weight alone, mobility is significantly greater over the period spanned by birth to kindergarten entry. Thus, while interventions may be more difficult to implement during this time period, relative to school-based reforms during periods with near universal enrollment, they are likely to be more effective.

Third, the patterns of mobility are quite distinct along racial and gender lines; surprisingly, the differences are less systematic when we differentiate children by SES status. We find that whites and boys experience greater anthropometric mobility during primary school (i.e., the full period spanning kindergarten entry through the end of middle school). However, non-whites and girls experience greater anthropometric mobility prior to primary school. Girls also experience greater mobility during the transition to adolescence despite having lower mobility overall during primary school. This suggests the potential for non-whites, and girls to a lesser extent, to be on an "obesity trajectory" earlier in life.

In light of the results, future work is needed to explore the sources of anthropometric mobility, or the lack thereof, during different time periods and across different demographic groups.

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Table 1. Mobility Measures: Percentile Weight

	M(P)	M(ρ)	M_S	CF(0)	$CF_R(0)$		M(P)	M(ρ)	M_S	CF(0)	$CF_R(0)$
I. Full Sample											
[0,7]	0.334	0.853	0.458	0.506	0.437						
	(0.003)	(0.011)	(0.006)	(0.012)	(0.007)						
[0,1]	0.312	0.763	0.557	0.467	0.378						
	(0.003)	(0.010)	(0.007)	(0.011)	(0.006)						
[1,7]	0.192	0.321	0.271	0.146	0.175						
	(0.002)	(0.007)	(0.005)	(0.005)	(0.005)						
[1,4]	0.102	0.111	0.134	0.056	0.063						
	(0.002)	(0.003)	(0.005)	(0.003)	(0.002)						
[4,5]	0.097	0.093	0.108	0.040	0.051						
	(0.001)	(0.003)	(0.006)	(0.002)	(0.002)						
[5,6]	0.080	0.060	0.072	0.024	0.032						
	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)						
[6,7]	0.110	0.106	0.149	0.041	0.054						
	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)						
II. White						**III. Non-White**					
[0,7]	0.331	0.840	0.461	0.463	0.431	**[0,7]**	0.334	0.850	0.448	0.564	0.433
	(0.003)	(0.013)	(0.006)	(0.015)	(0.008)		(0.004)	(0.017)	(0.009)	(0.022)	(0.010)
[0,1]	0.308	0.747	0.552	0.417	0.367	**[0,1]**	0.314	0.771	0.558	0.537	0.387
	(0.003)	(0.013)	(0.010)	(0.014)	(0.008)		(0.004)	(0.017)	(0.012)	(0.021)	(0.009)
[1,7]	0.201	0.347	0.273	0.154	0.189	**[1,7]**	0.180	0.280	0.266	0.133	0.152
	(0.003)	(0.009)	(0.006)	(0.007)	(0.006)		(0.003)	(0.010)	(0.008)	(0.007)	(0.006)
[1,4]	0.106	0.118	0.134	0.059	0.067	**[1,4]**	0.096	0.100	0.134	0.053	0.057
	(0.002)	(0.004)	(0.005)	(0.003)	(0.003)		(0.002)	(0.005)	(0.008)	(0.004)	(0.004)
[4,5]	0.101	0.103	0.107	0.040	0.054	**[4,5]**	0.090	0.078	0.109	0.041	0.044
	(0.002)	(0.003)	(0.007)	(0.002)	(0.002)		(0.002)	(0.004)	(0.012)	(0.005)	(0.003)
[5,6]	0.083	0.064	0.070	0.023	0.032	**[5,6]**	0.076	0.054	0.076	0.025	0.030
	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)		(0.002)	(0.003)	(0.006)	(0.003)	(0.003)
[6,7]	0.114	0.115	0.157	0.045	0.058	**[6,7]**	0.102	0.091	0.136	0.035	0.045
	(0.002)	(0.004)	(0.005)	(0.002)	(0.002)		(0.002)	(0.004)	(0.007)	(0.002)	(0.002)

Notes: Period 0 = birth; Period 1 = fall kindergarten; Period 4 = spring 1st grade; Period 5 = spring 3rd grade; Period 6 = spring 5th grade; and, Period 7 = spring 8th grade. Bootstrap standard errors based on 250 repetitions (clustered at the child-level) in parentheses. N = 8370 (full sample), 5330 (white sample), 3040 (non-white sample), 4230 (male sample), 4140 (female sample), 2660 (low SES sample), and 5710 (high SES sample) with sample sizes rounded to the nearest 10 per NCES restricted data regulations. See text for definition of mobility measures.

Table 1 (cont.). Mobility Measures: Percentile Weight

	M(P)	M(ρ)	M_S	CF(0)	$CF_R(0)$
IV. Male					
[0,7]	0.340	0.870	0.464	0.493	0.442
	(0.004)	(0.015)	(0.007)	(0.015)	(0.008)
[0,1]	0.309	0.755	0.544	0.435	0.371
	(0.004)	(0.014)	(0.011)	(0.014)	(0.008)
[1,7]	0.199	0.339	0.284	0.156	0.184
	(0.003)	(0.010)	(0.008)	(0.007)	(0.006)
[1,4]	0.105	0.119	0.144	0.060	0.067
	(0.002)	(0.005)	(0.007)	(0.004)	(0.003)
[4,5]	0.100	0.100	0.121	0.043	0.054
	(0.002)	(0.004)	(0.010)	(0.004)	(0.003)
[5,6]	0.078	0.059	0.071	0.020	0.031
	(0.002)	(0.003)	(0.003)	(0.001)	(0.001)
[6,7]	0.106	0.100	0.149	0.038	0.051
	(0.002)	(0.003)	(0.005)	(0.002)	(0.002)
VI. Low SES					
[0,7]	0.328	0.827	0.464	0.543	0.426
	(0.005)	(0.018)	(0.009)	(0.023)	(0.011)
[0,1]	0.306	0.742	0.566	0.510	0.372
	(0.005)	(0.018)	(0.012)	(0.021)	(0.010)
[1,7]	0.188	0.306	0.291	0.153	0.166
	(0.004)	(0.012)	(0.010)	(0.009)	(0.008)
[1,4]	0.099	0.107	0.142	0.056	0.059
	(0.003)	(0.006)	(0.009)	(0.004)	(0.003)
[4,5]	0.095	0.087	0.125	0.049	0.049
	(0.002)	(0.004)	(0.014)	(0.006)	(0.003)
[5,6]	0.076	0.055	0.083	0.026	0.031
	(0.002)	(0.003)	(0.006)	(0.003)	(0.003)
[6,7]	0.108	0.100	0.155	0.040	0.051
	(0.003)	(0.005)	(0.009)	(0.002)	(0.003)

	M(P)	M(ρ)	M_S	CF(0)	$CF_R(0)$
V. Female					
[0,7]	0.328	0.833	0.453	0.519	0.429
	(0.004)	(0.016)	(0.007)	(0.018)	(0.009)
[0,1]	0.315	0.771	0.570	0.499	0.383
	(0.004)	(0.015)	(0.011)	(0.020)	(0.009)
[1,7]	0.184	0.298	0.257	0.135	0.164
	(0.003)	(0.010)	(0.007)	(0.007)	(0.006)
[1,4]	0.098	0.103	0.124	0.052	0.059
	(0.002)	(0.004)	(0.006)	(0.003)	(0.003)
[4,5]	0.095	0.086	0.096	0.038	0.046
	(0.002)	(0.004)	(0.008)	(0.003)	(0.003)
[5,6]	0.081	0.061	0.074	0.027	0.033
	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)
[6,7]	0.112	0.110	0.148	0.045	0.054
	(0.002)	(0.004)	(0.006)	(0.002)	(0.002)
VII. High SES					
[0,7]	0.334	0.854	0.454	0.482	0.435
	(0.003)	(0.013)	(0.006)	(0.015)	(0.008)
[0,1]	0.314	0.771	0.552	0.444	0.380
	(0.003)	(0.013)	(0.010)	(0.014)	(0.008)
[1,7]	0.193	0.324	0.260	0.142	0.177
	(0.003)	(0.009)	(0.006)	(0.006)	(0.006)
[1,4]	0.103	0.113	0.130	0.056	0.065
	(0.002)	(0.004)	(0.005)	(0.003)	(0.003)
[4,5]	0.098	0.096	0.099	0.036	0.050
	(0.002)	(0.004)	(0.006)	(0.002)	(0.002)
[5,6]	0.081	0.063	0.067	0.022	0.032
	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)
[6,7]	0.111	0.110	0.148	0.042	0.055
	(0.002)	(0.003)	(0.005)	(0.001)	(0.002)

Table 2. Upward Mobility Measures: Percentile Weight

	Q1	Q2	Q3	Q4	Q5		Q1	Q2	Q3	Q4	Q5
I. Full Sample											
[0,7]	0.727	0.538	0.369	0.215	0.037						
	(0.010)	(0.011)	(0.011)	(0.010)	(0.005)						
[0,1]	0.680	0.530	0.388	0.227	0.034						
	(0.010)	(0.011)	(0.012)	(0.010)	(0.004)						
[1,7]	0.457	0.398	0.314	0.194	0.038						
	(0.011)	(0.012)	(0.011)	(0.009)	(0.004)						
[1,4]	0.217	0.225	0.222	0.120	0.008						
	(0.009)	(0.009)	(0.009)	(0.007)	(0.002)						
[4,5]	0.186	0.260	0.209	0.112	0.011						
	(0.008)	(0.010)	(0.009)	(0.007)	(0.003)						
[5,6]	0.146	0.227	0.192	0.105	0.006						
	(0.008)	(0.010)	(0.009)	(0.008)	(0.002)						
[6,7]	0.247	0.325	0.251	0.158	0.018						
	(0.009)	(0.011)	(0.010)	(0.009)	(0.003)						
II. White						**III. Non-White**					
[0,7]	0.727	0.538	0.362	0.214	0.026	**[0,7]**	0.731	0.548	0.385	0.190	0.025
	(0.013)	(0.015)	(0.014)	(0.011)	(0.006)		(0.017)	(0.019)	(0.019)	(0.016)	(0.007)
[0,1]	0.663	0.533	0.387	0.233	0.041	**[0,1]**	0.691	0.551	0.364	0.211	0.029
	(0.013)	(0.015)	(0.015)	(0.012)	(0.006)		(0.018)	(0.019)	(0.018)	(0.015)	(0.008)
[1,7]	0.472	0.404	0.313	0.194	0.042	**[1,7]**	0.429	0.387	0.309	0.191	0.033
	(0.013)	(0.015)	(0.012)	(0.011)	(0.006)		(0.016)	(0.018)	(0.017)	(0.015)	(0.007)
[1,4]	0.225	0.235	0.221	0.127	0.012	**[1,4]**	0.202	0.217	0.208	0.095	0.012
	(0.011)	(0.013)	(0.012)	(0.009)	(0.004)		(0.014)	(0.018)	(0.016)	(0.013)	(0.005)
[4,5]	0.186	0.269	0.209	0.130	0.011	**[4,5]**	0.182	0.259	0.188	0.103	0.005
	(0.011)	(0.012)	(0.011)	(0.010)	(0.003)		(0.015)	(0.017)	(0.015)	(0.013)	(0.003)
[5,6]	0.146	0.241	0.204	0.108	0.010	**[5,6]**	0.148	0.220	0.171	0.100	0.000
	(0.010)	(0.013)	(0.012)	(0.011)	(0.004)		(0.013)	(0.016)	(0.015)	(0.012)	(0.002)
[6,7]	0.254	0.317	0.267	0.177	0.015	**[6,7]**	0.233	0.296	0.238	0.126	0.007
	(0.012)	(0.014)	(0.014)	(0.011)	(0.005)		(0.016)	(0.019)	(0.016)	(0.013)	(0.006)

Notes: Period 0 = birth; Period 1 = fall kindergarten; Period 4 = spring 1st grade; Period 5 = spring 3rd grade; Period 6 = spring 5th grade; and, Period 7 = spring 8th grade. Q1 - Q5 refers to the first through fifth quantiles in the initial period. Bootstrap standard errors based on 250 repetitions (clustered at the child-level) in parentheses. N = 8370 (full sample), 5330 (white sample), 3040 (non-white sample), 4230 (male sample), 4140 (female sample), 2660 (low SES sample), and 5710 (high SES sample) with sample sizes rounded to the nearest 10 per NCES restricted data regulations. See text for definition of mobility measures (δ = 0.10).

Table 2 (cont.). Upward Mobility Measures: Percentile Weight

	Q1	Q2	Q3	Q4	Q5		Q1	Q2	Q3	Q4	Q5
IV. Male						**V. Female**					
[0,7]	0.737	0.544	0.372	0.208	0.032	**[0,7]**	0.702	0.512	0.351	0.211	0.026
	(0.014)	(0.016)	(0.016)	(0.012)	(0.007)		(0.013)	(0.016)	(0.015)	(0.015)	(0.006)
[0,1]	0.677	0.519	0.375	0.220	0.033	**[0,1]**	0.668	0.532	0.379	0.231	0.041
	(0.015)	(0.016)	(0.018)	(0.014)	(0.006)		(0.015)	(0.016)	(0.016)	(0.017)	(0.008)
[1,7]	0.479	0.410	0.312	0.204	0.041	**[1,7]**	0.432	0.392	0.314	0.188	0.028
	(0.015)	(0.016)	(0.015)	(0.013)	(0.007)		(0.016)	(0.016)	(0.018)	(0.012)	(0.006)
[1,4]	0.222	0.227	0.232	0.131	0.011	**[1,4]**	0.218	0.223	0.216	0.107	0.006
	(0.013)	(0.015)	(0.014)	(0.013)	(0.003)		(0.013)	(0.013)	(0.013)	(0.010)	(0.003)
[4,5]	0.185	0.268	0.216	0.111	0.010	**[4,5]**	0.171	0.263	0.205	0.120	0.011
	(0.012)	(0.014)	(0.013)	(0.010)	(0.004)		(0.013)	(0.015)	(0.013)	(0.011)	(0.005)
[5,6]	0.149	0.240	0.167	0.104	0.008	**[5,6]**	0.158	0.211	0.187	0.114	0.002
	(0.011)	(0.014)	(0.013)	(0.010)	(0.003)		(0.011)	(0.014)	(0.013)	(0.012)	(0.003)
[6,7]	0.244	0.301	0.247	0.139	0.012	**[6,7]**	0.223	0.331	0.265	0.176	0.013
	(0.015)	(0.015)	(0.015)	(0.013)	(0.004)		(0.013)	(0.015)	(0.014)	(0.013)	(0.004)
VI. Low SES						**VII. High SES**					
[0,7]	0.737	0.509	0.368	0.224	0.029	**[0,7]**	0.732	0.540	0.377	0.204	0.035
	(0.017)	(0.020)	(0.021)	(0.017)	(0.008)		(0.013)	(0.014)	(0.014)	(0.010)	(0.006)
[0,1]	0.690	0.513	0.382	0.239	0.038	**[0,1]**	0.678	0.542	0.398	0.216	0.042
	(0.017)	(0.021)	(0.020)	(0.019)	(0.008)		(0.013)	(0.013)	(0.015)	(0.012)	(0.006)
[1,7]	0.433	0.397	0.326	0.190	0.045	**[1,7]**	0.453	0.405	0.317	0.206	0.040
	(0.017)	(0.019)	(0.018)	(0.015)	(0.009)		(0.012)	(0.014)	(0.014)	(0.010)	(0.006)
[1,4]	0.206	0.239	0.215	0.104	0.009	**[1,4]**	0.219	0.226	0.221	0.127	0.011
	(0.015)	(0.018)	(0.017)	(0.014)	(0.005)		(0.011)	(0.012)	(0.011)	(0.010)	(0.003)
[4,5]	0.189	0.267	0.218	0.117	0.009	**[4,5]**	0.176	0.266	0.202	0.115	0.010
	(0.015)	(0.018)	(0.017)	(0.014)	(0.004)		(0.010)	(0.011)	(0.011)	(0.009)	(0.003)
[5,6]	0.158	0.215	0.141	0.102	0.006	**[5,6]**	0.145	0.231	0.206	0.112	0.008
	(0.015)	(0.017)	(0.016)	(0.014)	(0.004)		(0.011)	(0.011)	(0.011)	(0.010)	(0.003)
[6,7]	0.248	0.284	0.256	0.147	0.011	**[6,7]**	0.241	0.330	0.267	0.175	0.014
	(0.018)	(0.018)	(0.018)	(0.015)	(0.005)		(0.011)	(0.014)	(0.012)	(0.010)	(0.004)

Table 3. Downward Mobility Measures: Percentile Weight

	Q1	Q2	Q3	Q4	Q5		Q1	Q2	Q3	Q4	Q5
I. Full Sample											
[0,7]	0.037	0.234	0.418	0.584	0.741						
	(0.005)	(0.009)	(0.011)	(0.011)	(0.010)						
[0,1]	0.042	0.251	0.408	0.548	0.700						
	(0.005)	(0.010)	(0.012)	(0.011)	(0.010)						
[1,7]	0.062	0.287	0.374	0.479	0.390						
	(0.005)	(0.011)	(0.011)	(0.011)	(0.010)						
[1,4]	0.022	0.169	0.250	0.280	0.108						
	(0.004)	(0.009)	(0.011)	(0.011)	(0.008)						
[4,5]	0.023	0.166	0.283	0.289	0.091						
	(0.004)	(0.009)	(0.010)	(0.011)	(0.008)						
[5,6]	0.016	0.134	0.228	0.191	0.067						
	(0.003)	(0.009)	(0.010)	(0.010)	(0.007)						
[6,7]	0.045	0.219	0.305	0.295	0.140						
	(0.005)	(0.009)	(0.011)	(0.011)	(0.008)						
II. White						**III. Non-White**					
[0,7]	0.039	0.242	0.428	0.579	0.742	**[0,7]**	0.046	0.225	0.445	0.571	0.740
	(0.006)	(0.013)	(0.015)	(0.015)	(0.013)		(0.008)	(0.016)	(0.018)	(0.019)	(0.017)
[0,1]	0.048	0.249	0.398	0.538	0.695	**[0,1]**	0.034	0.241	0.407	0.526	0.700
	(0.007)	(0.012)	(0.015)	(0.013)	(0.012)		(0.007)	(0.017)	(0.019)	(0.020)	(0.019)
[1,7]	0.066	0.281	0.389	0.501	0.400	**[1,7]**	0.056	0.291	0.345	0.467	0.364
	(0.006)	(0.014)	(0.014)	(0.015)	(0.014)		(0.008)	(0.017)	(0.018)	(0.018)	(0.018)
[1,4]	0.023	0.164	0.274	0.295	0.107	**[1,4]**	0.020	0.170	0.220	0.265	0.104
	(0.005)	(0.013)	(0.014)	(0.014)	(0.009)		(0.005)	(0.015)	(0.020)	(0.019)	(0.013)
[4,5]	0.022	0.163	0.295	0.304	0.116	**[4,5]**	0.026	0.171	0.273	0.245	0.067
	(0.004)	(0.009)	(0.014)	(0.014)	(0.011)		(0.007)	(0.015)	(0.019)	(0.023)	(0.011)
[5,6]	0.014	0.138	0.239	0.203	0.078	**[5,6]**	0.018	0.134	0.194	0.169	0.046
	(0.004)	(0.011)	(0.013)	(0.013)	(0.009)		(0.006)	(0.016)	(0.015)	(0.017)	(0.009)
[6,7]	0.045	0.229	0.307	0.310	0.148	**[6,7]**	0.028	0.219	0.286	0.263	0.135
	(0.006)	(0.012)	(0.014)	(0.013)	(0.012)		(0.008)	(0.017)	(0.017)	(0.017)	(0.013)

Notes: Period 0 = birth; Period 1 = fall kindergarten; Period 4 = spring 1st grade; Period 5 = spring 3rd grade; Period 6 = spring 5th grade; and, Period 7 = spring 8th grade. Q1 - Q5 refers to the first through fifth quantiles in the initial period. Bootstrap standard errors based on 250 repetitions (clustered at the child-level) in parentheses. N = 8370 (full sample), 5330 (white sample), 3040 (non-white sample), 4230 (male sample), 4140 (female sample), 2660 (low SES sample), and 5710 (high SES sample) with sample sizes rounded to the nearest 10 per NCES restricted data regulations. See text for definition of mobility measures ($\delta = 0.10$).

Table 3 (cont.). Downward Mobility Measures: Percentile Weight

	Q1	Q2	Q3	Q4	Q5		Q1	Q2	Q3	Q4	Q5
IV. Male						**V. Female**					
[0,7]	0.037	0.246	0.435	0.587	0.754	**[0,7]**	0.059	0.235	0.418	0.587	0.736
	(0.007)	(0.015)	(0.017)	(0.016)	(0.013)		(0.009)	(0.014)	(0.016)	(0.016)	(0.016)
[0,1]	0.042	0.267	0.409	0.554	0.703	**[0,1]**	0.061	0.256	0.408	0.541	0.702
	(0.007)	(0.016)	(0.017)	(0.017)	(0.014)		(0.010)	(0.014)	(0.017)	(0.020)	(0.015)
[1,7]	0.065	0.279	0.383	0.498	0.388	**[1,7]**	0.054	0.279	0.365	0.464	0.395
	(0.007)	(0.014)	(0.015)	(0.016)	(0.016)		(0.008)	(0.014)	(0.015)	(0.018)	(0.016)
[1,4]	0.020	0.165	0.260	0.304	0.125	**[1,4]**	0.029	0.178	0.240	0.259	0.092
	(0.005)	(0.015)	(0.013)	(0.015)	(0.012)		(0.006)	(0.013)	(0.017)	(0.016)	(0.012)
[4,5]	0.020	0.171	0.294	0.301	0.097	**[4,5]**	0.022	0.170	0.272	0.281	0.086
	(0.006)	(0.014)	(0.016)	(0.019)	(0.011)		(0.005)	(0.013)	(0.016)	(0.017)	(0.011)
[5,6]	0.009	0.119	0.234	0.169	0.065	**[5,6]**	0.023	0.161	0.219	0.194	0.074
	(0.004)	(0.012)	(0.015)	(0.013)	(0.009)		(0.006)	(0.014)	(0.015)	(0.014)	(0.009)
[6,7]	0.026	0.233	0.306	0.275	0.107	**[6,7]**	0.039	0.222	0.308	0.299	0.183
	(0.006)	(0.015)	(0.016)	(0.015)	(0.011)		(0.006)	(0.014)	(0.016)	(0.015)	(0.012)
VI. Low SES						**VII. High SES**					
[0,7]	0.049	0.244	0.447	0.541	0.748	**[0,7]**	0.035	0.229	0.418	0.581	0.736
	(0.009)	(0.019)	(0.020)	(0.020)	(0.017)		(0.006)	(0.012)	(0.014)	(0.014)	(0.013)
[0,1]	0.038	0.248	0.418	0.512	0.689	**[0,1]**	0.046	0.249	0.383	0.566	0.705
	(0.008)	(0.018)	(0.021)	(0.020)	(0.018)		(0.007)	(0.013)	(0.015)	(0.014)	(0.013)
[1,7]	0.058	0.279	0.374	0.475	0.367	**[1,7]**	0.063	0.284	0.375	0.466	0.396
	(0.009)	(0.018)	(0.020)	(0.021)	(0.019)		(0.006)	(0.012)	(0.013)	(0.014)	(0.012)
[1,4]	0.019	0.173	0.245	0.271	0.106	**[1,4]**	0.023	0.167	0.253	0.288	0.109
	(0.006)	(0.017)	(0.021)	(0.024)	(0.014)		(0.005)	(0.011)	(0.013)	(0.013)	(0.010)
[4,5]	0.023	0.183	0.276	0.277	0.066	**[4,5]**	0.024	0.167	0.279	0.289	0.103
	(0.007)	(0.020)	(0.020)	(0.019)	(0.016)		(0.004)	(0.010)	(0.013)	(0.014)	(0.010)
[5,6]	0.017	0.124	0.215	0.166	0.062	**[5,6]**	0.015	0.140	0.225	0.200	0.073
	(0.006)	(0.016)	(0.018)	(0.016)	(0.012)		(0.004)	(0.010)	(0.012)	(0.011)	(0.008)
[6,7]	0.028	0.235	0.299	0.286	0.128	**[6,7]**	0.046	0.221	0.314	0.300	0.140
	(0.008)	(0.017)	(0.017)	(0.018)	(0.015)		(0.006)	(0.011)	(0.012)	(0.013)	(0.010)

Table 4. Mobility Measures: Percentile Height

	M(P)	M(ρ)	M_S	CF(0)	$CF_R(0)$		M(P)	M(ρ)	M_S	CF(0)	$CF_R(0)$
I. Full Sample											
[1,7]	0.180	0.287	0.207	0.111	0.130						
	(0.002)	(0.006)	(0.006)	(0.002)	(0.003)						
[1,4]	0.087	0.091	0.062	0.035	0.041						
	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)						
[4,5]	0.082	0.080	0.072	0.031	0.034						
	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)						
[5,6]	0.090	0.088	0.088	0.040	0.045						
	(0.001)	(0.003)	(0.005)	(0.002)	(0.002)						
[6,7]	0.153	0.211	0.172	0.074	0.092						
	(0.002)	(0.005)	(0.005)	(0.002)	(0.003)						
II. White						**III. Non-White**					
[1,7]	0.180	0.285	0.203	0.104	0.130	**[1,7]**	0.180	0.285	0.211	0.120	0.128
	(0.003)	(0.008)	(0.008)	(0.003)	(0.004)		(0.003)	(0.010)	(0.009)	(0.004)	(0.005)
[1,4]	0.085	0.089	0.058	0.033	0.039	**[1,4]**	0.089	0.094	0.068	0.040	0.044
	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)		(0.002)	(0.005)	(0.004)	(0.003)	(0.003)
[4,5]	0.078	0.072	0.066	0.026	0.030	**[4,5]**	0.089	0.093	0.082	0.039	0.040
	(0.002)	(0.003)	(0.005)	(0.001)	(0.001)		(0.002)	(0.005)	(0.007)	(0.002)	(0.002)
[5,6]	0.087	0.083	0.081	0.033	0.040	**[5,6]**	0.094	0.096	0.099	0.053	0.052
	(0.002)	(0.004)	(0.006)	(0.003)	(0.003)		(0.002)	(0.005)	(0.008)	(0.005)	(0.004)
[6,7]	0.147	0.192	0.156	0.064	0.085	**[6,7]**	0.162	0.235	0.190	0.091	0.100
	(0.002)	(0.006)	(0.006)	(0.002)	(0.003)		(0.003)	(0.009)	(0.008)	(0.003)	(0.004)
IV. Male						**V. Female**					
[1,7]	0.180	0.282	0.190	0.109	0.129	**[1,7]**	0.177	0.283	0.221	0.110	0.127
	(0.003)	(0.009)	(0.008)	(0.004)	(0.004)		(0.003)	(0.008)	(0.007)	(0.004)	(0.004)
[1,4]	0.082	0.088	0.057	0.034	0.041	**[1,4]**	0.086	0.089	0.065	0.036	0.039
	(0.002)	(0.005)	(0.004)	(0.003)	(0.003)		(0.002)	(0.005)	(0.003)	(0.002)	(0.002)
[4,5]	0.078	0.073	0.067	0.027	0.032	**[4,5]**	0.085	0.084	0.076	0.034	0.035
	(0.002)	(0.004)	(0.005)	(0.001)	(0.002)		(0.002)	(0.004)	(0.005)	(0.002)	(0.002)
[5,6]	0.076	0.070	0.079	0.032	0.037	**[5,6]**	0.102	0.104	0.097	0.048	0.051
	(0.002)	(0.004)	(0.006)	(0.003)	(0.003)		(0.002)	(0.004)	(0.006)	(0.003)	(0.003)
[6,7]	0.131	0.150	0.138	0.055	0.069	**[6,7]**	0.175	0.259	0.199	0.092	0.111
	(0.002)	(0.005)	(0.006)	(0.002)	(0.003)		(0.003)	(0.008)	(0.008)	(0.003)	(0.004)
VI. Low SES						**VII. High SES**					
[1,7]	0.182	0.295	0.218	0.128	0.131	**[1,7]**	0.180	0.283	0.201	0.103	0.131
	(0.004)	(0.011)	(0.011)	(0.005)	(0.005)		(0.002)	(0.007)	(0.007)	(0.003)	(0.004)
[1,4]	0.088	0.095	0.065	0.041	0.042	**[1,4]**	0.086	0.089	0.061	0.033	0.041
	(0.002)	(0.006)	(0.004)	(0.003)	(0.003)		(0.002)	(0.004)	(0.003)	(0.002)	(0.003)
[4,5]	0.082	0.078	0.073	0.035	0.033	**[4,5]**	0.082	0.081	0.072	0.029	0.034
	(0.002)	(0.005)	(0.007)	(0.002)	(0.002)		(0.002)	(0.004)	(0.005)	(0.001)	(0.002)
[5,6]	0.087	0.080	0.090	0.043	0.040	**[5,6]**	0.091	0.092	0.087	0.039	0.048
	(0.002)	(0.005)	(0.007)	(0.003)	(0.003)		(0.002)	(0.004)	(0.006)	(0.003)	(0.003)
[6,7]	0.155	0.219	0.180	0.088	0.094	**[6,7]**	0.152	0.206	0.167	0.068	0.091
	(0.003)	(0.009)	(0.008)	(0.004)	(0.004)		(0.002)	(0.006)	(0.006)	(0.002)	(0.003)

Notes: See Table 1 for details.

Table 5. Upward Mobility Measures: Percentile Height

	Q1	Q2	Q3	Q4	Q5		Q1	Q2	Q3	Q4	Q5
I. Full Sample											
[1,7]	0.379	0.426	0.342	0.255	0.044						
	(0.011)	(0.011)	(0.011)	(0.010)	(0.005)						
[1,4]	0.107	0.187	0.176	0.122	0.013						
	(0.008)	(0.009)	(0.009)	(0.009)	(0.003)						
[4,5]	0.091	0.198	0.190	0.104	0.011						
	(0.007)	(0.009)	(0.011)	(0.008)	(0.003)						
[5,6]	0.141	0.202	0.198	0.136	0.015						
	(0.008)	(0.009)	(0.009)	(0.008)	(0.003)						
[6,7]	0.304	0.404	0.355	0.260	0.044						
	(0.011)	(0.010)	(0.010)	(0.010)	(0.005)						
II. White						**III. Non-White**					
[1,7]	0.388	0.417	0.343	0.260	0.044	**[1,7]**	0.371	0.413	0.369	0.227	0.038
	(0.014)	(0.014)	(0.014)	(0.012)	(0.006)		(0.018)	(0.020)	(0.018)	(0.017)	(0.008)
[1,4]	0.102	0.182	0.178	0.130	0.017	**[1,4]**	0.125	0.189	0.175	0.112	0.010
	(0.009)	(0.011)	(0.012)	(0.010)	(0.004)		(0.013)	(0.015)	(0.016)	(0.013)	(0.004)
[4,5]	0.080	0.189	0.176	0.096	0.009	**[4,5]**	0.120	0.199	0.216	0.129	0.013
	(0.008)	(0.010)	(0.012)	(0.009)	(0.003)		(0.013)	(0.015)	(0.015)	(0.014)	(0.005)
[5,6]	0.132	0.179	0.225	0.132	0.012	**[5,6]**	0.156	0.236	0.189	0.116	0.021
	(0.010)	(0.012)	(0.012)	(0.011)	(0.004)		(0.015)	(0.017)	(0.015)	(0.012)	(0.006)
[6,7]	0.287	0.379	0.344	0.251	0.039	**[6,7]**	0.312	0.447	0.347	0.253	0.045
	(0.013)	(0.014)	(0.014)	(0.012)	(0.006)		(0.018)	(0.020)	(0.018)	(0.018)	(0.008)
IV. Male						**V. Female**					
[1,7]	0.419	0.418	0.353	0.261	0.039	**[1,7]**	0.356	0.419	0.335	0.237	0.045
	(0.015)	(0.015)	(0.016)	(0.014)	(0.007)		(0.015)	(0.016)	(0.015)	(0.014)	(0.007)
[1,4]	0.106	0.176	0.163	0.105	0.014	**[1,4]**	0.104	0.215	0.186	0.117	0.015
	(0.011)	(0.013)	(0.013)	(0.011)	(0.004)		(0.011)	(0.013)	(0.014)	(0.011)	(0.004)
[4,5]	0.090	0.184	0.160	0.091	0.006	**[4,5]**	0.092	0.212	0.191	0.125	0.019
	(0.010)	(0.014)	(0.013)	(0.012)	(0.003)		(0.010)	(0.014)	(0.013)	(0.012)	(0.005)
[5,6]	0.096	0.160	0.165	0.114	0.012	**[5,6]**	0.174	0.249	0.247	0.157	0.017
	(0.009)	(0.012)	(0.015)	(0.011)	(0.004)		(0.012)	(0.013)	(0.014)	(0.012)	(0.005)
[6,7]	0.269	0.352	0.308	0.198	0.033	**[6,7]**	0.348	0.455	0.404	0.294	0.054
	(0.014)	(0.015)	(0.015)	(0.013)	(0.006)		(0.017)	(0.017)	(0.017)	(0.015)	(0.010)
VI. Low SES						**VII. High SES**					
[1,7]	0.402	0.407	0.345	0.265	0.051	**[1,7]**	0.396	0.425	0.347	0.242	0.037
	(0.018)	(0.019)	(0.019)	(0.018)	(0.009)		(0.013)	(0.013)	(0.011)	(0.012)	(0.005)
[1,4]	0.114	0.185	0.170	0.117	0.009	**[1,4]**	0.113	0.188	0.181	0.126	0.014
	(0.014)	(0.017)	(0.016)	(0.016)	(0.004)		(0.010)	(0.011)	(0.012)	(0.010)	(0.004)
[4,5]	0.101	0.210	0.199	0.130	0.023	**[4,5]**	0.089	0.196	0.189	0.088	0.011
	(0.014)	(0.018)	(0.017)	(0.016)	(0.007)		(0.008)	(0.011)	(0.011)	(0.009)	(0.003)
[5,6]	0.160	0.204	0.173	0.134	0.011	**[5,6]**	0.131	0.208	0.221	0.124	0.018
	(0.015)	(0.017)	(0.017)	(0.014)	(0.005)		(0.009)	(0.011)	(0.011)	(0.010)	(0.004)
[6,7]	0.305	0.422	0.339	0.252	0.055	**[6,7]**	0.302	0.402	0.354	0.262	0.038
	(0.019)	(0.018)	(0.019)	(0.017)	(0.009)		(0.013)	(0.015)	(0.013)	(0.012)	(0.005)

Notes: See Table 2.

Table 6. Downward Mobility Measures: Percentile Height

	Q1	Q2	Q3	Q4	Q5
I. Full Sample					
[1,7]	0.042	0.222	0.354	0.385	0.398
	(0.005)	(0.010)	(0.012)	(0.011)	(0.011)
[1,4]	0.011	0.114	0.180	0.185	0.134
	(0.003)	(0.008)	(0.010)	(0.010)	(0.007)
[4,5]	0.011	0.086	0.166	0.178	0.135
	(0.003)	(0.007)	(0.010)	(0.009)	(0.008)
[5,6]	0.011	0.131	0.212	0.215	0.118
	(0.003)	(0.009)	(0.009)	(0.010)	(0.008)
[6,7]	0.024	0.195	0.303	0.333	0.333
	(0.004)	(0.008)	(0.012)	(0.011)	(0.010)

	Q1	Q2	Q3	Q4	Q5
II. White					
[1,7]	0.046	0.236	0.352	0.376	0.405
	(0.006)	(0.013)	(0.015)	(0.013)	(0.013)
[1,4]	0.010	0.104	0.169	0.171	0.141
	(0.003)	(0.010)	(0.013)	(0.011)	(0.010)
[4,5]	0.010	0.096	0.168	0.170	0.117
	(0.003)	(0.009)	(0.012)	(0.012)	(0.009)
[5,6]	0.009	0.131	0.164	0.218	0.117
	(0.004)	(0.011)	(0.014)	(0.014)	(0.010)
[6,7]	0.024	0.208	0.312	0.333	0.317
	(0.005)	(0.012)	(0.015)	(0.014)	(0.012)

	Q1	Q2	Q3	Q4	Q5
III. Non-White					
[1,7]	0.041	0.220	0.356	0.402	0.388
	(0.007)	(0.016)	(0.019)	(0.022)	(0.018)
[1,4]	0.012	0.126	0.211	0.205	0.130
	(0.006)	(0.014)	(0.015)	(0.020)	(0.013)
[4,5]	0.015	0.084	0.168	0.194	0.149
	(0.005)	(0.012)	(0.015)	(0.016)	(0.014)
[5,6]	0.018	0.128	0.257	0.226	0.125
	(0.006)	(0.015)	(0.017)	(0.018)	(0.015)
[6,7]	0.028	0.177	0.314	0.348	0.359
	(0.007)	(0.014)	(0.017)	(0.017)	(0.017)

	Q1	Q2	Q3	Q4	Q5
IV. Male					
[1,7]	0.048	0.253	0.341	0.378	0.388
	(0.008)	(0.013)	(0.015)	(0.017)	(0.014)
[1,4]	0.008	0.099	0.152	0.163	0.139
	(0.003)	(0.010)	(0.015)	(0.015)	(0.011)
[4,5]	0.012	0.087	0.155	0.154	0.117
	(0.003)	(0.010)	(0.013)	(0.012)	(0.011)
[5,6]	0.011	0.110	0.159	0.168	0.081
	(0.003)	(0.012)	(0.014)	(0.013)	(0.009)
[6,7]	0.025	0.211	0.342	0.342	0.243
	(0.006)	(0.014)	(0.015)	(0.017)	(0.014)

	Q1	Q2	Q3	Q4	Q5
V. Female					
[1,7]	0.040	0.207	0.350	0.370	0.395
	(0.006)	(0.013)	(0.015)	(0.017)	(0.014)
[1,4]	0.011	0.106	0.182	0.185	0.132
	(0.004)	(0.010)	(0.013)	(0.015)	(0.011)
[4,5]	0.011	0.088	0.170	0.188	0.140
	(0.004)	(0.010)	(0.014)	(0.013)	(0.011)
[5,6]	0.013	0.166	0.242	0.265	0.164
	(0.004)	(0.013)	(0.014)	(0.016)	(0.013)
[6,7]	0.022	0.207	0.308	0.379	0.432
	(0.005)	(0.014)	(0.015)	(0.014)	(0.016)

	Q1	Q2	Q3	Q4	Q5
VI. Low SES					
[1,7]	0.036	0.209	0.335	0.359	0.421
	(0.008)	(0.017)	(0.021)	(0.022)	(0.020)
[1,4]	0.013	0.124	0.173	0.184	0.153
	(0.007)	(0.015)	(0.016)	(0.016)	(0.015)
[4,5]	0.008	0.100	0.152	0.168	0.134
	(0.004)	(0.014)	(0.016)	(0.017)	(0.014)
[5,6]	0.011	0.151	0.205	0.199	0.126
	(0.005)	(0.017)	(0.018)	(0.018)	(0.014)
[6,7]	0.021	0.193	0.297	0.335	0.338
	(0.007)	(0.016)	(0.016)	(0.019)	(0.016)

	Q1	Q2	Q3	Q4	Q5
VII. High SES					
[1,7]	0.045	0.233	0.350	0.399	0.385
	(0.007)	(0.012)	(0.013)	(0.013)	(0.013)
[1,4]	0.013	0.103	0.186	0.191	0.124
	(0.004)	(0.010)	(0.012)	(0.012)	(0.009)
[4,5]	0.008	0.089	0.176	0.176	0.133
	(0.003)	(0.008)	(0.011)	(0.011)	(0.009)
[5,6]	0.010	0.137	0.198	0.233	0.117
	(0.003)	(0.010)	(0.013)	(0.013)	(0.009)
[6,7]	0.026	0.201	0.303	0.335	0.330
	(0.005)	(0.012)	(0.013)	(0.013)	(0.012)

Notes: See Table 3.

Table 7. Mobility Measures: Percentile BMI

	M(P)	M(ρ)	M_S	CF(0)	$CF_R(0)$		M(P)	M(ρ)	M_S	CF(0)	$CF_R(0)$
I. Full Sample											
[1,7]	0.217	0.405	0.498	0.358	0.243						
	(0.003)	(0.008)	(0.009)	(0.021)	(0.005)						
[1,4]	0.147	0.218	0.437	0.221	0.138						
	(0.002)	(0.006)	(0.011)	(0.013)	(0.004)						
[4,5]	0.125	0.155	0.313	0.113	0.101						
	(0.002)	(0.004)	(0.017)	(0.010)	(0.004)						
[5,6]	0.094	0.086	0.170	0.042	0.051						
	(0.001)	(0.003)	(0.011)	(0.003)	(0.002)						
[6,7]	0.118	0.126	0.230	0.050	0.067						
	(0.002)	(0.003)	(0.011)	(0.002)	(0.002)						
II. White						**III. Non-White**					
[1,7]	0.224	0.427	0.493	0.390	0.255	**[1,7]**	0.207	0.376	0.510	0.306	0.224
	(0.003)	(0.011)	(0.011)	(0.028)	(0.008)		(0.004)	(0.012)	(0.018)	(0.027)	(0.008)
[1,4]	0.151	0.231	0.435	0.234	0.144	**[1,4]**	0.140	0.199	0.443	0.199	0.128
	(0.003)	(0.007)	(0.014)	(0.017)	(0.005)		(0.003)	(0.009)	(0.021)	(0.018)	(0.006)
[4,5]	0.129	0.167	0.307	0.113	0.105	**[4,5]**	0.119	0.136	0.326	0.113	0.092
	(0.002)	(0.006)	(0.024)	(0.013)	(0.005)		(0.003)	(0.006)	(0.026)	(0.017)	(0.005)
[5,6]	0.097	0.091	0.160	0.042	0.053	**[5,6]**	0.091	0.080	0.193	0.042	0.047
	(0.002)	(0.003)	(0.012)	(0.004)	(0.002)		(0.002)	(0.004)	(0.023)	(0.006)	(0.003)
[6,7]	0.122	0.137	0.227	0.053	0.072	**[6,7]**	0.111	0.112	0.237	0.045	0.060
	(0.002)	(0.004)	(0.013)	(0.002)	(0.003)		(0.002)	(0.005)	(0.021)	(0.003)	(0.003)
IV. Male						**V. Female**					
[1,7]	0.221	0.416	0.532	0.408	0.250	**[1,7]**	0.212	0.391	0.458	0.307	0.233
	(0.003)	(0.012)	(0.014)	(0.035)	(0.008)		(0.003)	(0.011)	(0.010)	(0.023)	(0.007)
[1,4]	0.152	0.233	0.467	0.245	0.145	**[1,4]**	0.142	0.203	0.403	0.195	0.130
	(0.003)	(0.009)	(0.018)	(0.022)	(0.006)		(0.003)	(0.007)	(0.013)	(0.013)	(0.005)
[4,5]	0.129	0.167	0.340	0.129	0.108	**[4,5]**	0.121	0.143	0.287	0.096	0.093
	(0.002)	(0.006)	(0.029)	(0.018)	(0.005)		(0.002)	(0.006)	(0.020)	(0.009)	(0.004)
[5,6]	0.094	0.087	0.180	0.039	0.052	**[5,6]**	0.095	0.085	0.162	0.044	0.050
	(0.002)	(0.004)	(0.015)	(0.004)	(0.003)		(0.002)	(0.003)	(0.017)	(0.006)	(0.003)
[6,7]	0.113	0.120	0.243	0.048	0.064	**[6,7]**	0.120	0.128	0.210	0.052	0.068
	(0.002)	(0.004)	(0.019)	(0.002)	(0.003)		(0.002)	(0.005)	(0.011)	(0.002)	(0.003)
VI. Low SES						**VII. High SES**					
[1,7]	0.214	0.389	0.501	0.334	0.234	**[1,7]**	0.218	0.414	0.499	0.370	0.246
	(0.004)	(0.014)	(0.017)	(0.032)	(0.010)		(0.003)	(0.010)	(0.011)	(0.027)	(0.007)
[1,4]	0.144	0.211	0.428	0.201	0.132	**[1,4]**	0.149	0.223	0.442	0.230	0.140
	(0.003)	(0.010)	(0.018)	(0.017)	(0.007)		(0.003)	(0.008)	(0.014)	(0.016)	(0.005)
[4,5]	0.123	0.145	0.318	0.124	0.100	**[4,5]**	0.127	0.160	0.313	0.107	0.100
	(0.003)	(0.007)	(0.031)	(0.021)	(0.006)		(0.002)	(0.006)	(0.021)	(0.012)	(0.004)
[5,6]	0.090	0.077	0.144	0.032	0.044	**[5,6]**	0.097	0.093	0.182	0.047	0.054
	(0.002)	(0.004)	(0.012)	(0.003)	(0.003)		(0.002)	(0.003)	(0.015)	(0.005)	(0.002)
[6,7]	0.114	0.116	0.248	0.043	0.062	**[6,7]**	0.121	0.135	0.224	0.054	0.071
	(0.003)	(0.005)	(0.025)	(0.003)	(0.003)		(0.002)	(0.004)	(0.012)	(0.002)	(0.002)

Notes: See Table 1 for details.

Table 8. Upward Mobility Measures: Percentile BMI

	Q1	Q2	Q3	Q4	Q5		Q1	Q2	Q3	Q4	Q5
I. Full Sample											
[1,7]	0.543	0.409	0.311	0.189	0.032						
	(0.011)	(0.012)	(0.011)	(0.009)	(0.004)						
[1,4]	0.380	0.315	0.244	0.146	0.014						
	(0.010)	(0.010)	(0.010)	(0.008)	(0.003)						
[4,5]	0.329	0.274	0.225	0.118	0.013						
	(0.010)	(0.010)	(0.009)	(0.007)	(0.003)						
[5,6]	0.224	0.235	0.196	0.115	0.010						
	(0.009)	(0.009)	(0.010)	(0.008)	(0.003)						
[6,7]	0.292	0.319	0.256	0.160	0.016						
	(0.011)	(0.011)	(0.010)	(0.009)	(0.003)						
II. White						**III. Non-White**					
[1,7]	0.560	0.402	0.302	0.196	0.034	**[1,7]**	0.521	0.399	0.312	0.173	0.033
	(0.014)	(0.013)	(0.013)	(0.011)	(0.005)		(0.017)	(0.019)	(0.017)	(0.016)	(0.007)
[1,4]	0.386	0.320	0.230	0.160	0.017	**[1,4]**	0.363	0.312	0.259	0.130	0.008
	(0.012)	(0.014)	(0.012)	(0.010)	(0.004)		(0.016)	(0.017)	(0.016)	(0.014)	(0.005)
[4,5]	0.324	0.284	0.237	0.134	0.009	**[4,5]**	0.333	0.273	0.209	0.107	0.010
	(0.012)	(0.014)	(0.013)	(0.010)	(0.003)		(0.017)	(0.017)	(0.014)	(0.011)	(0.004)
[5,6]	0.229	0.240	0.206	0.115	0.011	**[5,6]**	0.225	0.222	0.163	0.117	0.012
	(0.010)	(0.013)	(0.013)	(0.010)	(0.004)		(0.016)	(0.016)	(0.014)	(0.013)	(0.005)
[6,7]	0.303	0.333	0.271	0.156	0.022	**[6,7]**	0.291	0.292	0.245	0.143	0.015
	(0.013)	(0.013)	(0.013)	(0.011)	(0.005)		(0.017)	(0.017)	(0.016)	(0.014)	(0.005)
IV. Male						**V. Female**					
[1,7]	0.557	0.389	0.319	0.183	0.024	**[1,7]**	0.517	0.423	0.307	0.192	0.034
	(0.014)	(0.014)	(0.015)	(0.014)	(0.005)		(0.016)	(0.016)	(0.015)	(0.013)	(0.006)
[1,4]	0.405	0.323	0.251	0.148	0.011	**[1,4]**	0.356	0.313	0.232	0.156	0.016
	(0.014)	(0.015)	(0.014)	(0.012)	(0.004)		(0.014)	(0.015)	(0.014)	(0.014)	(0.005)
[4,5]	0.321	0.288	0.213	0.117	0.015	**[4,5]**	0.324	0.259	0.233	0.120	0.011
	(0.013)	(0.014)	(0.013)	(0.011)	(0.004)		(0.014)	(0.014)	(0.013)	(0.011)	(0.004)
[5,6]	0.229	0.219	0.183	0.114	0.013	**[5,6]**	0.221	0.250	0.205	0.111	0.004
	(0.013)	(0.014)	(0.014)	(0.012)	(0.004)		(0.014)	(0.014)	(0.015)	(0.012)	(0.003)
[6,7]	0.275	0.322	0.251	0.137	0.014	**[6,7]**	0.291	0.324	0.266	0.164	0.016
	(0.014)	(0.014)	(0.014)	(0.012)	(0.004)		(0.015)	(0.015)	(0.015)	(0.012)	(0.005)
VI. Low SES						**VII. High SES**					
[1,7]	0.540	0.392	0.329	0.177	0.034	**[1,7]**	0.540	0.414	0.291	0.191	0.032
	(0.019)	(0.020)	(0.020)	(0.016)	(0.007)		(0.013)	(0.013)	(0.013)	(0.011)	(0.005)
[1,4]	0.378	0.307	0.248	0.138	0.008	**[1,4]**	0.379	0.320	0.232	0.156	0.018
	(0.015)	(0.019)	(0.018)	(0.014)	(0.004)		(0.012)	(0.013)	(0.012)	(0.011)	(0.004)
[4,5]	0.340	0.281	0.209	0.111	0.011	**[4,5]**	0.326	0.290	0.232	0.126	0.011
	(0.016)	(0.017)	(0.016)	(0.012)	(0.005)		(0.012)	(0.014)	(0.011)	(0.010)	(0.003)
[5,6]	0.205	0.222	0.196	0.119	0.011	**[5,6]**	0.236	0.256	0.204	0.109	0.013
	(0.018)	(0.019)	(0.016)	(0.014)	(0.005)		(0.011)	(0.012)	(0.012)	(0.010)	(0.003)
[6,7]	0.288	0.294	0.243	0.179	0.013	**[6,7]**	0.300	0.326	0.277	0.155	0.012
	(0.020)	(0.018)	(0.018)	(0.016)	(0.005)		(0.012)	(0.013)	(0.013)	(0.010)	(0.004)

Notes: See Table 2.

Table 9. Downward Mobility Measures: Percentile BMI

	Q1	Q2	Q3	Q4	Q5		Q1	Q2	Q3	Q4	Q5
I. Full Sample											
[1,7]	0.052	0.311	0.417	0.513	0.410						
	(0.005)	(0.011)	(0.011)	(0.011)	(0.011)						
[1,4]	0.046	0.245	0.361	0.361	0.186						
	(0.005)	(0.010)	(0.010)	(0.011)	(0.011)						
[4,5]	0.047	0.250	0.354	0.348	0.117						
	(0.005)	(0.010)	(0.012)	(0.011)	(0.008)						
[5,6]	0.035	0.206	0.253	0.222	0.090						
	(0.004)	(0.010)	(0.011)	(0.010)	(0.007)						
[6,7]	0.038	0.228	0.313	0.306	0.142						
	(0.005)	(0.010)	(0.010)	(0.010)	(0.009)						
II. White						**III. Non-White**					
[1,7]	0.046	0.325	0.431	0.514	0.445	**[1,7]**	0.046	0.294	0.406	0.525	0.368
	(0.007)	(0.014)	(0.014)	(0.013)	(0.013)		(0.009)	(0.018)	(0.020)	(0.020)	(0.018)
[1,4]	0.048	0.251	0.365	0.368	0.201	**[1,4]**	0.041	0.235	0.348	0.365	0.165
	(0.006)	(0.013)	(0.015)	(0.015)	(0.012)		(0.009)	(0.018)	(0.016)	(0.017)	(0.016)
[4,5]	0.038	0.250	0.337	0.354	0.162	**[4,5]**	0.061	0.268	0.339	0.328	0.089
	(0.006)	(0.014)	(0.014)	(0.014)	(0.013)		(0.009)	(0.018)	(0.018)	(0.019)	(0.013)
[5,6]	0.034	0.207	0.266	0.227	0.101	**[5,6]**	0.035	0.199	0.253	0.189	0.087
	(0.005)	(0.012)	(0.012)	(0.013)	(0.010)		(0.007)	(0.016)	(0.018)	(0.016)	(0.012)
[6,7]	0.038	0.234	0.323	0.310	0.161	**[6,7]**	0.048	0.253	0.294	0.259	0.127
	(0.006)	(0.012)	(0.013)	(0.013)	(0.010)		(0.010)	(0.016)	(0.019)	(0.017)	(0.015)
IV. Male						**V. Female**					
[1,7]	0.053	0.322	0.424	0.520	0.411	**[1,7]**	0.054	0.295	0.407	0.506	0.393
	(0.007)	(0.014)	(0.016)	(0.015)	(0.016)		(0.008)	(0.014)	(0.017)	(0.017)	(0.016)
[1,4]	0.047	0.259	0.359	0.374	0.193	**[1,4]**	0.051	0.238	0.354	0.350	0.184
	(0.008)	(0.014)	(0.015)	(0.016)	(0.014)		(0.008)	(0.013)	(0.015)	(0.017)	(0.015)
[4,5]	0.052	0.249	0.383	0.359	0.116	**[4,5]**	0.045	0.237	0.339	0.326	0.115
	(0.007)	(0.015)	(0.016)	(0.017)	(0.011)		(0.007)	(0.015)	(0.015)	(0.015)	(0.013)
[5,6]	0.037	0.199	0.245	0.228	0.088	**[5,6]**	0.031	0.211	0.252	0.207	0.103
	(0.007)	(0.015)	(0.015)	(0.016)	(0.010)		(0.006)	(0.016)	(0.015)	(0.014)	(0.012)
[6,7]	0.034	0.221	0.297	0.286	0.131	**[6,7]**	0.044	0.230	0.318	0.331	0.147
	(0.006)	(0.014)	(0.015)	(0.017)	(0.012)		(0.008)	(0.014)	(0.015)	(0.015)	(0.013)
VI. Low SES						**VII. High SES**					
[1,7]	0.056	0.307	0.414	0.535	0.379	**[1,7]**	0.053	0.307	0.425	0.503	0.426
	(0.011)	(0.018)	(0.020)	(0.019)	(0.020)		(0.007)	(0.014)	(0.015)	(0.014)	(0.013)
[1,4]	0.043	0.239	0.374	0.392	0.160	**[1,4]**	0.049	0.252	0.356	0.347	0.198
	(0.011)	(0.019)	(0.020)	(0.019)	(0.015)		(0.006)	(0.011)	(0.013)	(0.014)	(0.012)
[4,5]	0.041	0.283	0.355	0.343	0.098	**[4,5]**	0.049	0.243	0.336	0.359	0.131
	(0.008)	(0.022)	(0.019)	(0.019)	(0.016)		(0.006)	(0.014)	(0.013)	(0.013)	(0.011)
[5,6]	0.030	0.202	0.226	0.215	0.102	**[5,6]**	0.034	0.214	0.266	0.229	0.100
	(0.008)	(0.018)	(0.018)	(0.017)	(0.015)		(0.005)	(0.012)	(0.013)	(0.014)	(0.009)
[6,7]	0.049	0.256	0.312	0.277	0.147	**[6,7]**	0.045	0.219	0.319	0.307	0.152
	(0.009)	(0.019)	(0.017)	(0.019)	(0.015)		(0.006)	(0.011)	(0.012)	(0.014)	(0.010)

Notes: See Table 3.