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Abstract

Health and nutrition during a child's first years are crucial to his/her health and wellbeing later in life. Growth and development in childhood is determined by both genotype (nature) and phenotype (nurture), with the influence of the latter being particularly crucial during a child's first few years (Martorell and Habicht 1986). In this paper, we examine the patterns of inequality of opportunity in health and nutrition outcomes, such as height-for-age and weight-for-height, for children under five in selected Arab Countries and Turkey, using Demographic and Health Survey (DHS) data. Our objective is to decompose inequality into a portion that is due to inequality of opportunity, and a portion due to other factors, such as random variations in health. Inequality of opportunity is defined as in Romer (1998) as the inequality that is due to differences in circumstances, such as parental characteristics, household wealth, place of birth and gender. We measure inequality using decomposable general entropy measures, such as Theil's-L and Theil's-T indices. We use both parametric and non-parametric decomposition methods to determine the share of inequality of opportunity in total inequality. The results show that different levels and trends are evident across countries in both overall inequality and in the share of inequality of opportunity. Inequality of opportunity is shown to contribute substantially to the inequality of child health outcomes, but its share in total inequality varies significantly, both across and within countries over time. To further highlight the relative contribution of circumstances to the inequality of child health outcomes in different countries, we simulate height and weight outcomes for a most and least advantaged child in each context. Since these simulations observed circumstances at their best and worst levels, the larger the difference in predicted outcomes between the most and least advantaged child, the greater the inequality of opportunity facing children in that country.

ملخص

تعتبر الصحة والتغذية خلال السنوات الأولى للطفل حاسمة بالنسبة لصحته ورفاهيته في وقت لاحق في الحياة. يتم تحديد النمو والتنمية في مرحلة الطفولة من قبل كل من التركيب الوراثي (الطبيعة)، والنمط الظاهري (التربية)، مع التأثير الحاسم للعامل الأخير ولا سيما خلال السنوات الأولى للطفل (Martorell and Habicht 1986). ندرس في هذه الورقة أنماط عدم المساواة في الفرص في النتائج الصحية والتغذية، مثل الطول مقابل السن والوزن مقابل الطول، للأطفال دون سن الخامسة في بعض البلدان العربية المختارة، وتركيا، وذلك باستخدام بيانات المسح الديموغرافي والصحي (DHS). هدفنا هو ان نحلل عدم المساواة الى جزء يعود إلى عدم تكافؤ الفرص، وجزء بسبب عوامل أخرى، مثل التغيرات العشوائية في الصحة. ويعرف عدم تكافؤ الفرص كما هو الحال في رومر (1998) بسبب الاختلافات في الظروف، مثل الخصائص الأبوية، وثروة الأسرة، ومكان الميلاد والنوع. نقوم بقياس عدم المساواة باستخدام معايير التحلل العامة (decomposable general entropy) ، مثل Theil's-L ومؤشرات Theil's-T. وفيها نستخدم أساليب التحلل الحدودي والغير حدودي، لتحديد حصة عدم تكافؤ الفرص في مجموع عدم المساواة. أظهرت النتائج أن هناك مستويات مختلفة واتجاهات واضحة للعيان في مختلف البلدان في كل من إجمالي عدم المساواة، وحصة كبيرة من عدم تكافؤ الفرص. ويظهر أن عدم المساواة في الفرص تساهم إلى حد كبير في نتائج عدم المساواة على صحة الطفل، ولكن حصتها في إجمالي التفاوت يختلف اختلافا كبيرا، سواء عبر البلدان وداخلها بمرور الوقت. ولتسليط الضوء على مزيد من المساهمة النسبية للظروف على عدم المساواة في النتائج الصحية للطفل في مختلف البلدان، صنعنا محاكاة لنتائج طول ووزن الطفل الأكثر حظا والأقل حظا في كل سياق. وبما أن هذه المحاكاة اخذت فى الاعتبار الظروف عند مستوياتها الأفضل والأسوأ، يظهر انه كلما كبر الفارق في النتائج المتوقعة بين الأطفال الأكثر والأقل حظا، كلما زادت عدم المساواة في الفرص التي تواجه الأطفال في البلد محل الدراسة.

1. Introduction

It is by now well established in the public health literature that health and nutrition in the first years of life are crucial to health and wellbeing later in life. Poor health and inadequate nutrition in the first three years of life hamper a child's subsequent cognitive and physical development, leading to adverse health, productivity and wellbeing outcomes that persist into adulthood. Growth and development in childhood is determined by genotype (nature) and phenotype (nurture), with the influence of the latter being particularly crucial in the first two or three years of life (Martorell and Habicht 1986). Because parental inputs, such as the quantity and quality of food, and public health inputs, such as the availability of clean water and sanitation are unequally distributed across children, inequality of opportunity can be an important contributor to the observed inequality in child health outcomes, and, as such, an important source of inequality of opportunity later in life.

In this paper, we examine the patterns of inequality of opportunity in child health in selected Arab Countries and Turkey. Using Demographic and Health Survey (DHS) data we examine health outcomes as measured by anthropometric measures (such as height and weight) for children age five and younger in Egypt, Jordan, Morocco, Tunisia, Turkey and Yemen across a number of years to assess total inequality as well as the share of inequality that is attributable to unequal circumstances, such as parental education, parental wealth and place of residence. These anthropometric indicators are commonly used to assess both long-term and short-term malnutrition among children under five. Since malnutrition in childhood is the result of both inadequate food intake as well as an inability to absorb or assimilate nutrients due to disease or infections, it is a good indicator of the child's overall health.

It is standard practice in child health studies to use z-scores computed by comparing the observed anthropometric measures to reference distributions of height and weight for healthy children of the same age and sex. Since the transformations involved in computing these distributions would alter the scale of the measure and therefore change inequality indices in arbitrary ways, we rely instead on standardized height and weight measures that retain the original scale of the measures (i.e. centimeters and kilograms) but standardize for age and sex differences (see Pradhan, Sahn and Younger 2003).

Because our objective is to decompose inequality into a portion that is due to inequality of opportunity and a portion that is due to other factors, such as random variations in health, we measure inequality using decomposable general entropy measures, such as Theil's-L and Theil's-T indices. We use both parametric and non-parametric decomposition methods to determine the share of inequality of opportunity in total inequality. The parametric estimation also allows us to ascertain the separate contributions of different sets of circumstances, such as parental education or wealth, to the measured inequality of opportunity.

A variety of different trends are evident across countries in both overall inequality and in the share of inequality of opportunity. Inequality of opportunity is shown to contribute substantially to the inequality of child health outcomes. For example, total inequality of both height and weight measures rose significantly in Egypt in the period from 2003 to 2008 and so did the share of inequality of opportunity. Jordan has both low and slightly declining total inequality, with the exception of a spike in 2007, but the share of inequality of opportunity has been essentially flat in Jordan. Like Egypt, Morocco shows rising total inequality, but with a declining share of inequality of opportunity since 1992. This suggests that circumstances other than the ones we observe are increasingly contributing to inequality in Morocco. Turkey has both high total inequality and high inequality of opportunity, but exhibits a strong declining trend in both. To highlight the relative contribution of circumstances to the inequality of child health outcomes in different countries, we simulate height and weight outcomes for a most and least advantaged child in each context. Since these simulations set observed circumstances at their best and worst, the larger the difference in predicted outcomes between the most and least advantaged child, the larger is the inequality of opportunity facing children in that country.

Section 2 reviews the literature on the importance of child health to future health, productivity, and wellbeing outcomes. Section 3 presents the conceptual framework we use to ascertain inequality of opportunity in child health. Section 4 presents our data sources. Section 5 reviews the methodology we use to calculate standardized anthropometric measures and details the parametric and non-parametric inequality decomposition methods we use. Section 6 presents an overview of child health inequality based on a descriptive analysis of our data. Section 7 presents the findings on the contribution of inequality of opportunity to overall inequality in each country and over time and the results of the simulations on the most and least advantaged child. Section 9 concludes.

2. The Importance of Child Health to Future Health and Productivity Outcomes

The first few years of a child's life are the starting point for equality of opportunity. Physical, cognitive, and psychological development occurs early in life. The first three years of children's lives, when their synapses (connections within the brain) are forming at peak levels, are the most important for brain development (UNESCO 2006). Some have described the first few years of life as "an extended critical period, a window of opportunity for development, closed by age three" (UNESCO 2006, p. 109). These early years are also a period that is particularly sensitive to the conditions in which a child lives. Child development is quite fragile in the face of issues like poor nutrition. Any developmental deficits that occur in early childhood may be permanent (UNESCO 2006). This crucial childhood period also represents a time when individuals have the least control over their circumstances. Being born to a poor family, or in an underserved geographic location, is entirely outside of a child's control, but determines the child's opportunities to accumulate crucial health assets that could determine his or her entire life course.

Child health and nutrition play an important role in a variety of dimensions of child development and adult outcomes. Under-nutrition negatively impacts cognitive development, motor development, and social development and these effects can persist into adulthood (UNESCO 2006). Health, especially child health, can drive later labor market outcomes and productivity. For instance, height accumulated in childhood is connected to labor market outcomes later in life (Strauss and Thomas 1998). Crucial stages of development also occur *in utero*. Fetal development and birth weight affect later child health (Frankenberg and Thomas 2001).

Child under-nutrition, including stunting (excessively low height for one's age) and wasting (excessively low weight for one's height) increases the risk of child mortality, child illness, and poor adult health outcomes (Black et al. 2008). Height for age at two years old is the best predictor of human capital later in life, and under-nutrition is associated with lower human capital. Early health deficiencies have been shown to result in shorter adult height, lower attained schooling, reduced adult income, and decreased offspring birth weight (Victoria et al. 2008).

Importantly, these outcomes are alterable through public inputs and policies. For instance, a nutritional intervention among children under three in Guatemala has been shown to improve wages later in life (Hoddinot et al. 2008). There are a wide variety of different interventions that have been shown to be effective in improving child health outcomes. In Indonesia, the introduction of the 'midwife in the village' program improved child health outcomes, specifically child height (Frankenberg, Suriastini and Thomas 2005). Health improvements started with greater fetal development resulting in higher child birth weights (Frankenberg and Thomas 2001). Health services have a critical role to play in child health. One study in Bangladesh showed that mortality related to diarrhea was only reduced significantly within a two mile radius of a health clinic (Rahaman et al. 1982).

Interventions do not necessarily have to be directly targeted at health services to improve child health outcomes. Water and sanitation play an important role in health. In Cairo, Egypt, adequate water and sanitation within the home were shown to make an important contribution to infant weight. Community-level sanitation also made an important contribution to health and disease prevention (Tekce, Oldham and Shorter 1994). Other community conditions can also make a substantial contribution to child health. In Haiti, the combination of poor roads and mountainous terrain was found to reduce the likelihood of appropriate antenatal care or delivery attended by trained medical professionals. Even controlling for individual family poverty, neighborhood poverty also substantially affected receipt of health services (Gage and Calixte 2006). Geographic access and community poverty can be effective targets for improving child health.

A wide variety of family characteristics can affect the course of child development, and interventions targeting these areas can cause important improvements in child health. Mother's education can be an important contributor to child health, both in terms of receiving formal education (literacy, numeracy) and, most importantly, in terms of health knowledge (Glewwe 1999). Improving education can therefore be an important but indirect route for improving child health. Poverty is also a substantial contributor to poor child health outcomes, and even un-conditional cash transfer programs have been shown to improve child health outcomes in South Africa (Aguero, Carter and Woolard 2007).

Investments in the first few years of a child's life also have the greatest potential for substantial returns. In the context of the United States, it has been argued that, while return from early interventions to develop human capital is high, the return from later interventions is lower; it is much costlier to engage in remedial programs (Heckman 2006). A recent review of 30 early childhood interventions in 23 countries found substantial benefits across a wide variety of childhood outcomes, including health, for a wide variety of interventions, and that these gains were sustained over time (Nores and Barnett 2010). Economic constraints on family investment in early childhood and externalities make public policy interventions particularly important (Nores and Barnett 2010). Gaps in child health emerge early, and policies to prevent these gaps are crucial to altering the life course of at risk or marginalized children. It is important to note that deficits in health outcomes as well as gaps or inequality can be substantial regardless of the absolute level of a country's income or other forms of development (Marmot 2005).

Children from disadvantaged backgrounds diverge from their more advantaged peers quite early in their development, and gaps persist throughout life (Heckman 2006). Childhood presents the best opportunity for preventing or remedying these inequalities. Childhood also represents a truly blameless time for inequality. Achievements in education or income later in life are shaped by individuals' efforts. However, the opportunities experienced *in utero* and in the early years of children's lives are determined by factors the children themselves have no control over. Parental wealth, education, and access to health services shape a child's health and later life outcomes, but children have no input into these circumstances.

Ideally, a society would offer equal opportunities to its citizens. In such a society, the factors children cannot control would have no role in shaping their life outcomes. Although genetic variation and luck alone are expected to lead to some natural variations in outcomes among children facing similar circumstances, inequality due to differences in circumstances is what concerns us here. The objective is not to fully equalize health outcomes, but to provide children with similar opportunities to develop into healthy and productive adults.

3. Inequality of Opportunity in Child Health: A Conceptual Framework

3.1 Inequality of opportunity

In studying inequality of opportunity in child health, we draw on a recent and growing body of literature on the distinction between inequality of opportunity and inequality of outcomes and on ways to measure the contribution of inequality of opportunity. The conceptual framework inspiring this literature is due to Roemer (1998), who made the distinction between circumstances and effort as determining individuals' rewards. He argued that inequality of rewards that are due to effort are morally justifiable, but those that are due to differences in circumstances that an individual has no control over are not morally justifiable. Roemer would include genetic differences and luck among the set of circumstances an individual has no control over and therefore among the factors that an individual should be compensated for. If we did that in the case of child health, then all observed health inequality would be inequality of opportunity, since a child is not accountable for any part of their health outcomes by age five. We take a different position. We include within inequality of opportunity, inequalities that are due to observable circumstances such as parental education, wealth, and place of residence. Genetic variation and luck are unmeasured and therefore included in the residual inequality, which is not attributable to differences in opportunities.

In the context of child health, equality of outcome would imply that all children of the same age and sex would have the same height, which is clearly not realistic. Equality of opportunity means that, although individual children have different heights, differences in height are distributed independently of parent's education or other circumstances. For opportunity to be equal with circumstances C and outcome y, the distribution of y given C should be equal to the distribution of y unconditional on C, i.e. $F(y|C) = F(y)$. Inequality of opportunity is therefore the degree to which $F(y|C)$ is not equal to $F(y)$ (Ferreira and Gignoux 2008).

3.2 Child health production functions

In focusing on the determinants of child height and weight, we drew on the child health production function literature to include variables at the child and household level that are theoretically relevant to the determination of child health. In an adaptation of Strauss and Thomas (1998), we posit the following health production function:

$$H = h(N; A, B', \varepsilon_h)$$

where H is a set of measured health outcomes, which are a function of a vector of health inputs, N. The inputs N can be partially controlled by parents, and depend on the parents' motivations and circumstances. There are also environmental and public service or infrastructure dimensions to these health inputs, which we refer to as B'. Health should be generally increasing with health inputs. The underlying health production technology may vary with socio-demographic characteristics, A, family background, and with environmental and public health characteristics B'. Included within the random disturbance ε_h are the elements of genetic variation, both observable and unobservable, as well as measurement error. In Vietnam, child health was shown to depend on both inputs and the variation of the underlying technology with the distribution of income. Half of the change over time in child health in Vietnam was shown to be due to changes in the distribution of observable characteristics, and half was attributed to changes in the technology that translates those inputs into child health outcomes (O'Donnell, Nicolas, and Van Doorslaer 2009). We therefore expect child health production functions to change over time and across countries.

Theoretically, relevant child level variables include gender and birth order, and whether a child is part of a multiple birth. Household-level variables include things such as mother's and father's schooling, parental occupation, mother's anthropometrics, mother's age at birth, access to piped water, and availability of flush toilets, as well as geographical location (Pradhan, Sahn, and Younger 2003, Blau, Guilkey, and Popkin 1996, Aturupane, Deolalikar, Gunewardena 2006, Kabubo-Mariara, Ndenge, and Mwabu 2008).

In terms of outcomes, we focus on child height and weight-for-height after appropriate standardization to account for variations in sex and age. Although child health can be characterized by a number of different measures, height is a preferred indicator for child health status because it is also a good measure of general health status and represents the accumulation of episodes of poor nutrition or illness (Pradhan, Sahn, and Younger 2003). Weight-for-height is also examined as an outcome. Although more weight for a given height is not necessarily healthier (Pradhan, Sahn, and Younger 2003), it is a measure that is more sensitive to short-term variations in nutrition.

4. Data

The data we use in this study come from Demographic and Health Surveys (DHSs) (Measure DHS). We used all the DHSs for the Arab Countries and Turkey that including anthropometric data, specifically child height and weight for children five and under. Some datasets collected anthropometric data for only a sub-sample of the entire DHS, but most collected it for all households with children under five. The different surveys, however, did not always include the same explanatory variables.

Additionally, although the DHS is laudable for consistently naming common variables across rounds (countries and years), response categories vary by country and year, and each round has round and country-specific variables with their own variable names and response categories. For instance, the sewage connections question may be represented by different variables in different countries or years, and even if named the same thing, it could include anywhere from two to thirteen categories. A substantial amount of data harmonization was necessary in order to create comparable variables and categories across different rounds and countries.

In order to harmonize data across countries and rounds, we often created additional variables or collapsed categories. For instance, partner's occupation in the original DHS data had 13 categories, which we collapsed it into six. We retained (1) professional, technical, and managerial, combined (2) clerical and sales (3) agricultural self-employed and agricultural employees (4) household domestic and sales (5) skilled manual and unskilled manual (6) and missing, don't know, other, and did not work.

In a few countries and rounds, a wealth variable was not directly available from the DHS. We use the DHS methodology and created a wealth index using factor analysis from the household assets and housing quality variables in the data. Wealth quintiles are computed as relative measure within a country and year, and refer to the position of the household in the wealth distribution of households. Finally, we used the sampling weights provided in each survey to undertake our analysis.

5. Methodology

Our methodology consists of computing standardized anthropometric indicators, calculating decomposable General Entropy measures of inequality for these indicators, and then decomposing these measures into a portion that is due to observable circumstances and a residual; the former being the share that can be attributed to inequality of opportunity. We undertake this decomposition using both parametric and non-parametric methods in order to ascertain the influence of functional form assumption on the parametric estimates. Finally, we undertake simulations as to the extent of the impact of circumstances on inequality, by estimating standardized height and weight for children with the "best" (most advantaged) and "worst" (least advantaged) combination of observed circumstances.

5.1 Standardized anthropometric measures

The two outcome variables that are the focus of our analysis are child height and weight.

Both height and weight increase in variance with age and also vary by sex. In order to abstract from normal variations in height and weight, it is typical in the child health literature to use a reference distribution for "healthy" children put together by US Center for Disease Control (CDC) (Kuczmarski et al. 2002) to calculate either the percentile of the child's height and weight in the reference distribution of children of the same sex and age (in months) or their z-score; the latter being the child's deviation from the median of the reference distribution measured in units of standard deviations of the reference distribution. Because both of these transformations of the height and weight variables alter the scale of measurement, they would alter inequality measures in arbitrary ways and would therefore not be suitable for our analysis. To avoid this problem, we follow a method proposed by Pradhan Sahn and Younger (2003) to create "standardized" height and weight variables. This is done by transforming the z-score of the height or weight of the child using the reference CDC distribution into the equivalent height or weight for a twenty four month old female with the same z-score. Following Pradhan, Sahn and Younger (2003) "standardized" height can be denoted as:

$$h_s = F^{-1}_{\bar{a},\bar{g}}(F_{a,g}(\mathrm{h}))$$

F being the distribution function of heights in the CDC reference population for the age and sex group of an individual of age a and gender g. h is the actual height of that individual and $\bar{a}$ = 24 months, $\bar{g}$ = female. The resulting h_s is the standardized height.

Figure 1 provides an example of this process. From the DHS data we observe a 46 month old male who is 95.3 centimeters in height. Using the LMS coefficients for a 46-month male from the CDC data (Kuczmarski et al. 2002), we calculate his z-score (standard deviations from the median in the CDC health reference population) to be -1.40. We then use this relative position to determine what his height would be if he were a 24 month old female. We use the LMS coefficients for the 24 month old female to solve for what his height would be if he were a 24 month female; 80.1 centimeters. This 46-month old male with 95.3 centimeters thus maintains his relative position, but has a standardized height that can be compared to standardized heights for other children at a different age and sex. Heights that were less than -7 or more than 7 in their z-score, or that were flagged in the DHS data, were recoded as missing.

Because height-for-age and weight-for-age are highly correlated across individuals, a more independent measure of the short-run nutritional achievement controlling for long-run nutrition is weight-for-height. To obtain a standardized weight-for-height measure, we follow a similar procedure as in the case of height-for-age. We calculate the z-score of the child in the relevant weight-for-height reference distribution and then map this z-score into the weight of a 24-month-old female of median height to obtain the standardized weight at a given height. Like in the case of height, weights for height with a z-score of less than -7 or more than 7 and those flagged in DHS data were recoded as missing.

5.2 Inequality decomposition methodology

In order to estimate the contribution of circumstances to total inequality and thus get at the share of inequality of opportunity, we must both measure and decompose inequality. There are a number of inequality measures such as the well-known Gini index or the decile ratio index, however only some of these measures are decomposable into the inequality within and between groups; a property that is necessary to estimate the share of inequality of opportunity. As Ferreira and Gignoux (2008) discuss, even when examining the same set of outcomes and circumstances, estimates of the share of inequality of opportunity in total inequality can differ on three grounds: (1) the specific inequality index used in the decomposition (2) the path of the decomposition, whether direct or indirect and (3) the procedure used for decomposition (parametric or non-parametric). In what follows we discuss all three of these issues.

5.2.1 General entropy measures of inequality

Measuring the partial effects of different circumstance variables on inequality requires a decomposable inequality measure. Some of the best know decomposable inequality measures are the general entropy (GE) measures. There is a whole class of these measures depending on a parameter (that we refer to as α below) that indicates the weight given to distances between outcomes at different parts of the distribution of outcomes.

Figure 2 shows the distribution F of a continuous outcome y, where p is the proportion of the population below a certain value of y, μ is the mean of the distribution. y= *Q(p)* is the quantile function and F(Q(p))=p. Additionally, *Q(p)* is the outcome level below which we find p proportion of the population. It can also be interpreted as the outcome level (for instance, height) of an individual whose percentile in the population distribution is p (Duclos and Araar 2006). In this distribution, the median is Q*(0.5)*. At y_{max}, the proportion of the population $F(y_{max})=1$.

Under the assumption of a continuous outcome variable, the general class of GE Indices can be described as (Duclos and Araar 2006: 67):

$$GE(\alpha)=\begin{cases}\int_0^1 \ln\left(\frac{\mu}{Q(p)}\right)dp & \text{if } \alpha=0\\ \int_0^1 \frac{Q(p)}{\mu}\ln\left(\frac{Q(p)}{\mu}\right)dp & \text{if } \alpha=1\\ \frac{1}{\alpha(\alpha-1)}\left(\int_0^1\left(\frac{Q(p)}{\mu}\right)^{\theta}dp-1\right) & \text{if } \alpha\neq 0,1\end{cases} \quad (1)$$

GE(0) or Theil's-L index can be interpreted as the mean logarithmic deviation between Q(p) and μ. Because of the logarithmic transformation, it puts more weight on deviations from the mean at the lower end of the distribution. It is also the only measure of inequality among the decomposable inequality indices that is path independent (whether the direct or residual path to estimating inequality is used, the result is the same, see below). We obtain GE(1), or Theil's-T index, by multiplying what is inside the integral by Q(p)/μ.

This shifts the emphasis to higher up in the distribution. GE(2) is equal to half the square of the coefficient of variation (the coefficient of variation being SD/μ). This measure puts even more weight on deviations at higher ends of the distribution.

5.2.2 The decomposition of GE indices

The goal of decomposing inequality is to break up total inequality into within and between group inequality. In our case the groups are made up of individuals with unique combination of circumstances, which we call *types*. Each individual is assigned to a type, k, based on his or her circumstances. Having identified k types in a population, each with a unique combination of circumstances, the between-group component of inequality is a measure of inequality of opportunity. Our ability to measure inequality of opportunity is therefore limited by the quantity and quality of circumstance variables available in the DHS data.

With K types, we decompose inequality as:

$$GE(\alpha) = \sum_{k=1}^{K} \phi(k) \left(\frac{\mu_k}{\mu} \right)^{\theta} GE(k;\alpha) + \overline{G}\overline{E}(\alpha) \qquad (2)$$

Within Between

Where $\phi(k)$ is the proportion of the population in type k, μ_k is the mean height or weight of type k, and GE(k;α) is the GE index of type k. This element captures within-group inequality. $\overline{G}\overline{E}(\alpha)$, the between-group component of inequality, is the GE index of the population if each member of type k was assigned height or weight $\mu_{k,}$ their group's mean (Duclos and Araar 2006: 67).

5.2.3 The path of the decomposition

The share of inequality of opportunity in total inequality can either be measured directly or as a residual depending on the path of the decomposition, which in turn depends on whether a smoothed distribution or a standardized distribution is used. A smoothed distribution $\{\mu_i^k\}$ emphasizes the between-group differences by substituting the mean of each type μ^k for y_i^k where k is a type with a unique combination of circumstances. A standardized distribution $\{v_i^k\}$ emphasizes within-group differences by replacing each y_i^k with $\{v_i^k = y_i^k \frac{\mu}{\mu^k}$ where μ is the grand mean. The smoothed distribution eliminates all within-group inequality, giving a direct estimate of between-group inequality, while the standardized distribution eliminates all between-group inequality, generating a residual estimate of between-group inequality. These can be denoted by (Ferreira and Gignoux 2008):

$$\theta_d = \frac{I\left(\left\{\mu_i^k\right\}\right)}{I\left(\left\{y_i^k\right\}\right)} \qquad (3)$$

This is the ratio of inequality in the smoothed distribution to the total inequality. This *directly* summarizes between-group inequality.

$$\theta_r = 1 - \frac{I\left(\left\{v_i^k\right\}\right)}{I\left(\left\{y_i^k\right\}\right)} \qquad (4)$$

This is 1 minus the ratio of inequality in the standardized distribution to the total inequality. This is a *residual* way of calculating between-group inequality by subtracting from total inequality all within-group inequality.

Although total inequality is traditionally used as the denominator for determining the share of between- group inequality, this methods tends to understate the role of between-group inequality and this inequality of opportunity. Total inequality is the between-group inequality that would occur if each individual were a separate group. With a finite level of observable groups, the maximum between-group inequality will in general be lower than total inequality (Elbers et al. 2008). Elbers suggests an alternative approach. Rather than using total inequality in the denominator of between-group inequality shares, the denominator ought to be the maximum between-group inequality that could be obtained if the number of groups and the size of those groups were the same as for the numerator. This normalization also facilitates cross-country comparison, which can be difficult due to different group sizes and group numbers in different countries. However, this approach is very difficult to implement. If a population is partitioned into X number of subgroups, because of different possible relative orders, there are X factorial permutations of subgroups that need to be calculated. The maximum between-group inequality among all these combinations is then used as the appropriate denominator (Elbers et al. 2008). The computational difficulty of this operation drives us to use the traditional total inequality measure in the denominator. However, Elbers' approach makes another important contribution in showing that our between-group shares of inequality will always be biased downwards. Our findings can therefore be interpreted as a lower bound of between-group inequality.

5.2.4 Parametric and non-parametric estimation methods

We are interested in the between-group inequality when the groups are the types of unique circumstances an individual can have. There are, however, a variety of different ways to estimate the contribution of circumstances to inequality. We apply three estimation methods, a parametric method that uses regression to link circumstances to the outcome of interest and two non-parametric methods that measure the variation of the outcome across the k-circumstance groups. The non-parametric methodologies are referred to as decomposition by *type* and by *tranche*.

5.2.4.1 Parametric Estimation

With a large enough sample to have enough observations in each type k, we can get reliable distributions of the outcome in each type k and directly get measures for θ_d and θ_r.

This would be non-parametric estimation by *type*. However, with a large number of unique combinations of circumstances, the sample size in each cell could be quite low with standard household survey data. To overcome this problem, we make parametric assumptions about how y depends on the circumstance vector C. We thus start by estimating the following regression:

$$y = C\psi + \varepsilon \tag{5}$$

For an outcome y and a vector of circumstances C, we obtain the coefficients ψ that describe how each circumstance affects y. The standardized distribution is then estimated as (Ferreira and Gignoux 2008):

$$\tilde{\tilde{y}}_i = \bar{C}\hat{\psi} + \hat{\varepsilon}_i \tag{6}$$

Where $\bar{C}$ is the vector of sample mean circumstances. Once differences in circumstances are controlled for, the remaining variation is exclusively within groups. The residual parametric estimate of the share of inequality of opportunity (θ_r) can thus be calculated as shown in equation (4) above by substituting $\tilde{\tilde{y}}_i$ for v_i^k.

The smoothed distribution is estimated by replacing y_i with:

$$\tilde{\tilde{z}}_i = C_i\hat{\psi} \tag{7}$$

where the error term of the model is suppressed and the predicted value of y is used to replace y_i. This is then used to obtain the direct parametric estimate of the share of inequality of opportunity (θ_d) as in equation (3) above by substituting $\tilde{\tilde{z}}_i$ for μ_i^k (Ferreira and Gignoux 2008).

5.2.4.2 Partial Effects in Parametric Estimation

With parametric estimation it is possible to obtain the partial contribution of each group of circumstances on the share of inequality of opportunity. For instance, what portion of inequality of opportunity is due to wealth, parental education, or gender? To obtain the partial effect of a particular circumstance, J, we can construct the following counterfactual standardized distribution (Ferreira and Gignoux 2008):

$$\hat{\tilde{y}}_i^J = \bar{C}^J \hat{\psi}^J + C_i^{j\neq J} \psi^{j\neq J} + \hat{u}_i \qquad (8)$$

This allows us to neutralize the variation due to circumstance J, while maintaining the variation due to other circumstances. The share of inequality attributable to circumstance J is then given by:

$$\theta_r^J = 1 - I\left(\left\{\hat{\tilde{y}}_i^J\right\}\right) \Big/ I\left(\left\{y_i\right\}\right) \qquad (9)$$

5.2.4.3 Non-Parametric Estimation by Types

There are two non-parametric methods we use for decomposing total inequality. Ex-ante inequality of opportunity measurement measures the differences in outcomes between types, with types being the groups of individuals with identical circumstances. The share of inequality of opportunity calculated in this way is the ratio of inequality of a smoothed distribution across type over total inequality, as in equation (3) above.

Similarly a residual estimate of the share of inequality of opportunity by type is obtained if we used a standardized distribution $\{v_i^k\}$across types as in equation (4) above.

5.2.4.4 Non-Parametric Estimation by Tranches

An alternative ex-post measure of inequality of opportunity was proposed by Checchi and Peragine (2010). It starts by defining *tranches* as the individuals at the same percentile of the distribution for each type. This allows us to come closest to Roemer's theoretical definition of equality of opportunity that states that individuals in the same location of the "effort" distribution in each type should be rewarded similarly. Thus inequality within tranches (and across circumstances) is then interpreted as inequality of opportunity. Let e denote a *tranche* (a particular percentile of the distribution of individuals in each type k). Let $\{\mu_i^e\}$ denote the smoothed distribution for each tranche across the k types, where each individual's outcome is replaced by the mean outcome of the tranche. This neutralizes any difference due to circumstances and only leaves differences due to effort or luck. The share of inequality of opportunity can therefore be calculated as a residual using the tranche method as follows (Hassine, 2011).

$$\theta_{tranches}^r = 1 - \frac{I\left(\left\{\mu_i^e\right\}\right)}{I\left(\left\{y_i\right\}\right)} \qquad (10)$$

Computing the inequality of opportunity for tranches directly can be implemented by suppressing all between tranches inequality through the construction of a standardized distribution. The means of the different effort groups e are transformed so that an individual's outcome within tranche e of type k, $y_i^{e,k}$, becomes $z_i^{e,k} = \frac{\mu}{\mu_e} y_i^{e,k}$ and inequality of opportunity is given by:

$$\theta^d_{tranches} = \frac{I\left(\left\{z_i^{e,k}\right\}\right)}{I\left(\left\{y_i\right\}\right)} \qquad (11)$$

The types and tranches approaches can provide different estimates of the inequality of opportunity, but there is not a clear advantage in using one or the other, so we present both.

However, for any reasonable set of circumstances, K will be too large to have enough observations in each type k. Instead, we generally have to use parametric assumptions about how y depends on C. The parametric approach relies on particular functional form assumptions as to how y depends on C, which can be problematic. To assess how constraining these assumptions are, we significantly reduce the set of circumstances to allow for non-parametric estimation and compare the parametric estimates with the types and tranches of non-parametric estimates. We call the parametric estimates that use the reduced set of circumstances the "comparable parametric estimates". If these estimates are reasonably close to their non-parametric counterparts, we can conclude that the parametric assumptions are not highly constraining and that the full parametric estimates are plausible.

This report focuses primarily on GE(1), the Theil-L index or the mean log deviation, but we generally find that results using GE(0) and GE(2) are similar. We show these in the appendix.

5.2.4.5 Bootstrapped Standard Errors

Estimating standard errors analytically for inequality indices and their decompositions is quite challenging. We therefore rely on bootstrapped standard errors, following the example of Ferreira and Gignoux (2008). Bootstrapped standard errors are based on multiple subsamples from the sampled populations to estimate standard error from the distribution of the estimated parameters across these subsamples. We used 200 replications to obtain the sub-samples.

6. An Overview of Child Health Status in the Arab World and Turkey

In this descriptive overview of child health status in the Arab world and Turkey, we use a number of child health indicators, such as the proportion of children suffering from stunting or wasting. Stunting and wasting are defined as having a height-for-age and weight-for-height z-scores that are below two standard deviations from the median of the relevant CDC's healthy child distribution. This threshold corresponds to approximately the third percentile of height-for-age and weight-for-height in the reference distribution (Kuczmarski et al. 2002). Height-for-age, as the accumulation of nutrition and morbidity status over time, is an important measure of long-term child health outcomes. Weight-for-height is a good indicator of short-term nutritional stress and tends to be less correlated with height-for-age than weight-for-age. Besides the percent stunted and wasting, which are good indicators of the health of the most vulnerable children, we also report the mean percentile of height-for-age and weight-for-height (relative to the healthy child CDC distribution), which are good indicators of the health of the average child in that country at that time (see Table 1). A healthy child population, on average, would have a mean percentile of 50%.

In general the Arab countries and Turkey appear to perform poorly relative to the healthy child distributions in terms of height-for-age and stunting, but perform well relative to the relevant distribution for weight-for-height. The percent wasting is much closer to the expected 3% and the mean percentile of weight-for-height is closer to the expected 50% than are the respective statistics for height-for-age. This suggests that long-term nutrition deficits are more important in this region than short-term nutritional stress. Egypt generally exhibits a high rate of stunting and a low mean percentile of height-for-age even though it's wasting and weight-for-height statistics look fairly good. Although the worst year for stunting in Egypt was 1995, with a rate of 28.2%, the dramatic improvement in the subsequent decade appears to have been reversed in the latter part of the decade, with stunting going up to 24.4% in 2008 after having declined to as low 11.3% in 2003. This poor child health performance in 2008 is confirmed by a large increase in wasting during that period as well, which increased from 6.2% in 2005 to 10.6% in 2008. Some of this sharp deterioration in child nutrition in Egypt in recent years may be attributable to the sudden disruption in the supply of poultry and eggs to households after millions of poultry were culled during the avian influenza outbreak of 2006 (El-Zanaty and Way 2009). As many households bred poultry for their own consumption, the outlawing of such activities seems to have seriously affected the protein intake of young children as well as possibly straining household financial resources (Geerlings et al. 2007). It is ironic that a measure designed to solve one public health problem appears to have caused a possibly more serious problem in relation to the nutrition of young children.

Jordan exhibits generally better child health outcomes. Starting in 1990, it had a rate of stunting of 13.5%, which declined quite substantially up to 2002, worsened in 2007 and then fell to its lowest level (5.4%) in 2009. The short-term worsening of the health of the most vulnerable children in Jordan in 2007 is made readily apparent by the rate of wasting that increased from 5.5% in 2002 to 12.1% in 2007, only to drop to 4.3% in 2009. The average child in Jordan was less affected by this reversal as indicated by the mean percentiles for height-for-age, which continued to rise through 2007 and the mean percentile of weight-for-height, which only declined slightly from 2002 to 2007, before rising again in 2009.

Morocco exhibits a consistently improving trend in the rate of stunting and the mean percentile of height-for-age, with the proportion stunted dropping from 31.2% in 1987 to 16.3% in 2004 and the mean percentile of height rising from 22.5% in 1987 to 33.2% in 2004. In contrast, there appears to have been a short-term reversal in the nutrition of the most vulnerable children in Morocco in 2004 when the rate of wasting rose to 14.4%, and the mean percentile of weight for height dropping to 50% from 57% in 1992. This could well be due to the impact of the frequent droughts that Morocco experiences. Morocco started the observation period with stunting rates that were highest among the countries represented, save for Yemen, but managed to significantly improve child nutrition over time.

Although the only data we have for Tunisia is for 1988, and therefore time trends cannot be ascertained, it is noteworthy that Tunisia's percent stunted was only 18.3% and mean percentile of height-for-age was 30.2%, significantly better than Egypt in 1988 and Morocco in 1987. In contrast, the rate of wasting was higher in Tunisia and the mean percentile of weight-for-height lower than in Egypt and Morocco at that time.

Turkey, like Morocco, shows a strongly improving trend over time in both stunting and wasting. In 1993, 22.6% of children five and under were stunted and the mean percentile of height-for-age was 30.5%. It is interesting to compare this to Jordan in 1990, which had nearly the same mean percentile (30.6%), but a much lower percentage stunted (only 13.5%), suggesting larger inequality in health status in Turkey. Over time, however, Turkey has improved substantially, with the rate of stunting reaching 12.1% and the rate of wasting 1.7% by 2003.

The only data we have for Yemen is for 1992. It shows extremely poor child health outcomes, by far the worst in the region. Nearly half of children under five are stunted and

20% are wasting. The very low mean percentiles in Yemen (18 for height-for-age and 38.4 for weight-for height) show that the average child in Yemen is not doing so well either.

Comparing across countries using data from the 2000s, Jordan clearly performs the best in terms of child health outcomes. Turkey is close behind thanks to its improving trend and Morocco not too far behind. Egypt's most recent data is less promising, especially for the most vulnerable children affected by stunting and wasting, a reversal that could well be attributed to seemingly misguided public health policies. While Jordan, Morocco, and Turkey show clearly improving trends, Egypt' initial improvements appear to have stagnated or even reversed.

It is noteworthy that the relationship between per capita annual GDP (in 2000 constant USD) and health outcomes is not simple or clear. Evidence from Vietnam illustrates a case of inequality rising slightly along with substantial increases in economic growth, driving a decrease in stunting (O'Donnell, Nicolas, and Van Doorslaer 2009). Economic growth, absolute health outcomes, and health inequality, although related, are not clearly or uni-directionally deterministic.

In the Arab world, Jordan has had quite a modest per capita annual GDP when compared to Turkey; however, it has also had substantially lower stunting, and better or comparable mean height percentiles. Nor does the trend for a given country appear to necessarily be the result of changes in per capita GDP. In Turkey, between 1998 and 2003, per capita GDP rose very little, but stunting and wasting fell significantly. In Morocco, on the other hand, improvements in stunting have tracked with increases in GDP, but not so for wasting which deteriorated significantly in 2004 despite rising GDP per capita. Aside from the aberration in 2008, Egypt's child health indicators tracked its rising GDP per capita.

The key question from an inequality of opportunity point of view is whether these observed differences in child health outcome can be attributed to inequality in circumstances. An initial way to address this question is to examine the bivariate association between the distribution of a health outcome variable and observable circumstances, such as region of residence, parental education, etc. Due to space limitations, we do that only with the distribution of standardized height. Standardized weight-for-height showed very similar patterns.

The graphs shown in Figure 3 above show the distribution of children by region for each decile of standardized height. If region had no effect on child height outcomes, the share of childrent in each region would be the same across deciles and the horizontal lines would be totally flat. A region that has a larger share in lower deciles has relatively more disadvantaged children. One that has a larger share in higher deciles has relatively advantaged children.

We focus on Egypt in 1988, 2000, and 2008 in order to illustrate how the effect of region on child height changes over time. We also include Jordan 2002, Morocco 2004, and Turkey 2003 graphs for a comparison across countries at a similar point in time. In the case of Egypt,[1] in 1988 urban governorates and urban Lower Egypt are over-represented in the higher deciles of height. Rural Lower Egypt is symmetrically distributed. Urban Upper Egypt is disproportionately absent from the lowest qunitles, but otherwise proportional. It is rural Upper Egypt in 1988 that is strongly over-represented in the lowest deciles, confirming the well-known fact that children there are the most disadvantaged. In 1988 children in rural Upper Egypt were 36.0% stunted and had a mean percentile of height-for-age of 15.9%; for

[1] Only for Egypt, one region (the Frontier Governorates) was omitted from the graphs. It was not always sampled and is a small region in comparison to other regions.

comparison, urban Lower Egypt had only a 15.7% stunting rate and had a mean percenitle of 25.3%, the best on both measures (see Table 2 and Table 3). In 2000, rural Upper Egypt again dominates the lower deciles, but has improved to only 24.2% stunted with a mean percentile of 21.7%. Urban Upper Egypt is evenly distributed across the deciles.

Both rural and urban Lower Egypt are skewed towards the higher deciles, while the urban governorates are skewed towards the higher, but not highest, deciles. On stunting and percentiles in 2000, trends diverge. Urban governorates have the least stunting, only 6.3%, but have a mean percentile of 29.6%, while urban Lower Egypt is 12.6% stunted and has a mean percentile of 34.2%. In 2008, the regional differences are less dramatic, except at the lower end of the distribution. Urban governorates are slightly skewed towards higher deciles, while rural Lower Egypt is bimodal, skewed towards both the high and low ends. The impact of poultry culling due to the Avian Influenza scare appears to have had a particularly adverse impact on urban governorates and Lower Egypt. Rural Upper Egypt is over represented in the lower, but not lowest, deciles. It is actually urban Lower Egypt with the greatest percent stunted, 33.9%, in 2008, and also the lowest mean percentile, 23.5% (Table 2 and Table 3).

Jordan in 2002 shows a weaker relationship between region and height. Although the South is over-represented and the Central region under-represented in the lowest decile, there is only a very slight gradient past that point. The differences by region in stunting are small; while the Central region has 6.1% stunting, the South has 8.9%, a relatively small difference. Mean percentiles follow a similar pattern, 27.9% in Central and 32.9% in the South.

Morocco is likewise only weakly differentiated by region, with some regions (such as the South and Tensfit) over-represented at both ends of the spectrum, and others (such as the Central and Northwest regions) over-represented towards the middle deciles. On stunting the Tensfit region is the worst, at 21.0% stunted, while the Central south has half that percentage, only 10.5%. The mean percentiles show less dramatic variation across regions in Morocco. The South has the lowest mean percentile, at 30.2%, while the East has the highest, at 38.1% (Table 2).

Turkey in 2003 shows a much clearer and more dramatic association between region and the distribution of child height. The Eastern region of Turkey, known to be the poorest region of the country, dominates the lower end of the distribution, and all the other regions are strongly skewed towards the higher height deciles. Stunting in the North of Turkey is by far the worst, at 22.7%, and dramatically higher than the West region, with only 4.6% stunting (table 3). The mean percentiles are also fairly dramatically different. Again, the West is best, with a mean percenitle of 46.4% and the North with a mean percentile of 29.2% (table 2). Especially comparing Jordan and Turkey, it is clear that much stronger differences are observed by region in Turkey. Regional differences are comparatively small in Jordan, modest in Morocco and Egypt, and large in Turkey. Based on these results, we would expect geography to play an important role in the inequallity of child health, especially in Egypt and Turkey.

Wealth has an obvious and important role in child health, as it influences the resources parents are able to dedicate to their children's health and even their access to publicly provided resources through their residential choices. Figure 4 shows the bivariate association between the household's wealth quintile and the position of the child on the distribution of standardized height. In Egypt in 1988, there is a strong relationship between the distribution of wealth and child height. The poorest children are over-represented in the lower two height deciles. In 1988, 34.2% of the poorest children are stunted as compared to only 21.0% of the wealthiest (Table 3).The mean percentile is only 13.8% in 1988 in Egypt for the lowest quintile as compared to 29.5% for the richest quintile (Table 3). Children from the third and fourth decile are also somewhat skewed towards the lower end of the distribution. While children from the next four deciles of height are slightly under-represented in the lowest quintiles of wealth, they are otherwise generally evenly distributed. It is the wealthiest children that dominate the high end of the height distribution. A similar, but weaker, gradient is visible in Egypt in 2000. While 25.5% of the poorest children are stunted in 2000, only 9.0% of the richest children are stunted (Table 3). The wealthiest kids were the most to benefit from imporvements in child health from 1988 to 2000. By 2008, the relationship between wealth and child height has practically disappeared. This is because all of the quintiles seem to be experiencing high stunting and relatively low mean percentiles (Tables 2 and 3).

In Jordan, the poorest quintile of wealth has children moderately skewed towards the lower height deciles. The next three quintiles are relatively evenly distributed throughout the height distribution, but the top quintile of wealth is skewed toawrd the high end of the height distribution. While 11.9% of children in the poorest wealth quintile are stunted, only 3.0% of those in the highest quintile are (Table 3). Morocco shows a pattern similar to Jordan, with the top and bottom wealth quintiles skewed to the bottom and top of the height distributions, respectively, but the middle quintiles evenly distributed acorss the height distribution. In terms of stunting, 26.4% of the poroest children are stunted in Morocco, but only a third as many, 8.9%, of the wealthiest children are (Table 3). The mean percentiles exhibit a similarly large difference between poorest and richest, 25.5% vs. 43.2% (Table 3).

The relationship between household wealth and child height is even more dramatic in Turkey. Children from the poorest wealth quintile represent nearly half of the lowest height decile, but less than twenty percent of the highest decile. The second wealth quintile is fairly evenly distributed across the height distribution, but past that point, increasing wealth skews height towards the high end of the distribution. In Turkey, 25.6% of the poorest children are stunted, which is nearly *ten times* as high a rate as the richest quintile, which is 2.7% (Table 3). In Turkey the poorest quintile is by far the worst off; while other countries have more consitent gradients. In Turkey even just moving from the poorest to second quintile reduces the rate of stunting from 25.6% to 14.5%. While Egypt shows a modest gradient fluctuating over time by wealth, all the other countries show strong health outcome inequality by wealth. Turkey's is the most dramatic, while Jordan's and Morocco's are fairly similar in gradient, with Jordan being consistently better at each level.

We move next to an examination of the association between mother's education and child height.[2] First, note the significant increase in the education of mothers over time in Egypt, as indicated by the shrinking are for the two lightest colors and the expansion of the two darkest colors in Figure 5. The slope of the curves shows the association between mother's education and child height. Children whose mothers have no education are over represented in the lower end of the height distribution. Those children with primary-educated mothers are over-represented towards the middle and under-represented at both ends. Once mothers reach secondary education, children's height starts to skew towards the high end of the distribution, and children with mother with higher education are definitively over-represented in the highest couple of deciles. In 1988 children with uneducated mothers had a 30.3% rate of stunting, compared to 20.7% stunting for those with university-educated mothers (Table 3). In 2000 in Egypt, the gradients with respect to mother's education are less dramatic, but continue the same trend of increasing height with increasing mother's education. By 2008 in Egypt, like in the case of household wealth there is a much weaker association between children's height and parental education.

[2] Since the association with father's education is similar, we skip it in this descriptive section.

Jordan in 2002 does demonstrate a skew to the lower end for the (small proportion of) children with uneducated mothers. The distribution among secondary mothers is fairly symmetric, but children with highly educated mothers are definitively skewed towards the higher end of the distribution. While children with university-educated mothers in Jordan experience only a 2.9% rate of stunting, those with uneducated mothers experience a 19.3% rate of stunting (Table 3). In the case of Morocco in 2004, children with uneducated mothers are the majority and are definitively over-represented in the lower deciles (Figure 5). Children of mothers with at least secondary education are skewed towards the higher end of the distribution. The rate of stunting in Morocco is 19.6% for children whose mothers have no education and only 6.6% for children with university-educated mothers (Table 3). Morocco and Jordan provide a particularly interesting contrast on this measure; Jordan does by far the best of these four countries on providing high levels of education to mothers, and Morocco by far the worst. However, the gradients associated with mother's education and height deciles are quite similar despite the very different compositions of mother's education. This suggests that in both countries, educated mothers are more able to contribute to child health, but that in Jordan many more mothers have the requisite level of education.

In the case of Turkey in 2003, children with uneducated mothers are highly over-represented at the lower end of the height distribution; they are over 50% of the lowest decile but less than 20% of the highest. Children with mothers educated at the primary level are over-represented in the middle of the height distribution, and children with secondary or university-educated mothers overrepresented at the top of the distribution (Figure 5). Among the four countries we discuss here, rates of stunting in Turkey in 2003 were the most spectacularly different between the highest and lowest levels of mother's education. Children of uneducated mothers have a 25.8 % rate of stunting as compared to only a 2.3% rate among those of university-educated mothers. The big decline in stunting in Turkey occurs as mother's education goes from none to the primary level (Table 3).

Tunisia and Yemen

Although, for purposes of brevity, we did not include Tunisia and Yemen in our descriptive graphs, their differences in stunting and mean height percentile by background definitely merit a discussion (table 4). As discussed earlier, Yemen has by far the worst overall mean percentile for height (18.0%) and the highest stunting (46.6%), while Tunisia is middling with 18.2% stunting overall and a 30.2% mean percentile of height. Both countries show a strong gradient by parent's education. In Tunisia percent stunted goes from 23.9% to 0.0% when moving from a mother with no education to a mother with higher education, and the mean percentile rises from 26.3% to 65.1%. Yemen also shows a strong gradient; almost half (49.8%) of children with uneducated mothers are stunted, with a mean percentile of 16.7%, while in Yemen a highly educated mother is associated with only a 3.6% rate of child stunting and a mean percentile of 43.8%. The circumstances of children with mothers with no education are particularly poor in Yemen.

Wealth is clearly associated with child height outcomes in both Yemen and Tunisia; Tunisia, however, displays the stronger relationship. Stunting is 27.6% in the lowest wealth quintile in Tunisia, and only one fifth of that (5.8%) in the highest wealth quintile there. In Yemen, the highest rate of stunting (60.2%) is actually observed in the middle wealth quintile, with the lowest (32.8%) in the highest quintile. In the case of Yemen, less information was available for calculating the underlying wealth index, so some of the lack of variation may be a function of this lack of detail that is also observable in generally poor mean percentiles across all wealth quintiles in Yemen. Tunisia displays a stronger gradient in its mean percentiles and wealth quintiles. The worst is actually the second wealth quintile with a mean percentile of 23.2%, but the richest quintile has a 40.3% mean percentile.

In both Yemen and Tunisia, different regions display very different child health outcomes. For instance, in Tunisia, while Tunis has only 2.4% stunting, the South has 28.1% stunting. In Yemen, Aden has only 13.0% stunting, while the North has 56.3% stunting. Tunisia's mean percentiles match its stunting rates; Tunis has the highest mean percentile, 42.9%, and the South the lowest, 24.3%. Yemen is not as consistent, although Aden has the highest mean percentile (31.4%), the West has the lowest, 11.4%.

The comparison between Yemen and Tunisia illustrates an important challenge in discussing inequality. Inequality is a relative measure; the descriptive statistics suggest that Tunisia has greater inequality than Yemen. However, Yemen, in absolute terms, has much poorer child health outcomes. Greater inequality can be the result of an overall improvement in outcomes that is distributed unevenly across different groups. We therefore often reference absolute outcomes, as well as inequality, so as to not lose focus on this important distinction.

7. Findings: Inequality Measurements and Decompositions

7.1 An overview

In order to measure inequality of opportunity, the inequality due to circumstances, we now turn to the decomposable inequality measures discussed in the methodology section. First we measure and discuss total inequality across countries, then we describe the parametric specifications we use and present the share of inequality of opportunity by country and over time using the various parametric and non-parametric decomposition techniques. This is followed by a discussion of the partial effects of different sets of circumstances in contributing to inequality of opportunity and a simulation of the observed differences in outcomes that are obtained by setting circumstances at their combined best and worst case levels.

7.2 Comparing across countries: Total inequality

In order to examine the contribution of inequality of opportunity, we must first measure total inequality. Countries with greater total inequality would also be expected to have greater contributions of inequality of opportunity, since the level of "natural" inequality in healthy children in terms of standardized height and standardized weight-for-height should be relatively constant across countries.

A consistent ranking emerges when we compare inequality across countries (Figure 6). Among the four countries for which we have data at a similar point in time (Egypt, Jordan, Morocco and Turkey), Morocco consistently has the highest total inequality for both standardized height and weight-for-height. Egypt is the next most unequal, with Turkey close behind, at least in terms of height. Jordan has lower inequality in both measures but Turkey has the lowest inequality in weight-for-height, a figure that approaches the observed inequality in the CDC reference population, shown as a solid black line in the figure.

We include only the GE(1) measure of inequality here. The rank-order of the countries using GE(0) and GE(2) is the same. As shown by the confidence intervals around the measures, all the differences across countries are statistically significant, except for the differences in weight-for-height inequality between Jordan and Turkey.

7.3 Measuring the contribution of circumstances: Parametric and non-parametric specifications

To get the most accurate measures of the contribution of inequality of opportunity, it would be best to get the most detailed possible measure of the child's observable circumstances. Since there are limits as to how precisely we can measure all the relevant circumstances, the estimate of the contribution of inequality of opportunity is by necessity a lower bound. Data limitations will clearly dictate how accurately circumstances can be measured. Many more circumstances can be measured and with a greater degree of detail if we are using parametric approaches, so that the main limitation there is the extent to which the DHS survey measures these circumstances and how consistent the measurement is across countries and years. For the non-parametric approaches we will need to derive estimates for cells representing unique combinations of circumstance and are therefore limited by the size of the sample in each of these cells. Given our overall sample size limitations, we need to significantly reduce the number of circumstances we consider and the number of states each circumstance takes.

7.3.1 Parametric specifications

Because different circumstance variables are available for different countries and years, we selected a basic parametric specification that uses only variables that available across all the DHS samples we use. If we had limited the analysis to some of the later waves of the DHS, we could have used a more complete specification and if we limited it to individual countries, an even more complete one would have been possible. We experimented with two more complete specifications, but found that the results were essentially similar across specifications, although the share of inequality of opportunity we estimated was indeed higher with more complete specifications.

The parametric "base" specification, is consistent across all the years and countries and uses variables that are available in all years and countries. The circumstances variables that it includes are mother's education (4 categories), father's education (4 categories), governorate or province (varying by country), urban/rural residence, wealth quintile (as determined within country and year), whether a child was part of a multiple birth, mother's age and age squared at birth (continuous), birth order, and the sex of the child. The base specification is also noteworthy for consisting entirely of dimensions that can be influenced by public policy. We refer to this specification thereafter as the "parametric method."

Additional explanatory variables that we could have used and that are only available in the more recent waves of the DHS for all countries are father's occupation (6 categories), mother's height (continuous), mother's body mass index (continuous), whether the household has a modern toilet, and whether the household has drinking water piped into the house. Additional variables that are only available for some countries or whose specification varies by country are time to water source (continuous), sewage type (varies by country), kitchen trash disposal, whether toilet facilities are shared, and type of cooking fuel.

Another parametric specification we use is the *comparable* specification, which uses the same circumstance variables as in the non-parametric specifications and defines these circumstances in the same way. By necessity, this is a much more parsimonious specification than the base specification. We refer to this specification thereafter as the "comparable" method.

7.3.2 Non-parametric specifications

The non-parametric methods use a specification that is based on a much simpler set of circumstances. Children are divided into 18 types based on their circumstances (3 wealth groups[3] x 3 mother's education levels x urban/rural residence). All other circumstance variables are dropped. These groups are defined in the same way for all countries and years, but some cells were combined for countries when they had cell sizes that were too small. See Table A5 in the appendix for cell sizes and combinations. We use this specification of the circumstance variables for the "types" and "tranches" non-parametric methods and for the "comparable" parametric method.

[3] The three wealth categories are the lowest quintile, the second and third quintiles and the fourth and fifth quintiles.

7.4 The contribution of inequality of opportunity to total inequality: Cross-country comparison

Inequality of opportunity is measured as a share of total inequality and answers the question of 'what proportion of total inequality is due to circumstances?' Using the parametric specification, the types and tranches non-parametric methods, and the comparable parametric specification, we estimated inequality of opportunity both directly and as a residual. This section compares the share of inequality of opportunity across countries for the period around 2003.

As shown in Figure 7, the estimated share of inequality of opportunity in total inequality clearly varies according to the methodology used. The tranches method consistently produces the highest estimates of inequality of opportunity, with the direct and residual approaches (θ_d and θ_r) producing fairly similar results across methods.[4] The parametric specification produces the next highest estimate (see also Appendix Tables: Table A1 and Table A2). As mentioned earlier we experimented with two richer parametric specifications for some country-year combinations, which by necessity gave higher estimates of the share of inequality of opportunity than the base parametric specification, but these estimates were still lower than those provided by the tranches specification. The types and the comparable methods, produce very similar estimates that are much lower than those of the other two methods. Since the difference between them is only in the functional form assumptions embedded in the regression, the fact that they produce very similar results suggests that these parametric assumptions are not overly binding and that the base parametric specification is likely to produce reliable results.

The results as a whole suggest a clear ranking of inequality of opportunity in standardized height across countries, but this ranking does not necessarily correspond to the country's rank in the extent of total inequality. As shown by comparing Figure 6 and Figure 7, Turkey has the third highest total inequality in height among the four countries but has the highest share of inequality of opportunity, irrespective of the method of estimation used. The parametric and tranches methods give similar estimates of the share of inequality of opportunity in height for Egypt, Jordan and Morocco (around 4-7%) although Morocco and Egypt have much higher total inequality in height than Jordan. The types and comparable methods give much lower estimates for Egypt. These results suggest that inequality of opportunity in Egypt is not primarily manifested along the limited sets of circumstances measured by these two methods, namely urban/rural, mother's education and household wealth. As we will see later, geographic variation is very important in Egypt and that dimension is not adequately captured by just an urban/rural distinction.

There are smaller cross-country differences in the share of inequality of opportunity in total inequality for the weight-for-height variable, which measures shorter term fluctuations in nutrition. As shown in Figure 7, the tranches method provides similar estimates for Egypt, Jordan and Turkey (10-12%) and somewhat lower estimates for Morocco (8%) around 2003, despite the fact that Morocco has the highest level of total inequality in this variable. The parametric method estimate is highest for Egypt and lowest for Jordan. As before, the comparable and types specifications produce similar and much lower estimates.

It is important to remember that the estimated shares of inequality of opportunity only capture the inequality of opportunity due to *observed* circumstances. There are a number of dimensions of potential inequality of opportunity we were unable to capture from the DHS data and which are therefore not observed. Language barriers or ethnic discrimination may

[4] It is fairly typical in the literature for the "tranches" approach to give higher estimates than the other estimation methods. See Hassine (2011).

limit access to health care in some countries. Wealth is merely a proxy for household resources, whereas income is more likely the relevant variable in case of a child health crisis. Environmental contributors to health—such as water or air pollution—are not fully observed. The fact that Morocco for example has high total inequality but low inequality of opportunity shares suggests that the circumstances we account for do a relatively poorer job in capturing variations in child health and nutrition in Morocco than in the other countries. Conversely, the larger share of inequality of opportunity we capture for Turkey given its intermediate level of total inequality suggests that these circumstance do a relatively better job in getting at inequality of opportunity there. The shares of inequality of opportunity that we estimate must therefore be interpreted as lower bound estimates, with the unobserved dimensions absorbed into the unexplained component that also include natural variations across children.

7.5 The contribution of inequality of opportunity to total inequality: Countries over time

We now move to a comparison of the trends over time in inequality and inequality of opportunity across countries. The issues we are most interested in are the direction of the trend, if any, and whether the trend in the inequality of opportunity share is similar to that in total inequality. Again we state by limiting our analysis in this comparison to countries for which multiple years of DHS data are available, namely Egypt, Jordan, Morocco and Turkey and then move onto Tunisia and Yemen for which only one year of data is available.

7.5.1 Egypt, Jordan, Morocco and Turkey over time

First we note the contrasting trends in total inequality of height and weight-for-height shown in Figure 8 and Figure 9. Although fluctuating, the trend in Egypt for both standardized height and for weight-for-height is upward. Morocco is also exhibiting an upward trend, especially from 1992 to 2004. In contrast, the trend in Jordan and Turkey is downward, with the exception of 2007, which was an unusually high inequality year in Jordan.

Moving on to the share of inequality of opportunity, shown in the right panel of Figure 8 and Figure 9, we note that the types and comparable methods are very close to each other in terms of level and generally provide low estimates. The parametric method gives intermediate estimats in terms of level and the tranches method gives the highest levels.

In terms of trends, we first note that with the exception of the parametric method for Egypt, the various methods produce similar trends in the progression of inequality of opportunity shares over time. Leaving Egypt aside for the moment, we can conldude that, for standardized height, the share of inequality of opportunity in Jordan was relatively flat throughout the period of 1990 to 2009, increased in Morocco from 1987 to 1992 and then declined from 1992 to 2004, and fell throughout the period under study in Turkey, although the changes there remain within the confidence intervals of the various estimates (see Figure 8). The stability in Jordan is surprising given the sharp increase in inequality in 2007. If anything the share of inequality of opportunity seems to have fallen in 2007 rather than increased, as we would have expected. We therefore remain fairly ignorant as to what caused the big increase in inequality in Jordan in 2007. The reversal of the trend between 1992 and 2004 in Morocco is also somewhat surprising giving the increase in total inequality in that period. Again, that increase in inequality appears to be poorly explained by the circumstances we observe there. The declining trend in Turkey is consistent with the decline in total inequaliy over time.

In terms of weight-for-height, the trend is also flat in Jordan, declining throughout the period in Morocco and declining more slowly, if at all, in Turkey. The only method that is reflecting the sharp increase in inequality in Jordan in 2007 is the tranches method, albeit weakly. The sharp decline in the share of inequality of opportunity in Morocco contrasts even more sharply with the increase in total inequality during the 1992-2004 period.

Returning to the case of Egypt, which seems to exhibit contradictory trends across methods and between total inequality and inequality of opportunity. In our earlier discussion, we attributed the big increase in stunting and wasting we observed for Egypt in 2008 to the possible impact of the culling of domestic poultry in 2006 as a meams to combat bird flu. This had a geographically differentiated effect on child nutrition, depending on the availability of protein substitutes for families that relied heavily on domestic poultry for protein intake. This sort of geographic diversity is only captured in the parametric method, and it is therefore reasonable that it is the only decompostion method that captured the increase inequality of opportunity due to this misguided intervention. This unobserved variable, from the point of view of the tranches method, would have resulted in an increase in betweeen-tranche inequaliy and would have therefore resulted in the reduction of the share of within-tranche inequaltiy to total inequality, our measure of ineqiuality of opportunity (see equation 11 above). We should note that 2003, a relatively low total inequality year, is also showing up as low in the share of inequality of opportunity as measured by the parametric method, giving further credibility to the findings from this method.

These results suggest that the parametric method, given that it can incorporate a richer set of circumstances, is preferred. This is especially the case as it appears that the functional form that the parametric specification is imposing does not unduly constrian the data.

7.5.2 Tunisia and Yemen

Since we only have one year each for Tunisia and Yemen, we did not include them in the preceding analyses. However, we can say the following. Total inequality of standardized height in Tunisia in 1988 (at 0.00185) was relatively low, in the same range as that of Jordan in 1990 and Turkey in 1993. The share of inequality of opportunity in height in Tunisia ranges from 5 percent (types and comparable) to 15 percent (tranches), with the parametric method at 10 percent. This is in the same range as Morocco in 1987, higher than Egypt and Jordan in 1988 and 1990, respectively, and lower than Turkey in 1993 (see Appendix Tables: Table A1 in the appendix).

With respect to weight-for-height, Tunisia in 1988 has similar total inequality (0.00539) as Egypt in 1988, Jordan in 1990, Morocco in 1987 and Turkey in 1993. Its share of inequality of opportunity in 1988 ranges from 0.5% (types and comparable) to 12 percent (tranches), but is only 2% for the parametric method. Again, this range is the same as for Egypt in 1988, Jordan in 1990, but is lower than Morocco in 1987 and Turkey in 1993 (see Table A2 in the appendix).

Yemen in 1992 has higher total height inequality (0.00246) than the comparator countries save for Egypt. Its share of inequality of opportunity ranges from one percent using the types and comparable methods to 10 percent using the parametric method. Again this is in the same range as Egypt and Morocco, but higher than Jordan and lower than Turkey at a similar point in time. It is the only country where the tranches approach produces a lower estimate (6%) compared to the parametric method (see Appendix Tables: Table A1).

With respect to weight-for-height, Yemen in 1992 had similar levels of total inequality as Egypt (0.01), but nearly double the level of total inequality as the other comparator countries at similar points in time. Its share of inequality of opportunity ranges from 1% for the types and comparable parametric methods to 13 percent for the parametric reduced specification. At that level it has a much higher share than all the comparator countries at any point in time. Again, unusually, the estimate for the tranches methods for Yemen at 10% is lower than the parametric reduced specification estimate (see Table A2). These results suggest that inequality in opportunity is more likely to short-term nutritional stress in Yemen than in the other comparator countries, with the possible exception of Egypt in 2008.

7.6 Partial effects: Which circumstances are most important in determining inequality of opportunity?

The partial effects are the shares of explained inequality (relative to Θr) due to the partial effect of a certain background characteristic or group of background characteristics. They indicate how much of inequality of opportunity is due to a particular set of circumstances, such as parental wealth, or parental education. Since this kind of partial decomposition is only possible using the parametric method, we limit ourselves to this method and compare partial effects across countries over time. We use a slightly richer parametric specification in this section, one that includes father's occupation, two infrastructure variables relating to access to water and to a toilet in the home, and two additional demographic variables, mother's height and body mass index (BMI). To limit the discussion, we group circumstance variable into several groups in discussing their partial contribution. The first group, which we label "region", includes the governorate and province dummies and the urban/rural dummy and thus captures geographic differences in conditions left over after correcting for other circumstances. The second group, labeled "infrastructure" includes access to piped water in the home and to a toilet. The "demographic" group includes the child's sex and birth order, the mother's age and age squared at birth, and the mother's height and BMI. The "wealth" group includes the household wealth quintiles dummies and the final group "parents' education and occupation" includes father's and mother's education and father's occupation.

In theory, the partial effects of different sets of circumstances should all be positive and should add up to 100 percent of the inequality of opportunity component of total inequality. However, given the way we calculate these partials (see equations 8 and 9) it is possible in practice for some circumstances to contribute negatively under certain correlation structures between different sets of circumstances. This happened in our case with the partials for infrastructure in some yeas in Egypt and in Morocco. These variables were for the most part statistically insignificant determinants of child height and weight-for-height when they had negative partial effects.

The results of the partial effects decompositions for the four comparator countries and over time are shown in Figure 10. These results are reproduced in more detail in Table A3 and Table A4 in the Appendix together with their standard errors and with results for Tunisia and Yemen. As shown in Figure 10, geographic variables are the dominant driver of inequality of opportunity in Egypt in both height and weight-for-height. Its partial share in inequality of opportunity in height in Egypt increased from 34 percent in 1992 to 92 percent in 2008. Its partial share in weight-for-height inequality of opportunity is also high in Egypt, ranging from 37 percent in 1995 to 81 percent in 2008. Geography appears to play an important role in inequality of opportunity in weight-for-height in Morocco and Turkey as well, where its relative contribution is over 60 percent. The relative importance of geography as a determinant of child health suggests that public goods that affect health and that are unequally distributed in space play an important role in children's access to health and nutrition.

A child's demographics tend to play the next most important role in inequality of opportunity. Demographics play a particularly important role in Jordan, in Morocco and in Turkey and especially with respect to height. Although one can potentially target children by sex, it is harder and possibly undesirable to policy compensate for other demographic variables such as mother's height, and BMI.

Parental human capital, as measured by parental education and father's occupation, is surprisingly less important than expected. Its contribution to inequality of opportunity in height ranges from zero to 15 percent in Egypt, from 14 to 22 percent in Jordan, from 21 to 33 percent in Morocco, and from 34 to 39 percent in Turkey. It contribution to inequality of opportunity in weight-for-height is generally even lower than that.

Parental wealth is the last set of circumstances we examine. Its contribution to inequality of opportunity in height ranges from zero to 21 percent in Egypt, from 12 to 21 percent in Jordan, from 29 to 30 percent in Morocco and from 25 to 27 percent in Turkey. Again its contribution to inequality of opportunity in weight-for-height is smaller than for height.

To ascertain the relative importance of different sets of circumstances in different countries, we summarize in Table 5 the frequency with which a particular set of circumstances shows up as most important, second most important, etc... in either the height or weight-for-height decompositions. As shown in the table, the primacy of geography in Egypt is clear. In 10 out of 12 runs (five waves for height and five waves for weight-for-height) geography shows up as the most important set of circumstances for inequality of opportunity in Egypt. Demographics is second, coming out as the second most important set of circumstances 9 out of 12 times. Parent's human capital is the third most important set, coming out third 8 out of 12 times.

In Jordan demographics dominate, coming out on top in four out of six runs. Geography is next coming out on top in two out of six runs and as second most important two out of six times. Parent's human capital is third most important coming in second place in three out of six runs. In Morocco, geography comes out on top in two out of four runs, followed by demographics which came out on top once and in second place three times. Parent's human capital is third in importance in Morocco. In Turkey, first place position is divided between geography, which seems to matter most for weight-for-height and demographics, which matter most for height. Parent's human capital is next in importance.

As a general rule, the least important sets of circumstances in determining inequality of opportunity in child health and nutrition across all the four countries is household wealth and household access to infrastructure. The lack of importance of household connection to infrastructure to child health inequality is surprising, but given the importance of geography, what seems to matter most is the general state of infrastructure in the community rather than the specific access of the household itself.

7.7 Most and least advantaged child simulations

As a final exercise, we combine a variety of circumstance variable to simulate the impact of these combined circumstances on child height and weight-for-height. Unlike the previous exercise which depended on inequality decomposition, this exercise depends on predicting height or weight-for-height for children of particular pre-determined profiles. In particular, we set all the circumstance variables to their most advantageous level to simulate a "most advantaged" child and to their least advantageous level to simulate a "least advantaged" child. The difference between these two hypothetical children in a given context will illustrate the extent to which circumstances matter and therefore the importance of inequality of opportunity. These simulations are carried out with regressions using the base parametric specification discussed in section 5 above.[5] Figure 11 presents the predicted height for the

[5] For each country, the reduced specification regressions were examined for both height and weight to find both the best and worst effects of mother's education, father's education, wealth, gender, urban/rural residence, and governorate. Birth order was also maximized or minimized over the reasonable range of births; being either the first birth or third birth was simulated, depending on the effect of birth order in a country and year. Likewise, mother's age (and consequently mother's age squared) was maximized; if the maximum (or minimum, depending on the functional form mother's age and age squared took in a particular country year) was between the 5th and 95th percentiles of observed mother's ages, it was used. Otherwise the maximum or minimum was taken from the effect at the 5th or 95th percentile, whichever

most and least advantaged child for selected countries and years. Both the levels of the predictions and the dispersion between the most and least advantaged children are revealing. The fact that Yemen has the shortest height for the least advantaged child is no surprise, but what may be a surprise is that the most advantaged child in Yemen is taller than the most advantaged child in either Egypt, Jordan or Morocco. This indicates a much larger range in Yemen and therefore greater inequality of opportunity there. Tunisia does relatively well in terms of the height of the most advantaged child, is about average for the least advantaged child, but is among the worst performers on equality of opportunity in the region, based on its large gap. Turkey exhibits a similar pattern. Morocco in 2004 has the smallest gap between the least and most advantaged children, followed by Jordan and Egypt, which have fairly similar gradients.

8. Conclusions

The early years of a child's life are key to successful development. While a healthy childhood lays the groundwork for success later in life, health problems in childhood are both persistent and damaging to later outcomes. This paper has shown that children in the Arab world and Turkey face unequal opportunities to accumulate key dimensions of health, both height and weight, based on their circumstances. Circumstances entirely beyond the control of children determine their ability to develop healthily and succeed in life.

Using DHS data we examined the height and weight of children age five and younger in Egypt, Jordan, Morocco, Tunisia, Turkey and Yemen across a number of years to assess the inequality in health outcomes that is attributable to unequal circumstances. Total inequality in Egypt has been rising slightly over time, while the share of inequality of opportunity has been oscillating. 2008 was a particularly bad year for Egypt both in terms of inequality of child outcomes and inequality of opportunity, with geographic location explaining most of the explained variation in outcomes. We speculate that this is due to misguided policies about culling domestic poultry to curb the spread of bird flu, which appears to have had a disastrous and geographically uneven effect on child nutrition in Egypt. Jordan is doing fairly well in terms of both low and slightly declining total inequality, with fairly stable shares of inequality of opportunity. Morocco is experiencing rising total inequality, but the share of inequality of opportunity has risen and then fallen. Turkey, despite having fairly high inequality and a high inequality of opportunity share, has shown the most consistent declining trend in both. Comparing across countries, Morocco exhibited the highest total inequality, and Turkey the highest inequality of opportunity. Jordan demonstrated the lowest total inequality and inequality of opportunity.

Different measures, both parametric and non-parametric, indicated the same general trends. Although the non-parametric types method and the parametric method with a similar set of circumstances tended to under-estimate inequality of opportunity. We attribute this to the limited set of circumstances the size of the sample allowed us to define. On the other hand the non-parametric tranches method tends to overstate the contribution of inequality of opportunity compared to other methods. We conclude that a parametric method with as full a set of circumstances as possible is preferable. At least in our application, the functional form assumption behind the parametrization did not unduly constrain the data.

A variety of different circumstances were shown to contribute significantly to the inequality of opportunity we measured. Familial characteristics, such as parental education, wealth, and occupation did not have as big a contribution as we expected. Demographic characteristics, including child gender and birth order, as well as mother's anthropometrics, often had a large

was appropriate for a particular country and year. Because multiple births are a fairly rare occurrence, both cases used only single births. As a result, the best and worst case scenarios can be considered "reasonable extremes."

role in determining inequality of opportunity, but the largest role was reserved to geographic location. Where a child lives appears to strongly determine his/her health and nutrition outcomes. This suggests that the unequal distribution of public goods, such as water and sewer infrastructure, health facilities, and possibly food distribution channels plays a critical role in child health outcomes. Surprisingly, household-specific connections to the piped water and availability of a toilet seemed to make little difference. We conclude from this that what is important is the general level of sanitation in the community that matters rather than the household's individual access to services. The apparent importance of community-level variable to inequality of opportunity in child health requires further research to elucidate which public good deficits are most critical to child outcomes.

To assess differences between the best and worst circumstances, we used the parametric estimates of the effects of circumstances on child health outcomes to simulate height outcomes for a most and least advantaged child in a particular country. While the levels of the outcomes were not very surprising, with Yemen and Egypt faring poorly at the bottom end and Tunisia and Turkey faring best at the high end, the size of the gaps between the least and most advantaged children, which is an indication of inequality of opportunity, provided some surprises. The most unequal countries from that perspective turned out to be Yemen, the poorest country of the group and Tunisia, one of the richest.

Ideally, a society would offer equal opportunities to its citizens regardless of their circumstances. In such a society, the factors children cannot control would have no role in shaping their life outcomes. Although variation and luck would lead to different outcomes, each child would experience a similar opportunity to attain health in childhood, and would experience a fair investment in his or her development and health.

Children throughout the Arab world and Turkey face unequal opportunities to develop healthily. There is substantial scope for improving both the absolute health outcomes children face, and the inequality in health outcomes due to circumstances beyond children's control. Infants and children are at the mercy of their families and public services to provide a healthy environment. Children are blameless for their inequality of opportunity, and inequality amongst children is particularly abhorrent as well as particularly crippling. The differences between countries, such as between Jordan and Egypt, show that inequality is not necessarily a function of absolute economic development, and that countries can, with appropriate public policies, improve both the absolute level of child health and diminish inequality of opportunity.

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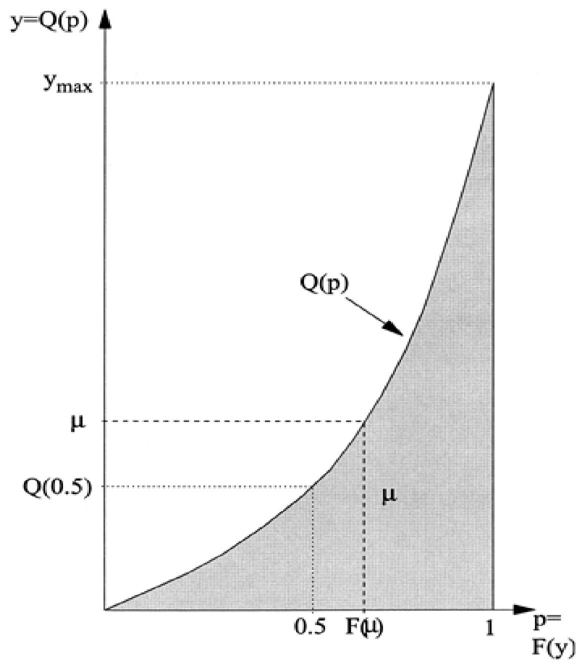
Figure 1: Height Transformation Example

Original			Zscore		Zscore		Standardized height
Height	= 95.3 cm	==>	-1.40	=	-1.40	==>	80.1 cm
for a			for a		for a		for a
Male			Male		Female		Female
46 months			46 months		24 months		24 months

Figure 2: Quantile Function



Source: Figure 3.1, Duclos and Araar 2006: 43

Figure 3: Regional Distribution by Decile of Standardized Height

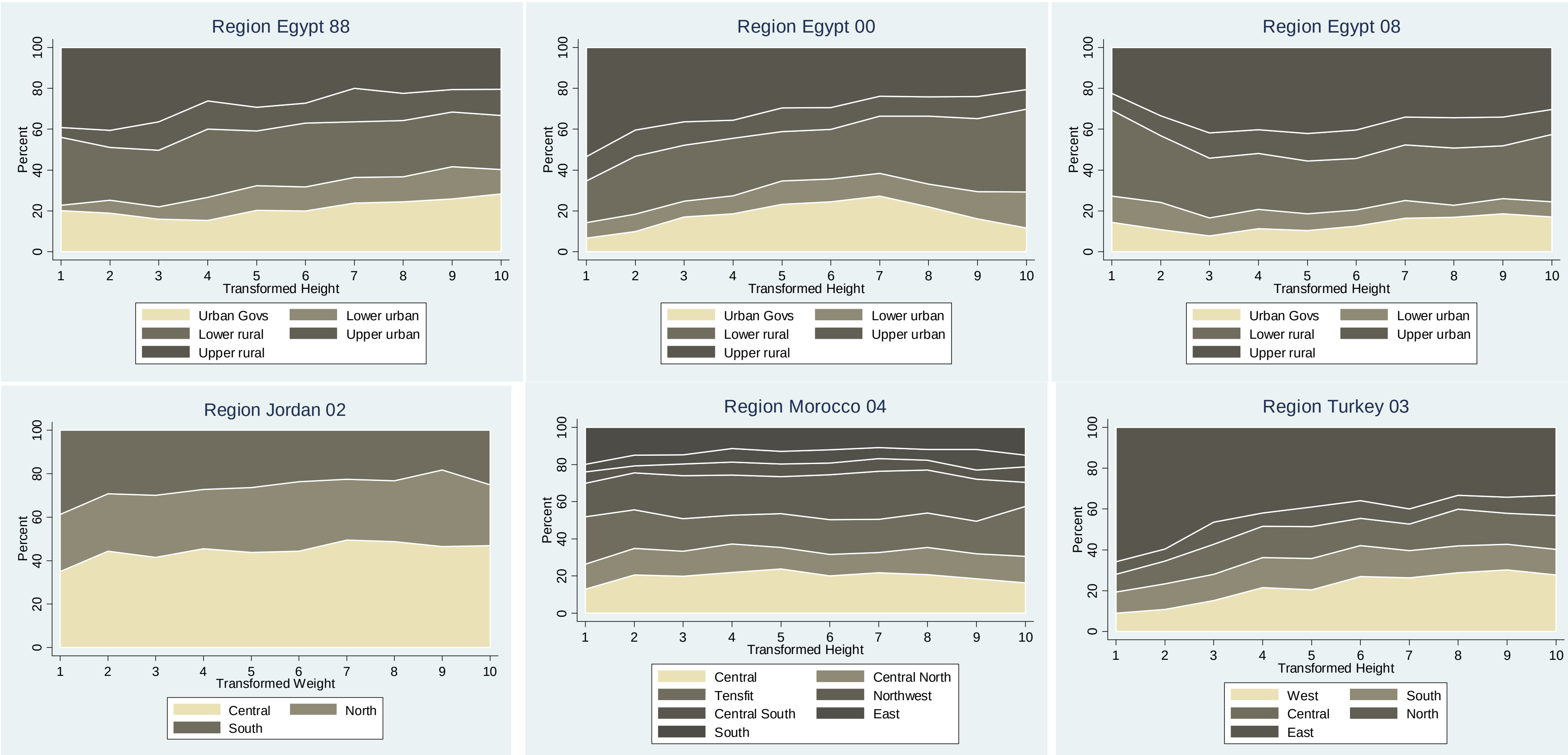


Figure 4: Wealth Distribution by Decile of Standardized Height

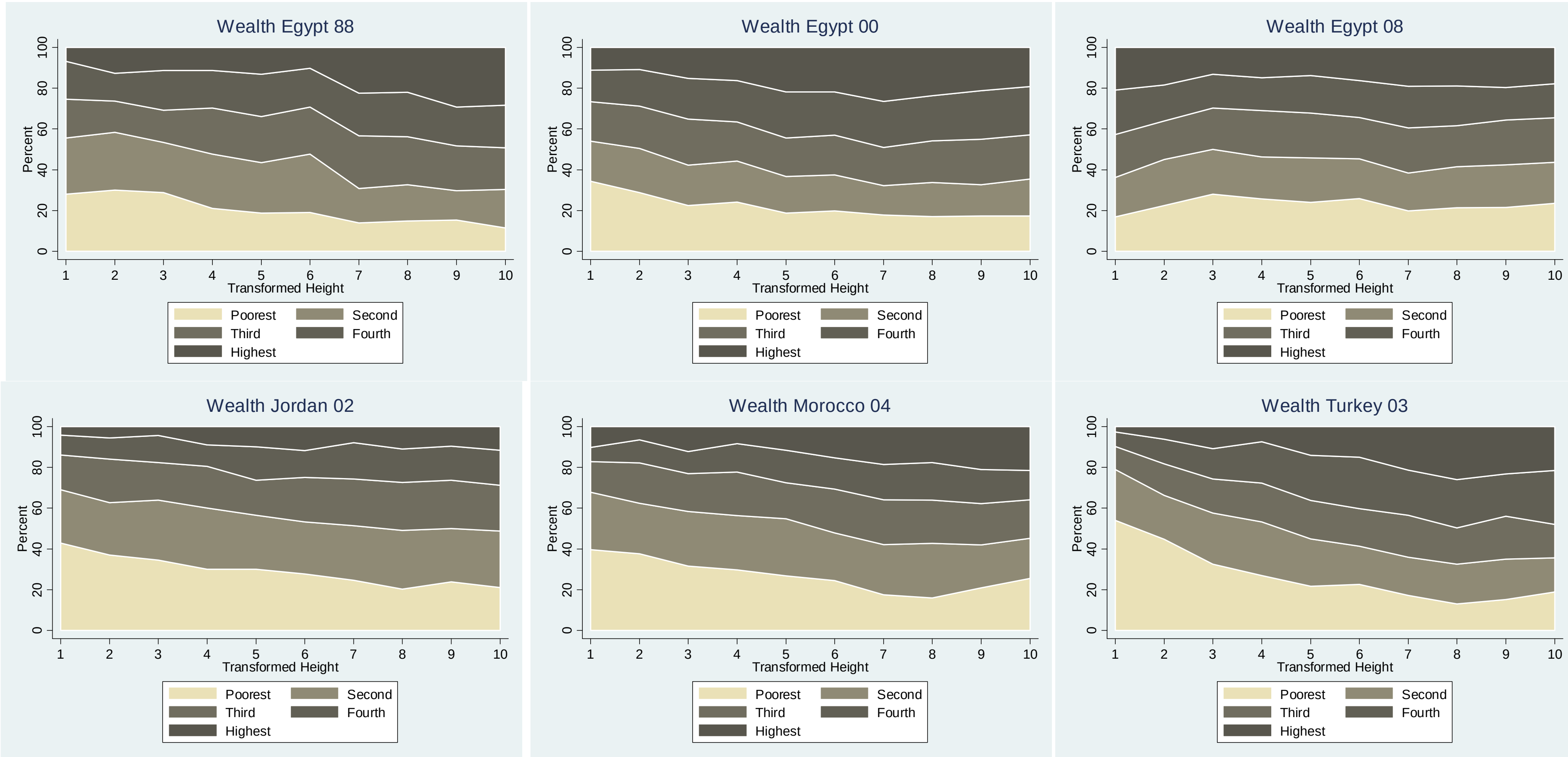


Figure 5: Mother's Education Distribution by Decile of Standardized Height

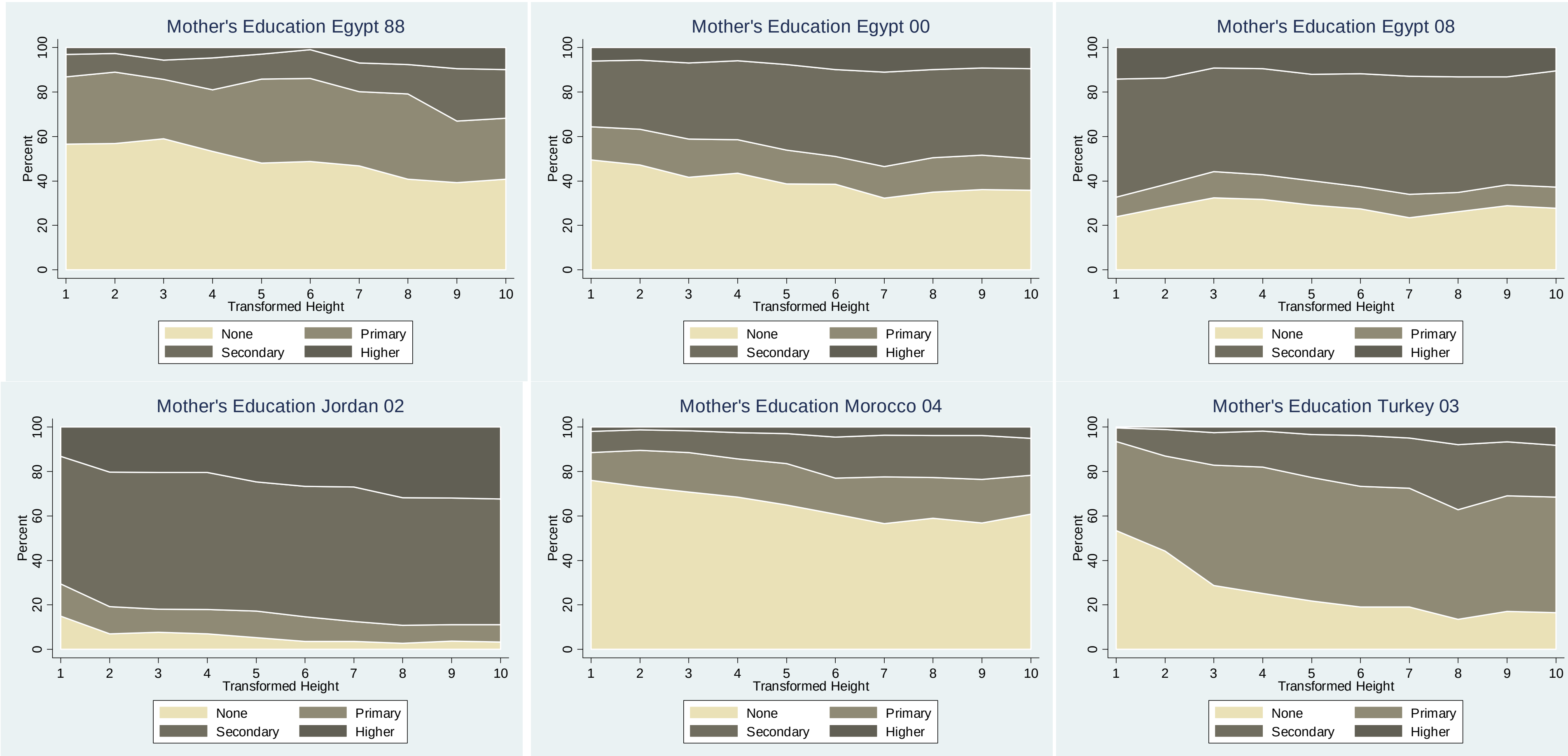
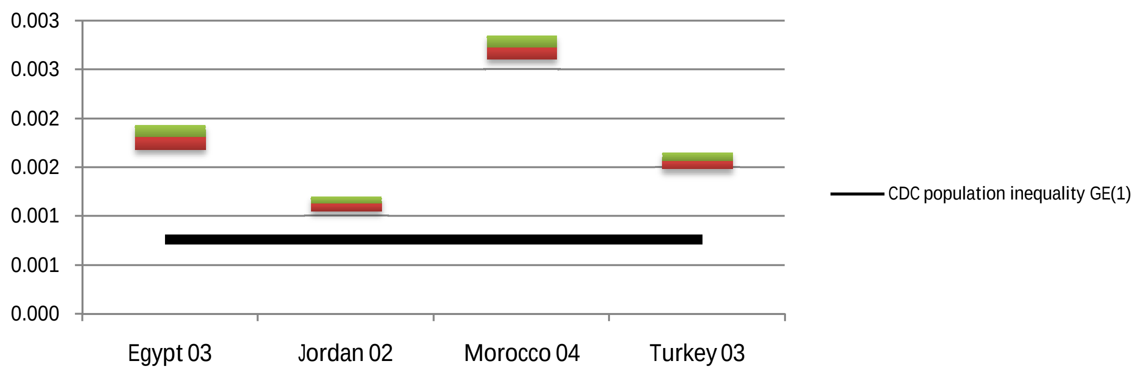


Figure 6: Total Inequality in Standardized Height and Standardized Weight-for-Height (with 95% confidence intervals) by Country as Compared to Inequality in CDC Reference Population of Healthy Children

Height



Weight-for-Height

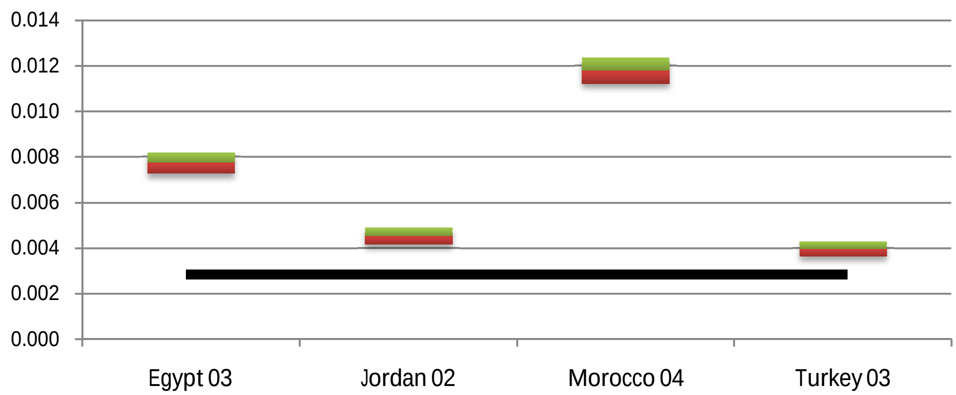
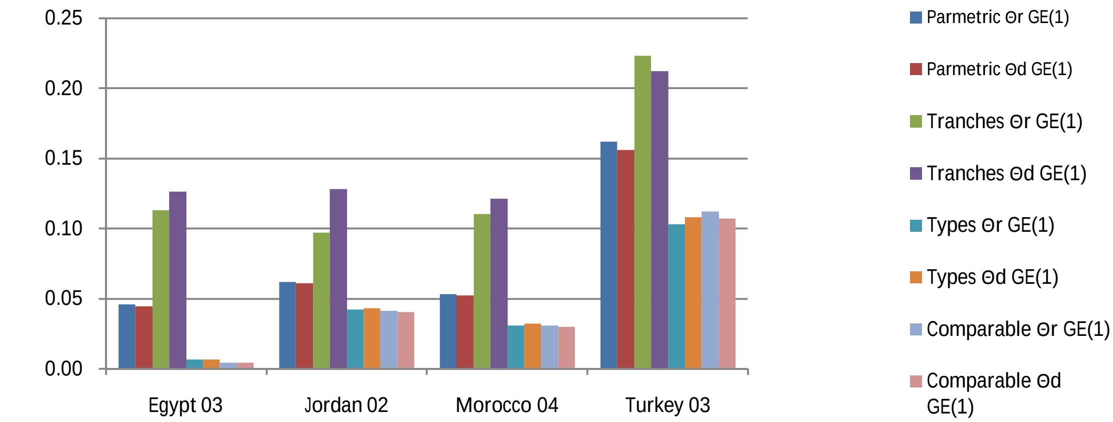


Figure 7: Country Comparison: Estimated Share of Inequality of Opportunity

Height



Weight-for-Height

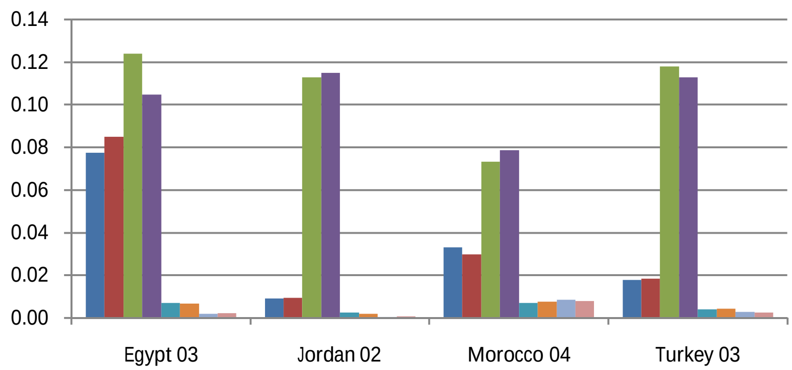
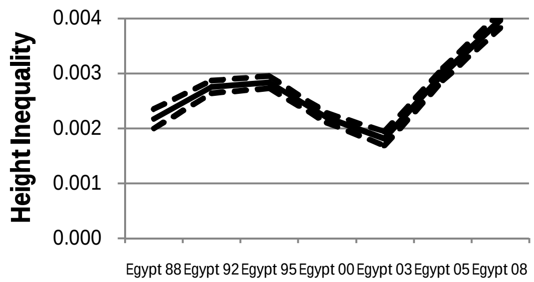
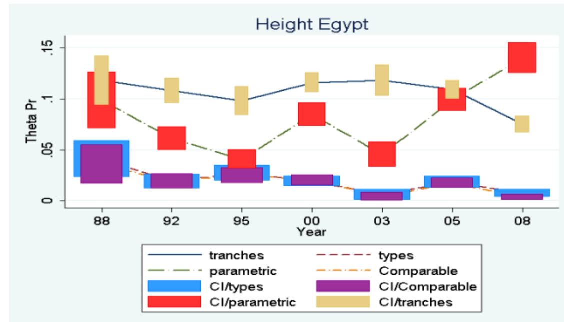


Figure 8: Trend in Total Inequality and Share of Inequality of Opportunity in Standardized Height over Time in Selected Countries (estimates and 95 percent confidence intervals)

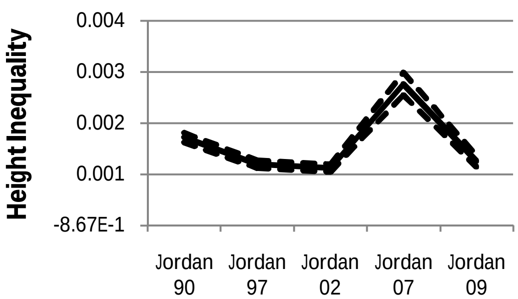
Total Inequality | **Share of Inequality of Opportunity**

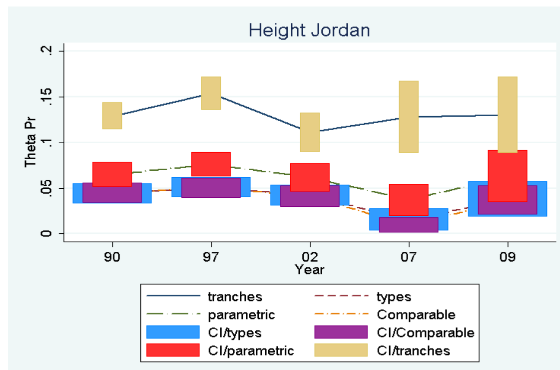
1. Egypt



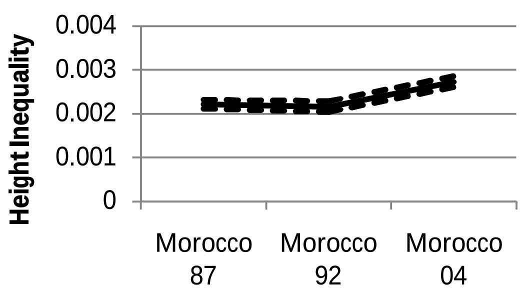


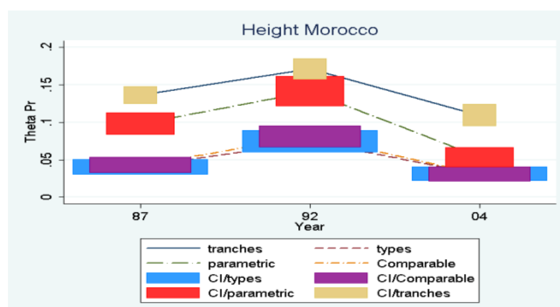
2. Jordan



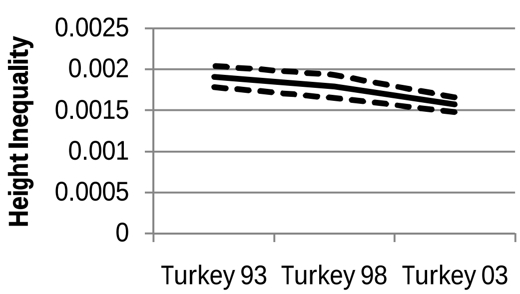


3. Morocco





4. Turkey



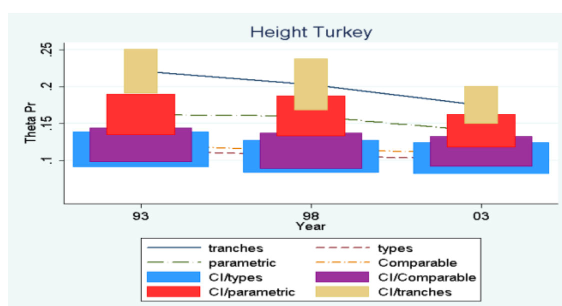


Figure 9: Trend in Total Inequality and Share of Inequality of Opportunity in Standardized Weight-for-Height over Time in Selected Countries (estimates and 95 percent confidence intervals)

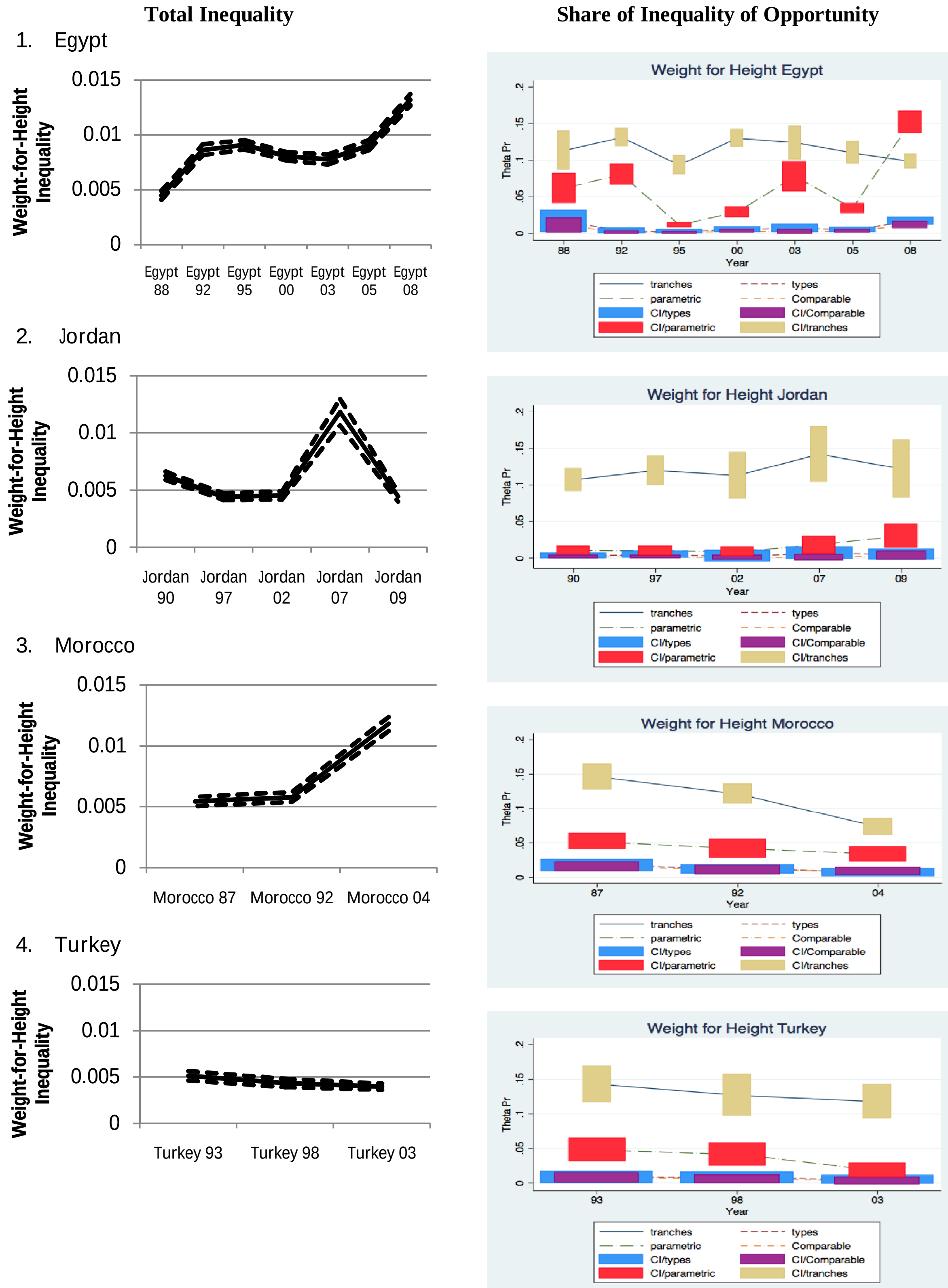


Figure 10: Partial Effects of the Contribution of Different Sets of Circumstances to Inequality of Opportunity in Standardized Height and in Weight-for-Height in Selected MENA Countries and Over Time

Standardized Height **Weight for Height**

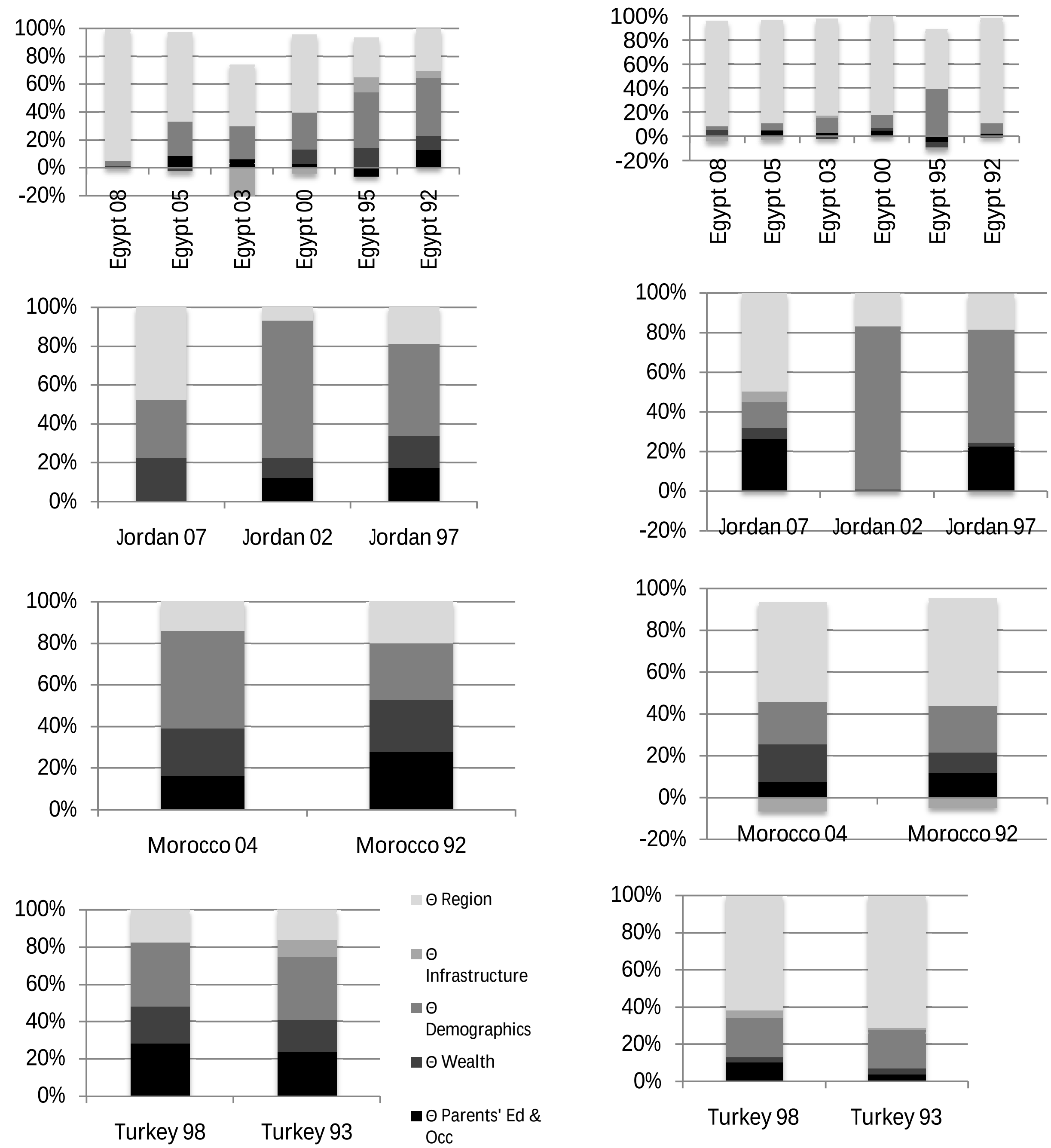


Figure 11: Most and Least Advantaged Simulations of Height, Based on All Circumstances in Reduced Specification

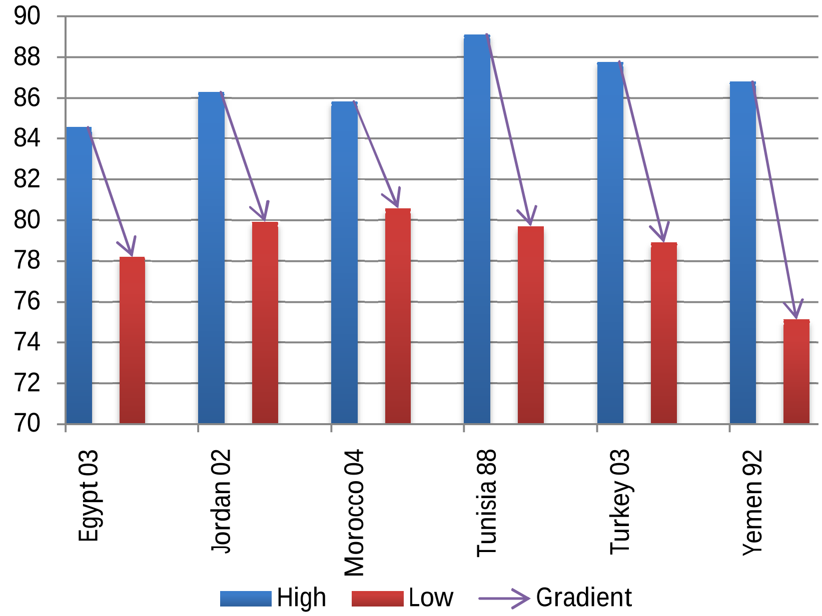


Table 1: Percent Stunted and Wasting and Mean Percentile of Height-for-Age and Weight-for-Height by Country and Year

	Height-for Age		Weight-for-Height		Per Capita GDP
	% Stunted	Mean Percentile	% Wasting	Mean Percentile	(2000 constant USD)
Egypt 08	24.4	29.1	10.6	57.0	1,786
Egypt 05	14.2	30.6	6.2	54.3	1,539
Egypt 03	11.3	26.7	9.1	45.1	1,470
Egypt 00	16.5	28.3	3.6	62.1	1,423
Egypt 95	28.2	23.8	6.0	56.4	1,214
Egypt 92	22.3	25.0	4.8	58.4	1,148
Egypt 88	27.6	20.2	3.1	55.1	1,075
Jordan 09	5.4	42.6	4.3	52.5	2,497
Jordan 07	11.3	39.5	12.1	46.7	2,378
Jordan 02	6.9	36.8	5.5	49.1	1,871
Jordan 97	6.1	35.8	5.3	47.5	1,710
Jordan 90	13.5	30.6	6.7	53.4	1,618
Morocco 04	16.3	33.2	14.4	50.3	1,499
Morocco 92	24.5	24.6	3.7	57.3	1,159
Morocco 87	31.2	22.5	5.0	49.4	1,059
Tunisia 88	18.3	30.2	7.2	46.6	1,418
Turkey 03	12.1	38.5	1.7	61.4	4,052
Turkey 98	18.3	33.5	3.0	50.3	4,012
Turkey 93	22.6	30.5	4.5	49.4	3,596
Yemen 92	46.6	18.0	19.8	38.4	449

Source: Measure DHS. Per-capita GDP is from World Bank, World Development Indicators.

Table 2: Mean Percentile of Height by Background, Egypt Jordan Morocco and Turkey

Mean Percentile	Egypt 08	Egypt 00	Egypt 88	Jordan 02	Morocco 04	Turkey 03			
Mother's Education									
No education	28.5	25.8	17.8	24.1	29.7	25.0			
Primary	27.5	27.1	18.9	30.4	36.2	39.3			
Secondary	29.2	30.7	27.6	35.9	40.3	46.3			
Higher	31.3	32.4	29.3	43.3	44.6	57.9			
Father's Education									
No education	27.6	26.0	17.6	23.9	29.0	21.3			
Primary	27.7	27.5	18.3	31.5	32.5	34.2			
Secondary	29.4	28.5	23.9	35.4	39.6	44.2			
Higher	31.2	33.3	29.5	43.6	44.2	50.4			
Residence									
Rural	27.6	27.0	17.3	31.7	28.5	30.9			
Urban	31.7	30.4	23.9	38.4	37.7	42.4			
Wealth Quintile									
Poorest	27.9	23.4	13.8	29.5	25.5	25.8			
Poorer	28.4	26.4	16.7	36.6	30.1	34.2			
Middle	29.4	28.9	20.3	39.6	33.9	40.2			
Richer	28.6	30.5	21.9	40.6	37.3	46.6			
Richest	31.6	32.8	29.5	43.2	43.2	52.5			
Region (Egypt)							**Region (Jordan)**	**Region (Morocco)**	**Region (Turkey)**
urban governorates	36.6	29.6	24.0	37.9	33.5		Central	Central	
								Central	
lower Egypt urban	23.5	34.2	25.3	35.8	34.7	46.4	North	North	West
lower Egypt rural	27.6	32.0	18.5	32.9	32.1	37.0	South	Tensfit	South
upper Egypt urban	32.6	28.0	22.4		32.4	40.7		North-west	Central
								Central	
upper Egypt rural	27.6	21.7	15.9		35.2	35.4		South	East
frontier governorates	31.2	30.2			38.1	29.2		East	North
					30.2			South	
Total	29.1	28.3	20.2	36.8	33.2	38.5			

Table 3: Percent Stunted by Background, Egypt Jordan Morocco and Turkey

Percent Stunted	Egypt 08	Egypt 00	Egypt 88	Jordan 02	Morocco 04	Turkey 03			
Mother's Education									
No education	23.4	20.2	30.3	19.3	19.6	25.8			
Primary	24.0	16.7	25.2	10.4	12.9	9.7			
Secondary	24.7	13.1	24.2	7.0	9.3	5.0			
Higher	25.6	12.0	20.7	2.9	6.6	2.3			
Father's Education									
No education	25.4	21.5	29.5	15.9	20.3	32.4			
Primary	25.0	15.3	29.3	12.5	16.5	15.0			
Secondary	24.3	16.1	20.8	7.0	10.8	7.3			
Higher	22.8	9.9	23.2	3.3	4.5	2.1			
Residence									
Rural	25.8	19.8	30.1	10.6	20.9	18.9			
Urban	21.9	11.2	24.4	5.7	11.8	8.6			
Wealth Quintile									
Poorest	23.0	25.5	34.2	11.9	26.4	25.6			
Poorer	26.7	19.0	30.5	6.7	17.5	14.5			
Middle	23.8	16.4	23.5	4.6	14.9	8.4			
Richer	24.2	11.7	27.0	5.3	9.5	3.3			
Richest	24.3	9.0	21.0	3.0	8.9	2.7			
Region (Egypt)							**Region (Jordan)**	**Region (Mor.)**	**Region (Turkey)**
Urban governorates	18.3	6.3	30.3	6.1	14.4	4.6	Central	Central	West
Lower Egypt urban	33.9	12.6	15.7	7.9	16.3	11.5	North	Central-North	South
Lower Egypt rural	29.8	15.8	25.3	8.9	21.0	9.6	South	Tensfit	Central
Upper Egypt urban	14.7	16.7	21.5		15.5	12.7		North-west	East
Upper Egypt rural	21.6	24.2	36.0		10.5	22.7		Central-South	North
Frontier governorates	25.7	17.3			11.6			East	
					19.3			South	
Total	24.4	16.5	27.6	6.9	16.3	12.1			

Table 4: Percent Stunted and Mean Height Percentile by Background, Tunisia and Yemen

	Percent Stunted		Mean Percentile		
	Tunisia 1988	Yemen 1992	Tunisia 1988	Yemen 1992	
Mother's Education					
No education	23.9	49.8	26.3	16.7	
Primary	13.1	32.6	31.3	22.3	
Secondary	6.7	11.0	46.6	32.9	
Higher	0.0	3.6	65.1	43.8	
Father's Education					
No education	22.4	51.6	25.3	15.7	
Primary	20.2	41.9	28.7	19.5	
Secondary	9.9	33.8	36.8	23.2	
Higher	4.0	24.5	52.9	24.8	
Residence					
Rural	26.4	51.5	24.2	17.1	
Urban	10.5	33.3	36.3	20.4	
Wealth Quintile					
Poorest	27.6	52.3	26.2	18.5	
Poorer	26.5	50.3	23.2	17.5	
Middle	11.7	60.2	32.1	16.6	
Richer	10.3	43.5	36.3	15.9	
Richest	5.8	32.8	40.3	20.5	
Region (Tunisia)					**Region (Yemen)**
Tunis	2.4	33.7	42.9	15.3	Sanaa City
Northeast	20.2	13.0	33.1	31.4	Aden
Northwest	11.6	51.7	27.7	17.8	Highlands
Central	22.2	51.5	28.0	11.1	West
Sahel	24.8	56.3	26.5	14.9	North
South	28.1	47.2	24.3	21.3	South
		19.5		28.8	East
Total	18.3	46.6	30.2	18.0	

Table 5: Circumstance Height and Weight-for-Height Inequality Relative Importance by Country

Height + Weight-for-Height	Most Important	2	3	4	Least Important
Egypt					
Parents' Education & Occupation	0	0	8	3	1
Wealth	0	1	2	5	4
Demographics	2	9	1	0	0
Infrastructure	0	0	1	4	7
Geography	10	2	0	0	0
Height + Weight-for-Height					
Jordan					
Parents' Education & Occupation	0	3	1	2	0
Wealth	0	0	2	3	1
Demographics	4	1	1	0	0
Infrastructure	0	0	1	0	5
Geography	2	2	1	1	0
Height + Weight-for-Height					
Morocco					
Parents' Education & Occupation	1	0	2	1	0
Wealth	0	1	2	1	0
Demographics	1	3	0	0	0
Infrastructure	0	0	0	0	4
Geography	2	0	0	2	0
Height + Weight-for-Height					
Turkey					
Parents' Education & Occupation	0	2	2	0	0
Wealth	0	0	2	1	1
Demographics	2	2	0	0	0
Infrastructure	0	0	0	1	3
Geography	2	0	0	2	0

Appendix Tables:

Table A1: Total Standardized Height Inequality using the GE(1) Inequality Measure and the Share of Inequality of Opportunity (θ) Using Various Decomposition Methodologies

HEIGHT	Egypt 08	Egypt 05	Egypt 03	Egypt 00	Egypt 95	Egypt 92	Egypt 88
Total Ineq. GE(1)	0.00397***	0.00298***	0.00181***	0.00219***	0.00284***	0.00275***	0.00217***
	(0.0000747)	(0.0000582)	(0.0000650)	(0.0000445)	(0.0000592)	(0.0000602)	(0.0000877)
Parametric Reduced							
ΘPr1	0.140***	0.0990***	0.0455***	0.0846***	0.0407***	0.0611***	0.0988***
	(0.00772)	(0.00569)	(0.00640)	(0.00584)	(0.00481)	(0.00588)	(0.0141)
ΘPd1	0.142***	0.102***	0.0442***	0.0825***	0.0399***	0.0632***	0.0954***
	(0.00777)	(0.00568)	(0.00633)	(0.00573)	(0.00476)	(0.00598)	(0.0138)
Non-Parametric Tranches							
ΘPr1	0.0751***	0.109***	0.118***	0.116***	0.0982***	0.108***	0.118***
	(0.00431)	(0.00456)	(0.00790)	(0.00490)	(0.00716)	(0.00628)	(0.0123)
ΘPd1	0.0684***	0.112***	0.125***	0.117***	0.0981***	0.112***	0.122***
	(0.00270)	(0.00336)	(0.00650)	(0.00442)	(0.00505)	(0.00518)	(0.0126)
Non-Parametric Types							
ΘPr1	0.00758***	0.0186***	0.00624*	0.0193***	0.0274***	0.0190***	0.0411***
	(0.00198)	(0.00292)	(0.00268)	(0.00264)	(0.00400)	(0.00357)	(0.00913)
ΘPd1	0.00731***	0.0188***	0.00646*	0.0205***	0.0283***	0.0204***	0.0420***
	(0.00195)	(0.00291)	(0.00268)	(0.00273)	(0.00410)	(0.00369)	(0.00935)

HEIGHT	Jordan 09	Jordan 07	Jordan 02	Jordan 97	Jordan 90
Total Ineq. GE(1)	0.00126***	0.00277***	0.00113***	0.00120***	0.00172***
	(0.0000570)	(0.000110)	(0.0000380)	(0.0000368)	(0.0000472)
Parametric Reduced					
ΘPr1	0.0630***	0.0371***	0.0617***	0.0761***	0.0648***
	(0.0147)	(0.00893)	(0.00788)	(0.00681)	(0.00696)
ΘPd1	0.0616***	0.0347***	0.0608***	0.0755***	0.0646***
	(0.0147)	(0.00873)	(0.00784)	(0.00676)	(0.00700)
Non-Parametric Tranches					
ΘPr1	0.130***	0.128***	0.111***	0.154***	0.129***
	(0.0214)	(0.0202)	(0.0110)	(0.00934)	(0.00760)
ΘPd1	0.130***	0.112***	0.128***	0.157***	0.145***
	(0.0133)	(0.0100)	(0.00854)	(0.00828)	(0.00708)
Non-Parametric Types					
ΘPr1	0.0379***	0.0153*	0.0420***	0.0509***	0.0441***
	(0.00977)	(0.00613)	(0.00591)	(0.00575)	(0.00553)
ΘPd1	0.0390***	0.0151*	0.0428***	0.0514***	0.0450***
	(0.00987)	(0.00612)	(0.00594)	(0.00579)	(0.00559)

Notes: *p<.05 **p<.01 ***p<.001

Table A1: Total Standardized Height Inequality using the GE(1) Inequality Measure and the Share of Inequality of Opportunity (θ) Using Various Decomposition Methodologies (Contn'd)

HEIGHT	**Morocco 04**	**Morocco 92**	**Morocco 87**	**Tunisia 88**	**Turkey 03**	**Turkey 98**	**Turkey 93**	**Yemen 92**
Total Inequality								
GE(1)	0.00273***	0.00216***	0.00222***	0.00185***	0.00157***	0.00179***	0.00191***	0.00246***
	(0.0000633)	(0.0000641)	(0.0000522)	(0.0000733)	(0.0000449)	(0.0000704)	(0.0000649)	(0.0000750)
Parametric Reduced								
ΘPr1	0.0531***	0.141***	0.0979***	0.0996***	0.140***	0.160***	0.162***	0.107***
	(0.00695)	(0.0102)	(0.00750)	(0.0134)	(0.0116)	(0.0140)	(0.0143)	(0.0126)
ΘPd1	0.0521***	0.137***	0.0951***	0.0987***	0.134***	0.153***	0.156***	0.108***
	(0.00689)	(0.0102)	(0.00740)	(0.0132)	(0.0114)	(0.0135)	(0.0141)	(0.0128)
Non-Parametric Tranches								
ΘPr1	0.109***	0.171***	0.136***	0.153***	0.175***	0.203***	0.221***	0.0735***
	(0.00754)	(0.00719)	(0.00604)	(0.0119)	(0.0131)	(0.0180)	(0.0153)	(0.00919)
ΘPd1	0.120***	0.175***	0.140***	0.153***	0.201***	0.207***	0.211***	0.0534***
	(0.00654)	(0.00743)	(0.00611)	(0.0118)	(0.0103)	(0.0147)	(0.0129)	(0.00551)
Non-Parametric Types								
ΘPr1	0.0308***	0.0747***	0.0402***	0.0521***	0.103***	0.105***	0.115***	0.00932*
	(0.00482)	(0.00756)	(0.00511)	(0.0103)	(0.0110)	(0.0113)	(0.0123)	(0.00408)
ΘPd1	0.0319***	0.0782***	0.0427***	0.0530***	0.108***	0.111***	0.121***	0.00998*
	(0.00487)	(0.00764)	(0.00529)	(0.0104)	(0.0111)	(0.0116)	(0.0126)	(0.00416)

Notes: *p<.05 **p<.01 ***p<.001

Table A2: Total Standardized Weight–for-Height Inequality using the GE(1) Inequality Measure and the Share of Inequality of Opportunity (θ) Using Various Decomposition Methodologies

	Egypt 08	Egypt 05	Egypt 03	Egypt 00	Egypt 95	Egypt 92	Egypt 88
Total Ineq. GE(1)	0.0126***	0.0112***	0.00941***	0.00958***	0.0126***	0.0145***	0.0104***
	(0.000305)	(0.000239)	(0.000363)	(0.000230)	(0.000264)	(0.000339)	(0.000407)
Parametric Reduced							
ΘPr1	0.0736***	0.0836***	0.0962***	0.0714***	0.0312***	0.107***	0.102***
	(0.00505)	(0.00470)	(0.0102)	(0.00544)	(0.00395)	(0.00820)	(0.0137)
ΘPd1	0.0745***	0.0901***	0.103***	0.0721***	0.0302***	0.121***	0.0976***
	(0.00534)	(0.00509)	(0.0104)	(0.00564)	(0.00399)	(0.00864)	(0.0138)
Non-Parametric Tranches							
ΘPr1	0.114***	0.121***	0.129***	0.115***	0.0917***	0.0933***	0.123***
	(0.00722)	(0.00703)	(0.0131)	(0.00557)	(0.00611)	(0.00593)	(0.0126)
ΘPd1	0.103***	0.105***	0.118***	0.104***	0.0962***	0.0886***	0.126***
	(0.00469)	(0.00447)	(0.00909)	(0.00392)	(0.00451)	(0.00427)	(0.0122)
Non-Parametric Types							
ΘPr1	0.0118***	0.0148***	0.0115**	0.0143***	0.0144***	0.00931***	0.0465***
	(0.00307)	(0.00268)	(0.00380)	(0.00265)	(0.00317)	(0.00273)	(0.00929)
ΘPd1	0.0113***	0.0146***	0.0117***	0.0152***	0.0151***	0.0111***	0.0496***
	(0.00273)	(0.00253)	(0.00356)	(0.00257)	(0.00315)	(0.00273)	(0.00943)

WEIGHT	**Jordan 09**	**Jordan 07**	**Jordan 02**	**Jordan 97**	**Jordan 90**
Total Ineq. GE(1)	0.00749***	0.0132***	0.00747***	0.00763***	0.00851***
	(0.000290)	(0.000813)	(0.000248)	(0.000211)	(0.000214)
Parametric Reduced					
ΘPr1	0.0424***	0.0263***	0.0367***	0.0498***	0.0454***
	(0.0114)	(0.00777)	(0.00561)	(0.00587)	(0.00539)
ΘPd1	0.0422***	0.0265**	0.0357***	0.0503***	0.0459***
	(0.0117)	(0.00829)	(0.00559)	(0.00612)	(0.00543)
Non-Parametric Tranches					
ΘPr1	0.0846***	0.145***	0.0809***	0.116***	0.114***
	(0.0195)	(0.0213)	(0.0108)	(0.00926)	(0.00860)
ΘPd1	0.0809***	0.116***	0.0969***	0.117***	0.120***
	(0.00961)	(0.00997)	(0.00665)	(0.00700)	(0.00687)
Non-Parametric Types					
ΘPr1	0.0226*	0.0138*	0.0199***	0.0355***	0.0331***
	(0.00879)	(0.00560)	(0.00439)	(0.00511)	(0.00476)
ΘPd1	0.0225**	0.0150**	0.0210***	0.0361***	0.0339***
	(0.00857)	(0.00556)	(0.00442)	(0.00509)	(0.00475)

Notes: *p<.05 **p<.01 ***p<.001

Table A2: Total Standardized Weight–for-Height Inequality using the GE(1) Inequality Measure and the Share of Inequality of Opportunity (θ) Using Various Decomposition Methodologies (Contn'd)

WEIGHT	Morocco 04	Morocco 92	Morocco 87	Tunisia 88	Turkey 03	Turkey 98	Turkey 93	Yemen 92
Total Ineq.								
GE(1)	0.0123***	0.0115***	0.0111***	0.0105***	0.00879***	0.00981***	0.0105***	0.00965***
	(0.000291)	(0.000339)	(0.000317)	(0.000483)	(0.000313)	(0.000369)	(0.000406)	(0.000376)
Parametric Reduced								
ΘPr1	0.0959***	0.142***	0.112***	0.0787***	0.0911***	0.123***	0.125***	0.0596***
	(0.00822)	(0.00992)	(0.00853)	(0.0126)	(0.0100)	(0.0125)	(0.0126)	(0.00945)
ΘPd1	0.0934***	0.140***	0.107***	0.0766***	0.0888***	0.118***	0.120***	0.0610***
	(0.00821)	(0.0101)	(0.00857)	(0.0125)	(0.0103)	(0.0120)	(0.0124)	(0.00976)
Non-Parametric Tranches								
ΘPr1	0.122***	0.168***	0.139***	0.142***	0.144***	0.168***	0.179***	0.0882***
	(0.00859)	(0.00804)	(0.00912)	(0.0137)	(0.0141)	(0.0149)	(0.0128)	(0.0120)
ΘPd1	0.135***	0.168***	0.141***	0.137***	0.155***	0.176***	0.167***	0.0711***
	(0.00756)	(0.00761)	(0.00846)	(0.0126)	(0.0100)	(0.0129)	(0.0111)	(0.00779)
Non-Parametric Types								
ΘPr1	0.0525***	0.0680***	0.0443***	0.0417***	0.0666***	0.0758***	0.0722***	0.00784*
	(0.00719)	(0.00785)	(0.00622)	(0.0105)	(0.00938)	(0.0107)	(0.0115)	(0.00360)
ΘPd1	0.0564***	0.0738***	0.0501***	0.0440***	0.0700***	0.0811***	0.0794***	0.00825*
	(0.00711)	(0.00759)	(0.00626)	(0.0105)	(0.00907)	(0.0111)	(0.0114)	(0.00356)

Notes: *p<.05 **p<.01 ***p<.001

Table A3: Standardized Height Partial Effects as a Share of Θr for Base Specification GE(1)

HEIGHT	Egypt 08	Egypt 05	Egypt 03	Egypt 00	Egypt 95	Egypt 92
Θ Father's Education	-0.000281	0.0255	0.0262	0.00972	0.00907	0.0567
	(0.00383)	(0.0210)	(0.0273)	(0.0268)	(0.0611)	(0.0463)
Θ Mother's Education	-0.00285	0.0749**	0.0387	-0.0416	-0.0416	0.0870
	(0.00447)	(0.0246)	(0.0328)	(0.0335)	(0.0701)	(0.0462)
Θ Father's Occupation	0.0128	0.0144	0.0130	0.0548**	-0.0564	0.00918
	(0.00699)	(0.0218)	(0.0293)	(0.0209)	(0.0501)	(0.0357)
Θ Parent's Education and Occupation	0.00868	0.104***	0.0792	0.0365	-0.0942	0.147***
	(0.00836)	(0.0251)	(0.0434)	(0.0309)	(0.0802)	(0.0405)
Θ Wealth	0.00382	-0.0284	0.00499	0.133**	0.208*	0.110*
	(0.00754)	(0.0460)	(0.0621)	(0.0418)	(0.0956)	(0.0544)
Θ Demographics	0.0411**	0.306***	0.313***	0.337***	0.604***	0.476***
	(0.0125)	(0.0302)	(0.0676)	(0.0356)	(0.0578)	(0.0434)
Θ Infrastructure	-0.00451	-0.00289	-0.338**	-0.0529	0.160*	0.0564
	(0.00728)	(0.0372)	(0.109)	(0.0456)	(0.0815)	(0.0541)
Θ Geography	0.923***	0.785***	0.589***	0.715***	0.434***	0.345***
	(0.0156)	(0.0257)	(0.0614)	(0.0354)	(0.0617)	(0.0609)
N	9736	12206	5738	9977	10388	7457

HEIGHT	Jordan 07	Jordan 02	Jordan 97	Morocco 04	Morocco 92	Turkey 98	Turkey 93
Θ Father's Education	-0.0788	0.0222	-0.00120	0.0818	0.172***	0.205***	0.110*
	(0.101)	(0.0549)	(0.0395)	(0.0546)	(0.0451)	(0.0558)	(0.0470)
Θ Mother's Education	0.114	0.0802*	0.168***	-0.0122	0.145***	0.268***	0.262***
	(0.0600)	(0.0386)	(0.0344)	(0.0627)	(0.0417)	(0.0520)	(0.0509)
Θ Father's Occupation	0.0912	0.0516	0.0611	0.146**	0.0690	-0.0468	-0.00848
	(0.0675)	(0.0337)	(0.0348)	(0.0506)	(0.0364)	(0.0341)	(0.0338)
Θ Parent's Education and Occupation	0.156	0.141***	0.217***	0.207**	0.334***	0.386***	0.340***
	(0.0837)	(0.0388)	(0.0414)	(0.0689)	(0.0408)	(0.0596)	(0.0562)
Θ Wealth	0.201*	0.119**	0.211***	0.299***	0.298***	0.274***	0.245***
	(0.0902)	(0.0404)	(0.0448)	(0.0800)	(0.0709)	(0.0595)	(0.0632)
Θ Demographics	0.273**	0.815***	0.604***	0.609***	0.330***	0.474***	0.482***
	(0.0857)	(0.0309)	(0.0425)	(0.0536)	(0.0407)	(0.0546)	(0.0538)
Θ Infrastructure	0.0974	0.0363	0.0420	-0.0587	0.0958	-0.0748	0.125*
	(0.0631)	(0.0242)	(0.0321)	(0.0795)	(0.0644)	(0.0385)	(0.0489)
Θ Geography	0.432***	0.0806**	0.241***	0.184*	0.244***	0.241***	0.236***
	(0.0967)	(0.0297)	(0.0369)	(0.0868)	(0.0732)	(0.0577)	(0.0658)
N	4434	4633	5635	5433	4573	2760	3147

Notes: *p<.05 **p<.01 ***p<.001

Table A4: Standardized Weight-for-Height Partial Effects as a Share of Θr for Base Specification GE(1)

WEIGHT	Egypt 08	Egypt 05	Egypt 03	Egypt 00	Egypt 95	Egypt 92
Θ Father's Education	0.0612**	0.0536**	0.0206	-0.0102	0.0559	0.0269
	(0.0217)	(0.0175)	(0.0193)	(0.0218)	(0.0447)	(0.0230)
Θ Mother's Education	0.000826	0.0397	-0.00315	0.0258	0.0366	0.0544*
	(0.0335)	(0.0256)	(0.0224)	(0.0268)	(0.0492)	(0.0211)
Θ Father's Occupation	-0.0231	0.00157	0.0345	-0.00587	-0.0591	-0.00706
	(0.0214)	(0.0179)	(0.0193)	(0.0143)	(0.0361)	(0.0176)
Θ Parent's Education and Occupation	0.0490	0.0820***	0.0495	0.0116	0.0411	0.0727***
	(0.0308)	(0.0233)	(0.0279)	(0.0256)	(0.0528)	(0.0205)
Θ Wealth	0.0839*	-0.0964*	0.0469	0.117***	-0.0841	0.0425
	(0.0380)	(0.0464)	(0.0275)	(0.0301)	(0.110)	(0.0219)
Θ Demographics	0.158***	0.384***	0.248***	0.368***	0.644***	0.256***
	(0.0281)	(0.0388)	(0.0377)	(0.0397)	(0.0528)	(0.0325)
Θ Infrastructure	-0.0393	0.0435	-0.0675	-0.0235	0.173***	0.0397
	(0.0520)	(0.0304)	(0.0417)	(0.0364)	(0.0513)	(0.0236)
Θ Geography	0.810***	0.742***	0.784***	0.677***	0.374***	0.561***
	(0.0303)	(0.0328)	(0.0385)	(0.0431)	(0.0499)	(0.0534)
N	9736	12206	5738	9977	10388	7457

WEIGHT	Jordan 07	Jordan 02	Jordan 97	Morocco 04	Morocco 92	Turkey 98	Turkey 93
Θ Father's Education	-0.269	-0.00948	0.0808	0.101*	0.155***	0.134*	0.111*
	(0.159)	(0.0593)	(0.0463)	(0.0492)	(0.0407)	(0.0571)	(0.0499)
Θ Mother's Education	0.257***	0.0354	0.155***	0.0381	0.120**	0.288***	0.199***
	(0.0743)	(0.0447)	(0.0406)	(0.0473)	(0.0441)	(0.0535)	(0.0540)
Θ Father's Occupation	0.256**	0.0353	0.0377	-0.0107	0.0707*	-0.0256	0.00650
	(0.0882)	(0.0362)	(0.0412)	(0.0370)	(0.0313)	(0.0395)	(0.0348)
Θ Parent's Education and Occupation	0.417***	0.0571	0.240***	0.127*	0.302***	0.363***	0.286***
	(0.0931)	(0.0530)	(0.0408)	(0.0562)	(0.0426)	(0.0617)	(0.0589)
Θ Wealth	0.349**	0.116*	0.162***	0.437***	0.263***	0.209**	0.192**
	(0.115)	(0.0471)	(0.0452)	(0.0465)	(0.0702)	(0.0716)	(0.0689)
Θ Demographics	0.191*	0.765***	0.658***	0.467***	0.364***	0.398***	0.326***
	(0.0868)	(0.0476)	(0.0394)	(0.0433)	(0.0472)	(0.0576)	(0.0549)
Θ Infrastructure	-0.0750*	0.0458	0.0238	-0.155*	0.0647	-0.0391	0.0673
	(0.0367)	(0.0338)	(0.0294)	(0.0728)	(0.0693)	(0.0392)	(0.0411)
Θ Geography	0.215**	0.171***	0.174***	0.340***	0.312***	0.367***	0.410***
	(0.0680)	(0.0384)	(0.0325)	(0.0726)	(0.0662)	(0.0589)	(0.0646)
N	4434	4633	5635	5433	4573	2760	3147

Notes: *p<.05 **p<.01 ***p<.001

Table A5: Cells used for Types and Tranches Non-Parametric Decomposition

Group (2 urb/rur. cats x 3 wealth cats x 3 mother's ed. cats) Egypt combinations	Country-Year Egypt 08 No.	Egypt 05 No.	Egypt 03 No.	Egypt 00 No.	Egypt 95 No.	Egypt 92 No.	Egypt 88 No.	Group (2 urb/rur. cats x 3 wealth cats x 3 mother's ed. cats) Jordan combinations	Country-Year Jordan 09 No.	Jordan 07 No.	Jordan 02 No.	Jordan 97 No.	Jordan 90 No.
0 1 1	1,330	1,938	1,093	1,648	2,206	1,337	289	0 1 1	68	76	136	182	324
0 1 2	267	409	236	299	411	285	72	0 1 2	88	78	126	122	134
0 1 3	504	514	210	185	95	29	3	0 1 3	586	478	346	290	163
0 2 1	944	1,447	736	1,477	1,866	1,395	396	0 2 1&2	37	100	149	128	588
0 2 2	391	629	346	554	782	610	215						
0 2 3	1,942	2,035	859	1,122	614	317	34	0 2 3	485	620	602	379	448
0 3 1	61	123	78	160	176	179	22	0 3 1&2&3	137	175	258	196	538
0 3 2	47	81	52	124	154	172	41						115
0 3 3	1,040	1,072	487	746	595	341	43						318
1 1 1	155	189	100	145	144	131	20	1 1 1	61	65	62	95	143
1 1 2&3	95	111	38	39	30	46	9	1 1 2	82	104	113	158	129
								1 1 3	584	781	672	514	217
1 2 1	256	393	187	430	504	437	106	1 2 1	14	25	36	78	352
1 2 2	149	192	112	197	299	273	90	1 2 2	65	85	106	235	476
1 2 3	590	664	268	312	244	194	22	1 2 3	1,347	1,397	1,469	1,704	1,228
1 3 1	119	192	104	375	274	297	129	1 3 1&2	15	14	51	117	490
1 3 2	136	266	119	409	448	451	202						
1 3 3	2,222	2,735	1,188	2,416	1,856	1,138	276	1 3 3	682	648	783	1,449	1,511
Total	10,248	12,990	6,213	10,638	10,698	7,632	1,969	Total	4,251	4,646	4,909	5,647	6,741

Table A5: Cells used for Types and Tranches Non-Parametric Decomposition (Contn'd)

Group (2 urb/rur. cats x 3 wealth cats x 3 mother's ed. cats) Morocco combinations	**Morocco 04 No.**	**Morocco 92 No.**	**Morocco 87 No.**	**Group (2 urb/rur. cats x 3 wealth cats x 3 mother's ed. cats) Tunisia combinations**	**Tunisia 88 No.**	**Group (2 urb/rur. cats x 3 wealth cats x 3 mother's ed. cats) Turkey combinations**	**Turkey 03 No.**	**Turkey 98 No.**	**Turkey 93 No.**	**Group (2 urb/rur. cats x 3 wealth cats x 3 mother's ed cats) Yemen combinations**	**Yemen 92 No.**	
0 1 1	1,357	1,122	1,633	0 1 1	342	0 1 1	377	202	294	0 1 1&2&3	384	0 1 1
0 1 2&3	138	16	27	0 1 2&3	61	0 1 2	255	240	244			0 1 2
						0 1 3	17	14	6			0 1 3
0 2 1	1,191	1,564	1,297	0 2 1	381	0 2 1	123	79	153	0 2 1&2&3	736	0 2 1
0 2 2 & 3	392	106	60	0 2 2&3	132	0 2 2	332	323	428			0 2 2
						0 2 3	33	53	26			0 2 3
0 3 1	32	156	439	0 3 1	56	0 3 1&2	140	50	89	0 3 1&2&3	516	0 3 1
0 3 2	20	35	45	0 3 2	40							0 3 2
0 3 3	24	19	21	0 3 3	16	0 3 3	44	25	28			0 3 3
1 1 1	19	11	46	1 1 1	78	1 1 1	254	98	93	1 1 1&2&3	3	1 1 1
1 1 2				1 1 2&3	52	1 1 2&3	215	100	42			1 1 2
1 1 3												1 1 3
1 2 1	586	286	405	1 2 1	147	1 2 1	256	247	272	1 2 1&2&3	59	1 2 1
1 2 2	199	53	72	1 2 2	195	1 2 2	635	504	467			1 2 2
1 2 3	126	11	19	1 2 3	30	1 2 3	201	104	70			1 2 3
1 3 1	441	624	761	1 3 1	104	1 3 1	50	33	73	1 3 1&2&3	776	1 3 1
1 3 2	345	264	293	1 3 2	265	1 3 2	524	380	491			1 3 2
1 3 3	722	329	277	1 3 3	132	1 3 3	596	368	391			1 3 3
Total	5,592	4,596	5,395	Total	2,031	Total	4,052	2,820	3,167	Total	2,474	Total

Table A6: Standardized Height Reduced Specification Regressions

	Egypt 08	Egypt 05	Egypt 03	Egypt 00	Egypt 95	Egypt 92	Egypt 88	Jordan 09	Jordan 07	Jordan 02	Jordan 97	Jordan 90
mothed2	0.0801	-0.0792	0.110	-0.0045	-0.241	-0.116	0.0773	0.213	0.140	0.427	0.475	0.420*
	(0.259)	(0.185)	(0.207)	(0.161)	(0.161)	(0.180)	(0.290)	(0.529)	(0.723)	(0.346)	(0.272)	(0.194)
mothed3	0.332	0.478**	0.206	0.0894	-0.0278	0.506*	0.216	0.623	0.656	0.743*	0.816**	1.101***
	(0.209)	(0.162)	(0.187)	(0.159)	(0.196)	(0.242)	(0.505)	(0.477)	(0.668)	(0.318)	(0.261)	(0.195)
mothed4	-0.268	0.760**	0.338	-0.293	0.298	1.031*	-0.120	1.103*	1.202	1.115**	1.314***	1.220***
	(0.331)	(0.271)	(0.320)	(0.277)	(0.368)	(0.470)	(0.776)	(0.499)	(0.700)	(0.349)	(0.293)	(0.277)
fathed2	0.0827	-0.257	-0.298	0.369*	0.00572	0.194	0.0554	-0.0967	-0.182	0.222	-0.421	0.238
	(0.249)	(0.184)	(0.205)	(0.156)	(0.161)	(0.181)	(0.293)	(0.620)	(0.819)	(0.411)	(0.337)	(0.235)
fathed3	0.359	-0.169	0.109	-0.0982	-0.154	0.308	0.597	-0.200	-0.271	0.565	-0.398	0.548*
	(0.224)	(0.170)	(0.198)	(0.159)	(0.184)	(0.222)	(0.445)	(0.601)	(0.798)	(0.398)	(0.326)	(0.227)
fathed4	0.575	0.361	-0.543	0.339	0.0164	0.371	0.760	-0.397	-0.176	0.934*	-0.0825	0.882***
	(0.309)	(0.243)	(0.279)	(0.236)	(0.290)	(0.366)	(0.625)	(0.617)	(0.826)	(0.419)	(0.346)	(0.267)
wiq2	-0.537*	0.203	0.158	0.347*	0.594***	0.475*	0.416	0.652***	1.100***	0.630***	0.404*	0.322
	(0.224)	(0.175)	(0.203)	(0.167)	(0.180)	(0.207)	(0.358)	(0.186)	(0.256)	(0.157)	(0.162)	(0.195)
wiq3	-0.312	-0.0931	0.119	0.435*	0.825***	0.271	1.319***	0.941***	0.845**	1.027***	0.730***	0.636**
	(0.244)	(0.185)	(0.214)	(0.177)	(0.198)	(0.234)	(0.398)	(0.208)	(0.275)	(0.168)	(0.169)	(0.194)
wiq4	-0.183	0.0354	0.252	0.836***	0.889***	0.813**	0.666	0.970***	0.665*	1.062***	1.002***	0.893***
	(0.276)	(0.210)	(0.241)	(0.200)	(0.231)	(0.263)	(0.485)	(0.217)	(0.303)	(0.188)	(0.182)	(0.210)
wiq5	-0.161	0.251	0.369	0.954***	1.584***	1.381***	1.760**	2.123***	1.620***	1.082***	1.258***	1.035***
	(0.320)	(0.250)	(0.285)	(0.247)	(0.277)	(0.327)	(0.594)	(0.273)	(0.356)	(0.221)	(0.204)	(0.214)
multiple births	-0.797*	-0.582*	0.476	-0.407	-1.743***	-0.468	-1.665*	-0.211	0.671	-0.318	-2.096***	-0.823*
	(0.364)	(0.287)	(0.355)	(0.297)	(0.403)	(0.475)	(0.750)	(0.391)	(0.539)	(0.312)	(0.366)	(0.408)
M. age at birth	0.156	0.0649	0.217**	0.152*	0.0394	-0.0648	-0.00055	0.222*	0.106	-0.0853	-0.0861	-0.0437
	(0.0963)	(0.0745)	(0.0821)	(0.0678)	(0.0736)	(0.0867)	(0.150)	(0.0914)	(0.129)	(0.0796)	(0.0711)	(0.0729)
M. age at birth sq./100	-0.210	-0.0752	-0.407**	-0.218	-0.0400	0.266	0.105	-0.335*	-0.226	0.251	0.237	0.281*
	(0.171)	(0.132)	(0.145)	(0.119)	(0.129)	(0.150)	(0.260)	(0.156)	(0.221)	(0.137)	(0.124)	(0.122)
Birth order	-0.176**	-0.0426	0.126*	-0.0728	-0.0930*	-0.170***	-0.0702	-0.194***	-0.0452	-0.165***	-0.105***	-0.195***
	(0.0623)	(0.0448)	(0.0515)	(0.0379)	(0.0397)	(0.0438)	(0.0734)	(0.0458)	(0.0637)	(0.0360)	(0.0310)	(0.0326)
Female	0.915***	0.651***	0.891***	0.716***	0.511***	0.419**	0.184	0.223	0.656***	0.0111	0.317**	0.218
	(0.135)	(0.107)	(0.124)	(0.101)	(0.115)	(0.135)	(0.230)	(0.127)	(0.181)	(0.110)	(0.105)	(0.115)

Table A6: Standardized Height Reduced Specification Regressions (Contn'd)

	Egypt 08	Egypt 05	Egypt 03	Egypt 00	Egypt 95	Egypt 92	Egypt 88	Jordan 09	Jordan 07	Jordan 02	Jordan 97	Jordan 90
Urban	0.199	-0.378*	0.225	0.260	-2.019	0.242	1.037**	0.403*	0.445	0.389**	0.779***	0.785***
	(0.197)	(0.155)	(0.162)	(0.140)	(1.162)	(0.198)	(0.362)	(0.190)	(0.274)	(0.149)	(0.156)	(0.148)
Constant	81.15***	82.95***	77.50***	79.28***	82.59***	80.70***	78.55***	80.12***	81.06***	82.18***	82.67***	80.38***
	(1.331)	(1.042)	(1.154)	(0.958)	(1.544)	(1.224)	(2.127)	(1.469)	(2.023)	(1.191)	(1.033)	(1.060)
Governorate or province dummies included	yes	yes	yes	Yes	Yes	yes	yes	yes	Yes	yes	yes	yes
N	10248	12990	6194	10622	10698	7632	1969	4251	4646	4909	5647	6741
R-sq	0.141	0.102	0.044	0.083	0.040	0.063	0.096	0.062	0.035	0.061	0.075	0.064

Notes: *p<.05 **p<.01 ***p<.001

Table A6: Standardized Height Reduced Specification Regressions (Contn'd)

	Morocco 04	Morocco 92	Morocco 87	Tunisia 88	Turkey 03	Turkey 98	Turkey 93	Yemen 92
mothed2	0.358	0.326	0.256	0.175	0.766***	1.444***	0.843***	0.367
	(0.233)	(0.276)	(0.271)	(0.272)	(0.218)	(0.271)	(0.232)	(0.412)
mothed3	0.0217	1.244**	0.0116	1.624***	0.850**	1.657***	1.736***	1.487
	(0.279)	(0.378)	(0.381)	(0.487)	(0.284)	(0.364)	(0.348)	(0.867)
mothed4	0.131	2.208**	1.460	2.680*	1.487**	2.140***	1.467*	2.643*
	(0.516)	(0.837)	(1.011)	(1.151)	(0.461)	(0.641)	(0.678)	(1.258)
fathed2	0.121	0.336	0.178	0.239	1.028**	1.737***	0.215	0.419
	(0.203)	(0.207)	(0.200)	(0.272)	(0.314)	(0.381)	(0.329)	(0.298)
fathed3	0.743**	1.260***	0.891**	0.876*	1.534***	2.122***	0.953*	0.744
	(0.262)	(0.281)	(0.280)	(0.354)	(0.343)	(0.420)	(0.370)	(0.487)
fathed4	0.744	1.014	0.661	1.603*	1.482***	2.378***	0.803	0.605
	(0.403)	(0.589)	(0.615)	(0.701)	(0.430)	(0.542)	(0.518)	(0.518)
wiq2	0.877***	0.936***	0.709**	-0.460	0.603**	0.236	0.531*	-0.0695
	(0.247)	(0.246)	(0.248)	(0.302)	(0.213)	(0.273)	(0.266)	(0.365)
wiq3	1.449***	1.381***	0.900***	0.332	0.996***	0.593	0.995***	-0.477
	(0.306)	(0.273)	(0.232)	(0.338)	(0.233)	(0.303)	(0.296)	(0.357)
wiq4	1.707***	2.410***	1.319***	0.413	1.694***	0.989**	1.750***	-0.122
	(0.374)	(0.345)	(0.258)	(0.378)	(0.243)	(0.347)	(0.333)	(0.369)
wiq5	1.809***	2.406***	2.632***	0.515	1.941***	1.837***	2.096***	-0.0388
	(0.421)	(0.400)	(0.318)	(0.428)	(0.290)	(0.410)	(0.389)	(0.474)
multiple births	-0.853	-1.457*	-1.480**	-4.237***	-0.620	-1.854**	-0.330	-2.722*
	(0.507)	(0.588)	(0.532)	(0.724)	(0.573)	(0.676)	(0.639)	(1.225)
M. age at birth	0.121	-0.0532	0.0357	-0.102	0.0638	0.0946	0.162	-0.0775
	(0.0983)	(0.0836)	(0.0807)	(0.156)	(0.0951)	(0.121)	(0.116)	(0.119)
M. age at birth sq./100	-0.0856	0.189	0.128	0.250	-0.00814	0.0837	0.00831	0.224
	(0.168)	(0.139)	(0.133)	(0.263)	(0.172)	(0.224)	(0.215)	(0.193)
Birth order	-0.211***	-0.212***	-0.177***	-0.0733	-0.193***	-0.193**	-0.298***	-0.0880
	(0.0536)	(0.0445)	(0.0421)	(0.0709)	(0.0496)	(0.0654)	(0.0589)	(0.0544)
Female	0.567***	0.233	0.531***	-0.111	-0.0373	0.272	0.0856	-0.651**
	(0.160)	(0.148)	(0.141)	(0.214)	(0.137)	(0.173)	(0.167)	(0.218)
urban	0.111	-0.280	-0.615**	0.879**	0.413*	0.332	0.0955	-0.208
	(0.258)	(0.278)	(0.231)	(0.282)	(0.166)	(0.223)	(0.219)	(0.457)
Constant	78.83***	80.49***	78.39***	83.76***	80.02***	76.27***	77.41***	80.82***
	(1.436)	(1.297)	(1.258)	(2.303)	(1.322)	(1.640)	(1.582)	(1.811)
Governorate or province dummies included?	yes	yes	yes	yes	yes	yes	Yes	yes
N	5592	4596	5395	2031	4052	2820	3167	2474
R-sq	0.052	0.137	0.095	0.099	0.135	0.154	0.156	0.107

Notes: *p<.05 **p<.01 ***p<.001

Table A7: Standardized Weight-for-Height Reduced Specification Regressions

	Egypt 08	Egypt 05	Egypt 03	Egypt 00	Egypt 95	Egypt 92	Egypt 88	Jordan 09	Jordan 07	Jordan 02	Jordan 97	Jordan 90
mothed2	0.0816	0.0958	-0.0088	0.0666	-0.0845	0.0336	-0.0988	0.0390	0.240	0.0751	0.209*	0.159*
	(0.0744)	(0.0553)	(0.0675)	(0.0530)	(0.0514)	(0.0618)	(0.0919)	(0.197)	(0.244)	(0.134)	(0.103)	(0.0652)
mothed3	0.0181	0.0668	-0.0173	0.0803	0.0756	0.211*	-0.114	0.0868	0.361	0.0111	0.287**	0.371***
	(0.0598)	(0.0485)	(0.0610)	(0.0525)	(0.0624)	(0.0830)	(0.160)	(0.178)	(0.225)	(0.123)	(0.0988)	(0.0655)
mothed4	-0.0498	0.153	-0.0349	0.0949	0.183	0.418**	-0.250	0.222	0.673**	0.162	0.446***	0.447***
	(0.0949)	(0.0811)	(0.104)	(0.0914)	(0.117)	(0.161)	(0.246)	(0.186)	(0.236)	(0.135)	(0.111)	(0.0928)
fathed2	-0.00758	0.0161	-0.0765	-0.0101	0.0689	-0.0371	0.109	0.0789	0.308	0.00753	-0.302*	0.0470
	(0.0714)	(0.0550)	(0.0670)	(0.0515)	(0.0511)	(0.0620)	(0.0929)	(0.231)	(0.276)	(0.159)	(0.128)	(0.0789)
fathed3	0.163*	0.0599	0.0646	-0.0690	0.0437	0.0137	0.268	0.240	0.196	0.0720	-0.212	0.0975
	(0.0643)	(0.0509)	(0.0646)	(0.0526)	(0.0587)	(0.0762)	(0.141)	(0.224)	(0.269)	(0.154)	(0.124)	(0.0761)
fathed4	0.279**	0.273***	-0.0898	-0.123	0.133	0.124	0.187	0.121	0.188	0.164	-0.0261	0.154
	(0.0886)	(0.0728)	(0.0911)	(0.0779)	(0.0924)	(0.125)	(0.198)	(0.230)	(0.278)	(0.162)	(0.131)	(0.0896)
wiq2	-0.0211	-0.0331	0.0676	0.126*	0.00530	0.221**	0.217	0.135	0.320***	0.216***	0.0766	0.0467
	(0.0643)	(0.0524)	(0.0661)	(0.0552)	(0.0575)	(0.0708)	(0.114)	(0.0693)	(0.0864)	(0.0609)	(0.0615)	(0.0655)
wiq3	0.0507	-0.0629	0.139*	0.231***	0.129*	0.295***	0.397**	0.240**	0.179	0.307***	0.192**	0.172**
	(0.0700)	(0.0555)	(0.0699)	(0.0584)	(0.0631)	(0.0803)	(0.126)	(0.0773)	(0.0926)	(0.0651)	(0.0640)	(0.0652)
wiq4	0.150	-0.0591	0.178*	0.284***	0.0674	0.403***	0.552***	0.388***	0.0851	0.295***	0.253***	0.311***
	(0.0793)	(0.0629)	(0.0787)	(0.0659)	(0.0735)	(0.0900)	(0.154)	(0.0806)	(0.102)	(0.0728)	(0.0690)	(0.0705)
wiq5	0.126	-0.00213	0.147	0.334***	0.233**	0.620***	0.787***	0.816***	0.619***	0.330***	0.360***	0.226**
	(0.0919)	(0.0748)	(0.0932)	(0.0817)	(0.0884)	(0.112)	(0.188)	(0.102)	(0.120)	(0.0854)	(0.0772)	(0.0719)
multiple births	-0.256*	-0.290***	0.180	-0.405***	-0.418**	-0.255	-0.160	-0.247	-0.391*	-0.355**	-0.648***	-0.408**
	(0.104)	(0.0861)	(0.116)	(0.0980)	(0.128)	(0.163)	(0.238)	(0.145)	(0.182)	(0.121)	(0.139)	(0.137)
M. age at birth	0.0108	0.0121	0.0477	0.0277	-0.0354	-0.0280	0.0603	-0.0146	0.0353	0.0258	-0.0231	0.0178
	(0.0276)	(0.0223)	(0.0268)	(0.0224)	(0.0235)	(0.0297)	(0.0476)	(0.0340)	(0.0436)	(0.0308)	(0.0269)	(0.0245)
M. age at birth sq/100	-0.00816	-0.0186	-0.0838	-0.0290	0.0471	0.0728	-0.0673	0.0162	-0.0731	-0.0387	0.0541	0.0235
	(0.0491)	(0.0396)	(0.0473)	(0.0393)	(0.0410)	(0.0515)	(0.0825)	(0.0580)	(0.0745)	(0.0530)	(0.0470)	(0.0410)
Birth order	-0.0417*	-0.00925	0.00317	-0.0234	0.0216	-0.00876	-0.0414	-0.0540**	-0.00491	-0.0277*	-0.00995	-0.0404***
	(0.0179)	(0.0134)	(0.0168)	(0.0125)	(0.0127)	(0.0150)	(0.0233)	(0.0170)	(0.0215)	(0.0139)	(0.0118)	(0.0109)

Table A7: Standardized Weight-for-Height Reduced Specification Regressions (Contn'd)

	Egypt 08	Egypt 05	Egypt 03	Egypt 00	Egypt 95	Egypt 92	Egypt 88	Jordan 09	Jordan 07	Jordan 02	Jordan 97	Jordan 90
Female	0.270***	0.195***	0.235***	0.189***	0.124***	0.0488	-0.0789	-0.0794	0.0655	-0.0379	0.000219	0.0277
	(0.0386)	(0.0319)	(0.0403)	(0.0334)	(0.0367)	(0.0462)	(0.0728)	(0.0473)	(0.0609)	(0.0427)	(0.0398)	(0.0385)
Urban	0.0211	-0.154***	-0.0552	-0.0918*	0.335	0.0262	0.154	-0.0126	0.0564	0.157**	0.293***	0.334***
	(0.0566)	(0.0463)	(0.0528)	(0.0463)	(0.370)	(0.0677)	(0.115)	(0.0706)	(0.0924)	(0.0576)	(0.0590)	(0.0498)
Constant	12.21***	12.14***	11.11***	11.87***	12.30***	12.02***	10.16***	12.56***	11.32***	11.55***	12.00***	10.96***
	(0.382)	(0.312)	(0.377)	(0.316)	(0.492)	(0.419)	(0.675)	(0.547)	(0.682)	(0.461)	(0.392)	(0.356)
Governorate or Province Dummies Included?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	10248	12990	6194	10622	10698	7632	1969	4251	4646	4909	5647	6741
R-sq	0.072	0.088	0.101	0.070	0.030	0.122	0.098	0.042	0.025	0.035	0.049	0.045

Notes: *p<.05 **p<.01 ***p<.001

Table A7: Standardized Weight-for-Height Reduced Specification Regressions (Contn'd)

	Morocco 04	**Morocco 92**	**Morocco 87**	**Tunisia 88**	**Turkey 03**	**Turkey 98**	**Turkey 93**	**Yemen 92**
mothed2	0.0469	0.269**	-0.0748	-0.0798	0.180*	0.409***	0.151	0.161
	(0.0718)	(0.0966)	(0.0877)	(0.0957)	(0.0822)	(0.0957)	(0.0825)	(0.114)
mothed3	0.132	0.284*	0.149	0.534**	0.342**	0.551***	0.456***	0.425
	(0.0859)	(0.132)	(0.123)	(0.171)	(0.107)	(0.129)	(0.124)	(0.241)
mothed4	0.222	0.703*	0.537	1.355***	0.400*	0.824***	0.331	0.476
	(0.159)	(0.292)	(0.328)	(0.404)	(0.173)	(0.226)	(0.241)	(0.349)
fathed2	0.0970	0.0897	0.0281	0.0898	0.363**	0.246	-0.0185	-0.116
	(0.0627)	(0.0722)	(0.0649)	(0.0955)	(0.118)	(0.134)	(0.117)	(0.0828)
fathed3	0.230**	0.388***	0.181*	0.215	0.528***	0.438**	0.196	0.0841
	(0.0808)	(0.0983)	(0.0908)	(0.124)	(0.129)	(0.148)	(0.131)	(0.135)
fathed4	0.166	0.452*	0.339	0.349	0.559***	0.471*	0.377*	0.129
	(0.124)	(0.206)	(0.199)	(0.247)	(0.162)	(0.191)	(0.184)	(0.144)
wiq2	0.247**	0.234**	0.154	0.00879	0.269***	0.0985	0.205*	0.0795
	(0.0760)	(0.0858)	(0.0804)	(0.106)	(0.0800)	(0.0964)	(0.0945)	(0.101)
wiq3	0.477***	0.382***	0.208**	0.142	0.228**	0.157	0.318**	0.183
	(0.0945)	(0.0954)	(0.0752)	(0.119)	(0.0877)	(0.107)	(0.105)	(0.0991)
wiq4	0.679***	0.765***	0.400***	0.356**	0.542***	0.319**	0.471***	0.312**
	(0.115)	(0.120)	(0.0835)	(0.133)	(0.0915)	(0.123)	(0.118)	(0.103)
wiq5	0.894***	0.729***	0.795***	0.190	0.433***	0.467**	0.642***	0.490***
	(0.130)	(0.140)	(0.103)	(0.151)	(0.109)	(0.145)	(0.138)	(0.132)
multiple births	-0.298	-0.850***	-0.397*	-1.619***	-0.217	-0.863***	-0.318	-0.334
	(0.156)	(0.206)	(0.172)	(0.254)	(0.216)	(0.239)	(0.227)	(0.340)
M. age at birth	-0.0118	-0.0426	-0.00590	-0.0579	0.0103	0.0320	0.0535	0.0375
	(0.0303)	(0.0292)	(0.0261)	(0.0548)	(0.0358)	(0.0428)	(0.0412)	(0.0329)
M. age at birth sq/100	0.0262	0.0917	0.0562	0.0959	0.0268	-0.00740	-0.0610	-0.0304
	(0.0517)	(0.0486)	(0.0429)	(0.0923)	(0.0647)	(0.0790)	(0.0764)	(0.0535)
Birth order	-0.0276	-0.0502**	-0.0544***	0.00809	-0.0446*	-0.00226	-0.00101	-0.0359*
	(0.0165)	(0.0156)	(0.0136)	(0.0249)	(0.0187)	(0.0231)	(0.0209)	(0.0151)
Female	0.0323	0.0974	0.0326	-0.0344	-0.0850	0.0203	0.0297	0.0823
	(0.0494)	(0.0519)	(0.0456)	(0.0752)	(0.0517)	(0.0612)	(0.0595)	(0.0605)
urban	0.0137	-0.0458	-0.140	0.282**	0.124*	0.108	-0.101	-0.0847
	(0.0796)	(0.0973)	(0.0747)	(0.0991)	(0.0625)	(0.0787)	(0.0777)	(0.127)
Constant	11.97***	12.06***	11.33***	12.47***	11.84***	10.49***	11.01***	9.660***
	(0.443)	(0.453)	(0.407)	(0.809)	(0.498)	(0.579)	(0.562)	(0.503)
Governorate or Province Dummies Included?	yes	yes	yes	yes	yes	yes	yes	yes
N	5592	4596	5395	2031	4052	2820	3167	2474
R-sq	0.092	0.137	0.106	0.075	0.087	0.116	0.118	0.060

Notes: *p<.05 **p<.01 ***p<.001