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Rural–urban differences in children's dietary diversity in Ethiopia: A Poisson decomposition analysis☆

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HIGHLIGHTS

- Low dietary diversity is linked with stunting and micro-nutrient deficiencies.
- There is a large rural–urban inequality in children's dietary diversity in Ethiopia.
- Non-linear decomposition methods are used to study this inequality.
- The rural–urban gap is mostly due to differences in observable characteristics.

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ABSTRACT

An emerging body of literature shows how low diversity in diets is associated with increased risk of chronic undernutrition and micro-nutrient deficiencies in young children. The latest available Demographic and Health Survey data for Ethiopia reveals unusually large differences in children's dietary diversity between rural and urban areas. Applying recently developed non-linear decomposition methods, this large rural–urban gap in dietary diversity can almost entirely be explained by differences in household wealth, parental education, and access to health services between rural and urban areas.

1. Introduction

An emerging body of literature shows how low diversity in diets is associated with increased risk of chronic undernutrition and micro-nutrient deficiencies in young children (Arimond and Ruel, 2004; Kennedy et al., 2007; Moursi et al., 2008). A comparison of children's diets between Ethiopia and the rest of sub-Saharan Africa reveals two striking features (Fig. 1). First, Ethiopian children consume a diet that is one of the most undiversified on the continent. Second, there exists an extraordinary large rural–urban gap in children's dietary diversity.

Recent research suggests that the low dietary diversity in Ethiopia is due to a combination of poor access to nutritious foods and limited knowledge about appropriate feeding practices (Hirvonen and Hoddinott, 2014; Stifel and Minten, 2015; Hirvonen et al., 2016). This research note examines the second striking feature observed in Fig. 1: the large rural–urban gap in children's dietary diversity. The latest available Demographic and Health Survey (DHS) data for Ethiopia and recently developed non-linear decomposition techniques (Yun, 2004; Bauer and Sinning, 2008; Park and Lohr, 2010) are used to analyse the factors contributing to this inequality. The evidence emerging from this observational study suggests that the rural–urban gap is almost entirely due to differences in wealth and parental education levels, as well as unequal access to health services (antenatal care).

2. Data

The analysis is based on the nationally representative 2010/11 Demographic Health Survey (DHS) data for Ethiopia. The 2010/11

☆ The Stata program code (do & log files) can be downloaded from the author's website (kallehirvonen.com).

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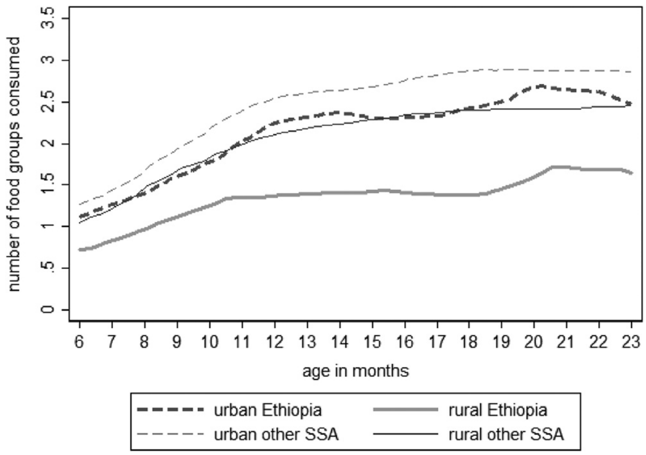

Fig. 1. Children's dietary diversity by age in sub-Saharan Africa.
Note: Local polynomial regression.

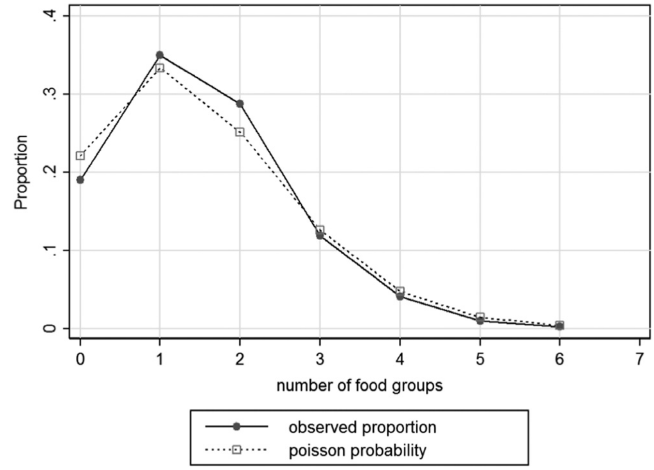

Fig. 2. Fitting a Poisson distribution on dietary diversity score.

survey instrument contained a standard module to collect information about children's diets. Specifically, the questionnaire included a series of Yes/No questions about children's food consumption in the previous day. Following WHO (2008) guidelines for assessing the feeding practices of children between 6 and 23 months of age, the responses were grouped into the following seven food group categories: grains, roots and tubers (e.g. barley, enset, maize, teff, and wheat); legumes and nuts; dairy products (milk, yogurt, cheese); flesh foods (meat, poultry and fish products); eggs; Vitamin A rich fruits and vegetables; and other fruits and vegetables. Totalling the number of food groups consumed by a child yields a dietary diversity score ranging in value from zero to seven. This simple indicator is considered in the literature as a good proxy of the quality of children's diets (Ruel, 2003; Steyn et al., 2006; Kennedy et al., 2007; Moursi et al., 2008).

The DHS surveys routinely collect information on household characteristics, including education levels, assets and access to health services. This information is used to construct the covariates used in the decomposition analysis. After data cleaning, the final sample used in this analysis includes 2898 children (2383 rural and 515 urban) aged 6–23 months. Table 1 provides the summary statistics for all variables used in this study.[1]

3. Econometric approach

Following Blinder (1973) and Oaxaca (1973), the difference in the mean dietary diversity ($\overline{D}$) between rural (subscript r) and urban (subscript u) areas is formally expressed as:

$$\overline{D}_r - \overline{D}_u = \left[f\left(\overline{X}_r\widehat{\beta}_r\right) - f\left(\overline{X}_u\widehat{\beta}_r\right)\right] + \left[f\left(\overline{X}_u\widehat{\beta}_r\right) - f\left(\overline{X}_u\widehat{\beta}_u\right)\right], \quad (1)$$

where $\overline{X}$ refers to a vector of covariates at mean values and $\widehat{\beta}$ to estimated coefficients. The first part of the right-hand side of the equation $\left[f\left(\overline{X}_r\widehat{\beta}_r\right) - f\left(\overline{X}_u\widehat{\beta}_r\right)\right]$ captures the 'explained' component—the part of the difference that is due to differences in child or household characteristics between the rural and urban areas (in coefficients estimated for the rural sample). The second part is the 'unexplained' component $\left[f\left(\overline{X}_u\widehat{\beta}_r\right) - f\left(\overline{X}_u\widehat{\beta}_u\right)\right]$—the part that is due to differences in the estimated coefficients.

The functional form (f) depends on the underlying data generating process (linear or non-linear). Our dependent variable of interest – the number of food groups consumed by the child (dietary diversity score) – takes only non-negative integer values. This warrants a count-data modelling approach (Winkelmann, 2008). Fortunately, the Poisson distribution fits the unconditional distribution extremely well (Fig. 2). Of particular note is that over-dispersion, for example, in the form of excess zeros, does not seem to be a concern for the analysis.[2] The Poisson model can be used to estimate the $\widehat{\beta}$ coefficients in Eq. (1). Specifically, a maximum likelihood method is used to estimate the following Poisson model separately for the rural and urban samples, for child c residing in household h:

$$\overline{D}_{ch} = \exp\left(c'_{ch}\gamma + x'_h\delta + \varepsilon_{ch}\right), \quad (2)$$

where c'_{ch} is a vector of child level characteristics (sex and age in months) and x'_h is a vector of household level characteristics that includes maternal and paternal education in years, a wealth index, mother's age, and livestock ownership. ε_{ch} represents the error term. In non-linear models, the marginal effect depends on the values of the covariates in the model. The mean values of the covariates are used to evaluate Eq. (2).

The contribution of each variable in Eq. (1) to the overall difference in dietary diversity between rural and urban areas is also examined. In the case of a non-linear decomposition, the results of such detailed decomposition are sensitive to the order in which the variables enter the decomposition equation. The solution proposed by Yun (2004) is to apply weights that are proportional to the overall contribution of the characteristics or coefficient portion to the difference. The equation for the detailed decomposition for K covariates can now be expressed as:

$$\overline{D}_r - \overline{D}_u = \sum_{i=1}^{K} w^i_{\triangle X}\left[f\left(\overline{X}_r\widehat{\beta}_r\right) - f\left(\overline{X}_u\widehat{\beta}_r\right)\right] + \sum_{i=1}^{K} w^i_{\triangle\beta}\left[f\left(\overline{X}_u\widehat{\beta}_r\right) - f\left(\overline{X}_u\widehat{\beta}_u\right)\right], \quad (3)$$

where the weights for covariate i are:

$$w^i_{\triangle X} = \frac{\left(\overline{X}^i_r - \overline{X}^i_u\right)\beta^i_r}{\left(\overline{X}_r - \overline{X}_u\right)\beta_r} \qquad w^i_{\triangle\beta} = \frac{\overline{X}^i_u\left(\beta^i_r - \beta^i_u\right)}{\overline{X}_u\left(\beta_r - \beta_u\right)}. \quad (4)$$

[1] The choice of the covariates is motivated by Headey (2014) who offers a careful analysis of the long-run trends in child nutrition in Ethiopia.

[2] Zeros in the dietary diversity score indicate either breastfeeding or that the child did not consume any food in the previous day. Here, the zeros are largely due to the former: 95% of the children with zero dietary diversity are exclusively breastfed.