**Is rapid urbanisation exacerbating wealth-related urban inequalities in child nutritional status? Evidence from least developed countries**

**Abstract**

*Limited evidence exists regarding the extent of wealth-related urban inequalities in nutrition outcomes presumably attributable to the rapid pace of urbanisation. The present study has four interrelated objectives. First, it investigates whether these is a difference in the extent of wealth-related urban inequalities between the most rapidly and less rapidly urbanising countries and whether and to what degree parents’ education exacerbates these inequalities. Furthermore, the study examines the nature and strength of the associations between mother’s socio-economic status and child nutrition and low birth weight and child nutrition in the selected countries. Data are drawn from the recent Demographic and Health Surveys conducted during 2005-11. The analysis considered inequality measures, such as concentration indices and concentration curves, and logistic regression modelling. Results show significant inequalities in children’s nutritional outcomes, and that these inequalities are greater in the most rapidly urbanising countries and exacerbated by parents’ poor education. The results further confirm that mother’s socio-economic status and child birth weight are significantly associated with child nutritional outcomes, albeit the former are particularly important in the most rapidly urbanising LDCs. The findings call for a renewed focus on inclusive urban development in poorest countries.*

*Il n’existe que des rares données sur les inégalités urbaines causes par la richesse ou la pauvreté (vraisemblablement du a la rapidité de l’urbanisation), en relation a ce qui concerne la situation nutritionnelle. Cet étude vise à voir si il y a une différence dans la mesure des inégalités urbaines causes par la richesse entre les pays en forte voie d’urbanisation, et ceux moins urbanisés ; et jusqu’à quel point l’éducation des parents accentue ces différences. Dans certains pays sélectionnées, on étude la nature et la force de l’association entre la situation socio-économique de la mère, la nutrition de l’enfant, et son faible poids à la naissance. Les donnes utilisées proviennent des enquêtes sur la Démographie et la Sante menées en 2005-2011. Les analyses prennent en considération les mesures d’inégalités, telles que les indices et courbes de concentration, et des modèles de régression logistique. Les résultats indiquent des différences significatives dans la situation nutritionnelle des enfants avec des parents moins éduquées, qui sont d’autant plus significatives dans les pays en forte voie d’urbanisation. Les résultats confirment que la situation socio-économique de la mère, et le poids à la naissance de l’enfant, sont significativement associés à la situation nutritionnelle de l’enfant ; la situation socio-économique est plus important dans les pays moins développés avec une forte croissance de l’urbanisation. Les résultats soulignent à nouveau l’importance du développement urbain inclusif dans les pays les plus pauvres.*

Key words: urbanisation; inequalities; child nutrition; least developed countries, LDCs

# Introduction

Today, the majority of the human population resides in urban areas and urban sprawl is projected to continue. Least developed countries (LDCs) often lack basic means of subsistence, infrastructure and access to education, and increasing urban inequalities pose additional societal challenges ([UNCTAD, 2012b](#_ENREF_47)). Instead of reaping the benefits of the demographic dividend, the LDCs continue to struggle with a growing number of children affected by urban poverty and poor nutritional and health status. The human rights of children, including the basic right to survival, as stipulated in the 1989 Convention on the Rights of the Child ([UN, 1989](#_ENREF_43)), are often violated. While residing in urban areas has traditionally been associated with better livelihood opportunities, the rapid pace of urbanisation also contributes to greater urban poverty, thus exacerbating inequalities. Recognizing the need to focus on sustainable urban development, the Sustainable Development Goals (SDG) agenda specifically includes a goal on cities and human settlements ([UN, 2014](#_ENREF_44)).

Previous scholarship confirmed the existence of large wealth-related urban inequalities, however limited comparative analysis exists focusing on the impact of macro-level pace of urbanisation on individual nutritional and health outcomes. Already in the 1970s, Samir Basta ([1977](#_ENREF_6)) reported that intra-urban differentials in health and nutritional status exceeded those between urban and rural areas. The detrimental impact of living in slums (as compared to other urban areas) on households’ health conditions has been attested by recent research ([Martinez et al., 2008](#_ENREF_27), [Ompad et al., 2007](#_ENREF_33)). Geographers have argued that globally “spatial segregation” is linked to the place of residence ([Skop, 2006](#_ENREF_37)). The implications of people’s geographical habitat are thus far reaching and have consequences on overall welfare of households and individuals, including their access to healthcare and education ([Vlahov et al., 2007](#_ENREF_51), [BloomCanning and Fink, 2008](#_ENREF_7), [Fotso, 2006](#_ENREF_19)). Macro-level processes of rapid, unmanaged urban growth can lead to environmental degradation, lack of adequate housing. And greater risk of food insecurity (Szabo, 2015) Those living in densely populated poorly planned urban areas are at increased risk of malnutrition and infections including waterborne diseases and respiratory conditions, provided that urban service provisioning do not manage to cope with rapid urban population growth.

A relatively scarce, but growing body of evidence suggests that countries and regions, which experience rapid urban growth, are also those where malnutrition rates are disproportionately high. In many places, such as in the city of Windhoek in Namibia, the new urban migrants originate from poor and marginalised segments of rural populations who decide to move in pursuit of better livelihoods ([Nickanor and Kazembe, 2016](#_ENREF_31)). This implies that with a rapid pace of urban growth, a relatively large proportion of the new urban population is likely to be in the lowest socio-economic strata. Empirical evidence from Nigeria shows that the increasingly urban population have challenges in accessing and preparing nutritious food due to the time spent in the workplace and commuting, inadequate cooking spaces, and growing food and fuel prices ([Ekpenyong, 2015](#_ENREF_17)). We therefore postulate that the rapid pace of urban growth is likely to be positively associated with greater likelihood of malnutrition amongst the urban poor, and increased inequalities in nutritional status amongst children in urban households.

More specifically, the present study has two primary objectives. First, it aims to examine whether countries experiencing the most rapid urbanisation suffer from greater wealth-related urban inequalities. The second objective of the study is to assess whether parents’ education has a modifying effect on the extent of wealth based inequalities in child nutritional status. In addition, the study aims to test the impact of mother’s socio-economic attributes and child’s background characteristics, notably birth weight, on child’s nutritional outcomes.

The remainder of this paper is organized as follows. The next section focuses on discussing contemporary inequality trends in the context of rapid urbanisation in the LDCs. Section 3 describes selection criteria for the chosen LDCs, and discusses the data and methods used. Section 4 offers the discussion of the main results, including descriptive statistics and regression results. The final part of this paper highlights the key findings, acknowledges study limitations and offers policy recommendations.

# Urbanisation and child nutrition in the least developed countries

The label of the LDCs was created by the UN’s General Assembly in 1971 in order for the international community to pay greater attention to the needs of the most vulnerable nations ([UNCTAD, 2011](#_ENREF_45), [UNCTAD, 2012a](#_ENREF_46)). Currently forty-eight countries are classified as LDCs and most of them are geographically located in sub-Saharan Africa (thereafter SSA) ([UNCTAD, 2012b](#_ENREF_47)). In these countries weak economic systems, structural challenges and the inability of governments to provide growing urban populations with basic services are likely to contribute to increased social stratification ([WHO, 2008](#_ENREF_55)). Recent theoretical and empirical research by Michaels et al. ([2012](#_ENREF_30)) confirmed that urbanisation can lead to structural transformation through shifting patterns of economic activities. In addition, while at the macro level structural population change related to urbanisation processes is typically associated with income growth, is has also been proved to lead to greater wealth based inequalities ([Clarke Annez and Buckley, 2009](#_ENREF_11)).

Economic literature on economic development, suggest that a rise of the middle class resulting from rapid urbanisation is typically associated with reduction of inequalities. However, in Africa, where most LDCs are located, the emerging middle class continues to be highly vulnerable (ADB, 2011). Recent research by the African Development Bank (ADB, 2011) suggests that the middle class in the continent is concentrated amongst the lower ranks. With its per capita expenditure estimated at USD2-4 per day, many households risk to fall back to the poorest segments of the society ([ADB, 2011](#_ENREF_3)). This is particularly the case in environmentally vulnerable regions, such as climate hotspots, where environmental factors exacerbate traditional socio-economic inequalities ([Szabo et al., 2015](#_ENREF_42), Szabo et al. 2016a) . In addition, because in LDCs out of pocket payments for health are relatively high, catastrophic health expenditure can put families at risk of falling back into poverty (REF).

In many LDCs, environmental dynamics, including the consequences of climate change, constitute additional push factors when it comes to migration decisions ([Warner et al., 2010](#_ENREF_54), [Reuveny, 2007](#_ENREF_34)). Such environmental migration contributes to overall rural-urban migration flows and thus constitutes an additional driver of rapid urban growth. A paper by Barrios et al. ([2006](#_ENREF_5)) found that in SSA shortage of rainfall was positively associated with rural to urban migration and that this relationship was stronger in the post-colonial period. In the Ganges Brahmaputra delta of Bangladesh out migration from predominantly rural costa areas has become a coping strategy of households affected by flooding, cyclones and creeping processes linked to clime change ([Mallick and Vogt, 2012](#_ENREF_25), [Marshall and Rahman, 2013](#_ENREF_26), Szabo et al. 2015). Irrespective of the causes of continuous urban growth, the consequences of increasing inequalities amongst urban populations deserve attention.

A very rapid pace of urbanisation can pose challenges to children’s nutrition both in terms of greater overall poverty, which translates into barriers with access to food, and increasing social stratification. Unmanaged urban sprawl often results in large populations being forced to live in crowded, disease-prone settings, which are often illegal or semi-legal. In the LDCs, approximately 78% of the urban population lives in areas classified as slums ([Vlahov et al., 2007](#_ENREF_51)). Children are particularly vulnerable to the threats caused by poor urban environments both in terms of their physical and cognitive needs and opportunities for advancement. A recent report by UNICEF ([2012](#_ENREF_48)) highlighted that, in 2010, eight million children under five died due to diseases, such as diarrhoea and pneumonia, as well as birth complications. Although no desegregation of these data was reported so as to enable urban-rural comparisons, wide body of literature has confirmed that poor urban children are particularly at risk of ill health ([Arokiasamy et al., 2012](#_ENREF_4), [Dabone, Delisle and Receveur, 2011](#_ENREF_12), [Fotso, 2006](#_ENREF_19), [Vlahov et al., 2007](#_ENREF_51)). In the context of the least developed countries, these urban threats are exacerbated by overall structural problems, including weak health systems and poor healthcare services ([UNCTAD, 2012b](#_ENREF_47)).

The trends in child undernutrition in the context of rapid urbanisation can be best analysed when considering relevant time series. The World Bank’s Development Indicators contain temporal data on child stunting from 1960. While for the early years the data for LDCs are unavailable, from 1980s the statistics become more frequently reported. This allowed plotting under-fives’ stunting data accounting for the pace of urbanisation of the corresponding country (Figure 1). The graph illustrates that, although in both groups of the LDCs (more rapidly urbanising and less rapidly urbanising) the trends in stunting appear to be similar, countries which underwent more rapid pace of urbanisation have suffered from relatively higher prevalence of child undernutrition. Even though caution is required when interpreting these patterns due to between-country variations, at the aggregate level the trends confirm the previous arguments regarding the presupposed negative effect of rapid urbanisation.

* Figure 1 around here –

Drawing from the literature on urbanisation and inequalities, the objectives of the present study, as outlined in the Introduction, will be achieved by examining the following inter-related hypotheses:

**H1**: Wealth-related urban inequalities in children’s nutritional status are greater in those least developed countries that have been experiencing most rapid urbanisation.

**H2**: Parents’ education has a modifying effect on the extent of wealth-related urban inequalities in child nutrition in the LDCs.

**H3** Mother’s socio-economic background is associated with children’s undernutrition in the LDCs.

**H4** There is a positive association between child’s low birth weight and child undernutrition in the LDCs.

The data and methods used for the analysis as well as the justification of the choice of LDCs are presented in the next section. This section also highlights key country-level statistics quantifying the pace of urbanisation and level of human development in the selected LDCs.

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# Analytical strategy

## The choice of LDCs

The selection of countries was based on two main criteria. The first one involved the objectives of the study and resulting research hypotheses. The second criterion was related to the availability of data, including access to recent surveys and availability of main variables of interest. Regarding the first criterion, the key selection and categorisation criterion was that of rapid urbanisation. In this context, the three most widely used variables are proportion of urban population, rate of urban growth and pace of urbanisation. Proportion of urban population is a static measure in a sense that it allows capturing the horizontal aspect of urbanisation and thus enables cross-country comparisons. Urban growth rate, on the other hand, facilitates detection of the rapidity with which urban populations increase. Eventually, pace of urbanisation, which is based on the percentage change of the proportion of urban populations over time, was considered to best capture the speed of urban sprawl. The cut-off points were based on the last 30 years (1980-2010). No standard criteria exist and cut-off points are often arbitrary. The authors are however confident that the selected cut-off points reflect adequately the urban progress. This has been validated through comparison with other urban indicators.[[1]](#footnote-1)

 In addition to the macro-level considerations, practical constraints had to be taken into account. The first practical limitation of the study involved restricting the selection of countries to those who have recent (post-2005) DHS datasets publically available[[2]](#footnote-2). Secondly, amongst the available datasets, not all surveys contain key variables required for this study, and hence could not be considered. Table 1 provides an overview of the selected macro-level statistics for the chosen study countries. These include indicators related to human development, i.e. the inequality-adjusted Human Development Index (HDI), and population characteristics, as well as other relevant indicators, such as proportion of urban population with access to improved water sources and prevalence of child undernutrition. All selected countries suffer from different developmental challenges, which also vary in terms of their gravity and progress made.[[3]](#footnote-3)

* Table 1 around here-

## The datasets

This study makes use of the most recently available DHS data for the selected LDCs. In all ten countries considered in this paper survey fieldwork was conducted between 2005 and 2011. As highlighted previously, countries with highest values of pace of urbanisation (measured as change in proportion of urban population) between 1980 and 2010 have been classified as most rapidly urbanising. Conversely, countries with lowest scores in their pace of urbanisation have been classified as less rapidly urbanising. The use of “less rapidly urbanising” rather than “least rapidly urbanising” has been preferred because most LDCs have been experiencing relatively rapid urbanisation. Only countries with recent (post 2005) DHS data have been considered. In all datasets only observations for children and households residing in urban areas have been taken into account. Both individual country datasets and pooled datasets were used in order to provide a more comprehensive overview of nutritional inequalities. Sample sizes by country are reported in Table 2.

* Table 2 around here –

Key outcome variables considered in this study include the anthropometric indicators of undernutrition (stunting and underweight), as recommended by WHO. Stunting, measured as height for age z-scores (HAZ), has been widely used as an indicator of chronic undernutrition ([Srinivasan,Zanello and Shankar, 2013](#_ENREF_39); [Van de Poel, O'Donnell and Van Doorslaer, 2007](#_ENREF_50); [Menon, Ruel and Morris, 2000](#_ENREF_29); [Arokiasamy et al., 2012](#_ENREF_4); [Hoffman and Lee, 2005](#_ENREF_22)). Standard WHO cut-off point of HAZ of less than -2 standard deviations (SD) from the median of the reference population indicates that a child is stunted (severe stunting occurs if HAZ is below -3 SD from the median of the reference population) ([WHO, 2010](#_ENREF_56); [Kumar,Aggarwal and Iyengar, 1996](#_ENREF_23); [Arokiasamy et al., 2012](#_ENREF_4)). This indicator is particularly useful because stunting is associated with permanent growth retardation and as such influences productive capacity in later life ([Hoffman and Lee, 2005](#_ENREF_22)). On the other hand, underweight (weight for age z-scores, or WAZ), which is a composite index of stunting and wasting, allows the measuring of both acute and chronic undernutrition. Underweight is the most widely used measure of child undernutrition in developing countries. ([Fishman et al., 2004](#_ENREF_18)). Similarly to stunting, children with WAZ of less than two standard deviations below the reference median are classified as suffering from underweight.

As far as explanatory variables are concerned, the key indicators are ownership of household’s assets (as an approximation of household wealth), socio-economic characteristics of the mother (working status, years of education and exposure to media) as well as child’s gender and birth weight. Regarding parents’ education, we used categorical variables measuring level of educational attainment by both mother and father of the child. Mother’s socio-economic background has been frequently reported as a significant predictor of child undernutrition. For example, an extensive report by IFPRI ([Smith and Haddad, 2000](#_ENREF_38)) highlighted the importance of women’s education in terms of influencing their nutritional choices as well as having an overall positive impact on child care. In addition, following on from the analysis by Arokiasamy et al. ([2012](#_ENREF_4)), mother’s exposure to media is accounted for. It has been assumed that women with regular exposure to media have greater access to information, which in turn can influence their behaviour. In terms of child’s background characteristics, birth weight has been found to be a significant predictor of children’s undernutrition ([Abuya Ciera and Kimani-Murage, 2012](#_ENREF_1); [Das et al., 2012](#_ENREF_13)). Importantly, because low birth weight was found to be positively associated with poor health outcomes in later life ([Adair et al., 2013](#_ENREF_2)) and thus should regularly be incorporated in similar studies. Following the WHO standards, a child is classified as having low birth weight if their birth weight falls below 2500 grams ([WHO, 2010](#_ENREF_56), [de Onis et al., 2006](#_ENREF_15)). The details of variables’ coding are provided in Table 3, while descriptive statistics of key variables are summarized in Table 4.

* Table 3 around here-
* Table 4 around here-

## Statistical methods

This study makes use of descriptive statistics, inequality measures and logistic regression. In addition, in order to derive inequality indicators, Principal Component Analysis (PCA) is carried out. A convenient alternative to creating a new Assets Index (AI) is to apply the existing wealth index provided by the DHS. However, DHS wealth indices do not distinguish between urban and rural differences. In the context of the present study, this is important as the focus of this research is on intra-urban inequalities only. Thus, ownership of agricultural land, although an important factor, is likely to occur less frequently in urban settings. The selection of key indicators was therefore carried out for urban areas only and PCA was used to reduce the dimension of the data. The variance explained by the first proportion of variance explained ranged from 31 to 42 per cent, depending on the country. In addition, in order to overcome the limited focus of asset-based indices on households’ goods, complementary factors have been considered. These included house material (roof, wall and floor) as well as parents’ education. Regarding the latter, continuing variables measuring both mother’s education and father’s education have been included in an additional AI. As highlighted by Montgomery and Hewett (2005, p.405), “education is a type of long-lasting characteristic that produces a lifetime stream of income and consumption” and therefore it is useful to test for its potential impact. Asset indices were created for each country individually. The list of variables included in PCA is provided in Annex A.

Inequality measures used in the present study include wealth-based ratios, concentration indices and concentration. In terms of computation, ratios can be said to be most straightforward indicators, as they simply involve dividing the relevant variables in the highest and lowest distributions of the data. Traditionally, decile ratios and quintile ratios have been used to assess inequality ([Gold et al., 2001](#_ENREF_21), [Lobmayer and Wilkinson, 2000](#_ENREF_24), [Singh et al., 2012](#_ENREF_36)). Regarding concentration curves, their key advantage is that they enable graphical representation of inequality patterns in a selected outcome variable. In a perfectly equal society the concentration curve would be a 45-degree line. On the other hand, the greater the distance between the 45-degree “equality line” and the concentration curve, the larger the health inequalities. The concentration index is defined as “twice the area between the concentration curve and the line of equality” ([O'Donnell et al., 2008, p.95](#_ENREF_32)). The values of the concentration index fall between -1 and 1, with O indicating perfect equality. When health variables measure ill health a negative sign of a concentration index indicates greater concentration of the outcome amongst the disadvantaged groups ([O'Donnell et al., 2008](#_ENREF_32), [Wagstaff, 2000](#_ENREF_52)). Finally, in order to test all study hypotheses and account for controlling factors, logistic regression modelling is used. Logistic regression is routinely used in studies where outcome variables are binary.

# Results

## Descriptive statistics and inequality measures

Tables 5-6 summarize the results of descriptive analysis and key inequality measures, which will allow examining hypotheses 1 and 2. Based on the results in Table 5, it can be deducted that, overall, most rapidly urbanising countries experience greater intra-urban inequalities when compared to less rapidly urbanising nations. Thus, for example, when considering child underweight, it can be noticed that in the most rapidly urbanising countries group, amongst the poorest households, 21.7 per cent of children suffer from underweight. While this is comparable to an equivalent proportion in the less rapidly urbanising countries, the percentages of underweight children amongst the richest households differ, thus revealing more severe inequalities in most rapidly urbanised countries. More specifically, around 6.4 per cent of children from richest households are underweight in the most rapidly urbanising LDCs as compared to 9.6 per cent in less rapidly urbanising countries. When considering child stunting, the patterns are similar. In line with official sources ([UNICEF, 2013](#_ENREF_49)), country-level proportions of stunted children are higher when compared to proportions of children suffering from underweight. In the most rapidly urbanising nations, amongst the children in the poorest households, 44 per cent of children are stunted and this number declines to 15 per cent for children in the richest households. On the other hand, in the less rapidly urbanised nations, 40 per cent of children from poorest households are stunted as compared to 19 per cent of those living in richest households. Based on the results of the χ2 test, the differences between cells in the cross-tabulations are statistically significant.

Further conclusions can be drawn when analysing selected inequality measures (Tables 5 & 6). Quintile proportion ratios confirm existing wealth-based inequalities. While at the country group level most rapidly urbanising countries show greater intra-urban inequalities, discrepancies between individual countries exist. Overall, in the most rapidly urbanising LDCs, the ratio of child undernutrition of poorest to richest households is almost 3 for stunting, and approximately 3.4 for underweight. At the individual country level, the equivalent ratios vary, with the largest inequalities observed in Burundi and Mozambique. For example, in Burundi, the child stunting ratio is 4.2, while the child underweight ratio is as high as 6.5. Importantly, when the assets index is constructed by including parents’ education (in order to test hypothesis 2), the inequalities in children’s nutritional status are wider. For the pooled data, in the most rapidly urbanising countries, the ratios increase from 3.0 to 3.4 for child stunting and from 3.4 to 3.8 for child underweight.

* Table 5 around here –

Concentration curves and concentration indices confirm previous observations and allow more nuanced conclusions. Based on the results presented in Table 6, it can be deducted that overall the most rapidly urbanising countries experience greater intra-urban inequalities. Based on the ranking constructed using households’ material assets only, at the aggregate level, the concentration indices are -0.20 for child stunting and -.23 for child underweight. The absolute values of these indices are greater (indicating larger disparities) when parents’ education is added to households’ durable assets. In all the most rapidly urbanising countries but Rwanda, concentration indices suggest that inequalities are greater in child underweight than in child stunting. In particular, Burundi and Mozambique experience very severe intra-urban disparities in child underweight with concentration indices equal to or exceeding -0.3. Comparatively, in the less rapidly urbanising countries, the intensity of inequalities is less pronounced. At the pooled data level, based on the wealth index ranking the values of all concentration indices are -0.13 (for underweight) and -0.14 (for stunting). As with the previous country group, inequalities are slightly greater when accounting for parents’ education. Figures 2-5 provide a graphical illustration of the above-discussed inequality patterns.

Finally, unadjusted logistic regression modelling with binary underweight and stunting variables was conducted in order to examine the extent of inequalities between the top and bottom quintiles of wealth distribution (results are also presented in Table 6). For the most rapidly urbanising LDCs, the odds ratio for stunting is 0.22, while the odds ratio for underweight is 0.25, indicating that children in the poorest households are more likely to be undernourished. When parents’ education is included in the households’ assets index, as previously, the severity of inequalities intensifies. On the other hand, in the less rapidly urbanising LDCs, the equivalent odds ratios fall in the range of 0.36 to 0.37, and follow the previous patterns, where poor education of the parents exacerbates intra-urban inequalities. Based on the results of unadjusted logistic regression, largest inequalities in child stunting can be observed in Burundi and Nepal, while greatest inequalities in child underweight are reported for Burundi and Mozambique.

* Table 6 around here –
* Figure 2 around here –

 - Figure 3 around here –

## Regression results

The aim of the logistic regression analysis was to incorporate controlling variables and evaluate to what extent they influence child undernutrition in the context of rapid urbanisation. More specifically, logistic regression modelling allows the testing of hypotheses 3 and 4. Table 7 provides summary results of the logistic regression for child underweight as the outcome variable. For comparison, the outcome of regression analysis with child stunting as the dependent variable is provided in Annex B.

Based on the results of the regression modelling (Table 7), it can be concluded that, controlling for other variables included in the model, children in poorest households are at significant disadvantage when it comes to their nutritional status. This impact is greater in the most rapidly urbanising countries, where all wealth groups are statistically significant at the 5 per cent level. When compared with the children from poorest households, for children from richest households the odds of being underweight are 0.36 times the odds for children from poorest households. Comparatively, in the less rapidly urbanising LDCs, for children from wealthiest households the odds of being underweight are 0.62 times the odds for children in poorest households. In the less rapidly urbanising LDCs, intermediary household wealth quintiles lose their statistical significance when controlling for other confounding factors.

The results of the regression modelling presented in this paper confirm the importance of mother’s education. Thus, in both most rapidly urbanising and less rapidly urbanising LDCs, when controlling for confounding variables, for an additional year of mother’s education we expect to see about 7 to 8 per cent decrease in the odds of child being underweight. Surprisingly, mother’s working status is not statistically significant, even if no other explanatory variables are accounted for. This might be explained by the fact that women often receive very modest remuneration for their work, which does not allow them to purchase quality nutrition. At the same time, female work implies spending time outside of their households, which can also have a negative impact on child care. Regarding regular media exposure, this factor is statistically significant when considered as the only explanatory variable in both most rapidly and less rapidly urbanising LDCs. The impact of regular media exposure remains highly significant in the less rapidly developing countries group, even as a confounding factor (OR=0.77, p<0.05). It has been assumed that regular media exposure constitutes a valuable source of information and thus is likely to influence mother’s behaviour, also in terms of nutritional habits. At the same time, the lack of statistical significance of this variable in the most rapidly urbanising LDCs can be explained by the fact that in these countries the vast majority of mothers (almost 74%) have regular exposure to media. We also found that the effect of household size is not statistically significant when included in the models as a controlling factor (with the exception of the effect at 10% significance level for the largest households in the most rapidly urbanising LDCs). This indicates that at the household level, other factors, in particular household wealth, are key predictors of child nutritional status.

* Table 7 around here –

Finally, child background characteristics, such as birth weight and gender, have a mixed effect on the likelihood of child underweight. Child birth weight stands out as a strong significant predictor of underweight in both country groupings. The strength of these associations is greater in the most rapidly urbanising LDCs (OR = 3.22, p<0.01). In this group of LDCs, the odds of underweight for children born with a low birth weight are more than 3.2 times the odds of children born with normal weight. The association is also strong in the less rapidly urbanising countries (OR=2.35, p<0.01). Regarding gender, male children seem to be at more of a disadvantage when it comes to their nutritional outcomes, although the association is only significant in the more rapidly urbanising countries (OR=0.84, p<0.1). When looking at the regression results with stunting as the outcome variable (Table B.1. in Appendix B), the association is highly significant in both country groupings. This confirms the results of previous research which concluded that boys are at a higher risk of stunting ([Svedberg, 1990](#_ENREF_41), [Wamani et al., 2007](#_ENREF_53)) and that this trend is also prevalent in the poorest households.

# Discussion

Our analysis tested four inter-related hypotheses investigating the effect of pace of urbanisation on socio-economic inequalities in nutritional outcomes, the impact of parents’ education on the extent of existing inequalities, the effect of mother’s characteristics and finally, child birth weight on child’ nutritional status. The findings of the present study confirm that, even when controlling for confounding factors, the scale of intra-urban inequalities in child undernutrition is greater in the most rapidly urbanising LDCs. Moreover, our findings suggest that these inequalities are exacerbated by parents’ poor educational attainment. In both LDC groups (most rapidly and less rapidly urbanising countries), mother’s education, but not working status, was found to be a significant predictor of child’s nutritional outcomes.

The results of the present study are largely in line with existing literature on intra-urban inequalities ([Fotso, 2006](#_ENREF_19); [Menon Ruel and Morris, 2000](#_ENREF_29); [Van de Poel, O'Donnell and Van Doorslaer, 2007](#_ENREF_50); [Arokiasamy et al., 2012](#_ENREF_4)), although no direct comparison can be made due to limited literature on the subject. Fotso’s results showed greatest intra-urban inequalities for Mozambique and Tanzania, while narrowest inequalities are reported in Zambia and Chad ([Fotso, 2006](#_ENREF_19)). Similarly, Menon et al. (2000) also found that, amongst the 11 analysed countries, Zambia had the lowest intra-urban inequality of child stunting. This is in line with the argumentation and findings of our study, as both Mozambique and Tanzania have undergone a very rapid pace of urbanisation, while Zambia and Chad are amongst the less rapidly urbanising countries. With regards to mother’s socio-economic characteristics, the results are largely in line with findings by other scholars. For example, Arokiasamy el al. ([2012](#_ENREF_4)) found that, in India, mother’s education had a highly significant effect on the risk of child undernutrition. The decomposition analysis conducted by the authors showed that, after household wealth, mother’s education was the second greatest contributor to both child stunting and child underweight. In some, but not all studies, mother’s working status has been found to positively associated with child malnutrition. For example, in Nigeria, which has been experiencing a relatively high pace of ubanistaion, it was found that mother’s work status had a significant positive impact on child child growth in localities with high prevalence of malnutrition (Ajieroh, 2014). Concerning child’s birth weight, previous studies (Abuya et al., 2012; Das et al., 2012) have shown that, in poor urban areas or slums, birth weight is a strong predictor of children’s undernutrition, which is in line with the results of the present study.

It is interesting to observe that the biggest differences seem to start to occur especially in the middle wealth group and above (richer and richest). This can be explained by the fact that, as highlighted previously, the middle class in the LDCs remains fragile and tends to be at the bottom of the rank (ADB, 2011). Thus, households, which are classified as middle class often cannot afford quality nutritious food and access to health care. This is particularly relevant in the most rapidly urbanising countries, where expenses tend to be higher and family networks looser. It should also be noted that wealth effect differ when comparing the results for stunting and for underweight. For stunting, wealth effects are significant for both less rapidly and most rapidly urbanising countries. This can be explained by the fact that stunting, an indicator of chronic malnutrition, reflects long term nutritional deprivation and poor environmental conditions (WHO, 2010). In this sense, acute poverty is likely to have similar effects regardless of how fast countries are urbanising.

It should be acknowledged that, despite its contributions, this study has several limitations. The first limitation is linked to the quantitative assumptions as pertaining to the choice of countries. While utmost scrutiny has been applied to select most rapidly and least rapidly urbanising LDCs, given the availability of different indicators and their variability over time, ultimately, no perfect combination of countries exists. Furthermore, the choice of study countries had to be restricted to those nations where recent DHS data exist. The second limitation of this research is related to the fact that no community or neighbourhood effects have been accounted for due to the focus of this research on macro-micro level interlinkages. In this context, future research agenda should consider case study analyses with a specific focus on meso level geographical factors.

**Conclusions**

This research aimed at estimating the extent of intra-urban inequalities in child undernutrition in the context of rapid urbanisation. The results of our analysis highlight the importance and negative effects of the rapid pace of urbanisation at the country level and show that pace of urbanisation can be associated with negative human development outcomes, such as prevalence of child malnutrition. The findings also highlighted the critical role of parental education in reducing nutrition inequalities in urban areas in poorest countries. Our analysis also showed that mother’ s socio-economic status, in particular education and work status, as well as child birth weight continue to be associated with child malnutrition. The analysis of two separate datasets divided by countries’ pace of urbanisation, wealth effects and the effects of mother’s socio-economic characteristics are stronger in the most rapidly urbanising countries. This confirms the existing scholarly arguments around the negative impacts of rapid poorly planned urban growth (Szabo et al., 2015, Szabo et al., 2016, Nickanor and Kazembe, 2016). The findings also imply a need for an increased policy focus on on the challenges faced by the middle class, in particular with regards to adult education and job opportunities for women...

Reducing socio-economic inequalities in rapidly growing urban areas and eradicating the underlying challenges pertaining to child survival, such as universal access to nutritious food and safe drinking water, should be a *sine qua non* condition for other developmental initiatives. While child survival is embedded in the UN Convention on the Rights of the Child ([UN, 1989](#_ENREF_43)), formal M&E and accountability mechanisms are required in order to ensure progress towards SDG 2 and wider human development agenda (Szabo et al. 2016b). In this context, an increased global focus on social inclusion, accountability and environmental factors (SDSN, 2013) constitute a move in the right direction.

As highlighted previously, future research should build on the results of the present study and focus on context-specific associations between pace of urbanisation and inequalities in child nutrition an health status. This would also contribute to advancing the SDG agenda is specific LDCs,. Future studies should also consider analyses using different cut off criteria for urban growth as well as examining how different drivers of urbanisation might contribute to widening socio-economic inequalities. Because of the importance of the topic pertaining to the practical implications of rapid urbanisationn children’s nutritionaloutcomes and health, it is crucial to invest both time and funding in a comprehensive research strategy in this area of study.

# Annex A Variables used for the creation of the Assets Index.

* Table A1 around here –

# Annex B Additional regression models - outcome variable: stunting

* Table B1 around here –

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**TABLES**

Table 1 Macro-level characteristics of study countries.

|  |  |
| --- | --- |
|  | **Selected macro-level characteristics of case study countries**  |
| **most rapidly urbanising countries** | **Indicator** | **Burkina Faso** | **Burundi** | **Mozambique** | **Nepal** | **Rwanda** |
| average annual urban growth, % (1980-2010) | 6.32 | 5.35 | 5.05 | 5.65 | 7.00 |
| pace of urbanisation, % (1980-2010) | 192 | 145 | 136 | 173 | 298 |
| proportion of urban population, % (2010) | 25.7 | 10.60 | 31.0 | 16.7 | 18.8 |
| population size, total (2012) | 16,460,141 | 9,849,569 | 25,203,395 | 27,474,377 | 11,457,801 |
| TFR (2011) | 5.8 | 4.2 | 4.8 | 2.7 | 5.3 |
| HDI value (2012) | 0.343 | 0.355 | 0.327 | 0.463 | 0.434 |
| Inequality-adjusted HDI value (2012) | 0.226 | n/a | 0.220 | 0.304 | 0.287 |
| net ODA received, % of GNI (2011) | 9.6 | 24.8 | 16.7  | 4.7 | 20.2 |
| geographic region (UN classification)  | West Africa | Eastern Africa | Southern Africa | South-Central Asia | Eastern Africa |
| access to improved water sources, % of urban population with access (2010) | 95 | 83 | 77 | 93 | 76 |
| prevalence of stunting amongst children (% of children under 5) | 35.1 (2009) | n/a | 43.7 (2008) | 40.5 (2011) | 44.3 (2010) |

**Table 1 (ctnd) Macro-level characteristics of study countries.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **less rapidly urbanising countries** |  | **Congo (DRC)** | **Niger** | **Senegal** | **Sierra Leone** | **Zambia** |
| average annual urban growth, % (1980-2010) | 3.51 | 4.14 | 3.33 | 3.03 | 2.63 |
| pace of urbanisation, % (1980-2010) | 17 | 31 | 18 | 34 | -3 |
| proportion of urban population, % (2011) | 33.7 | 17.6 | 42.3 | 38.9 | 38.7 |
| population size, total (2012) | 65,705,093 | 17,157,042 | 13,726,021 | 5,978,727 | 14,075,099 |
| TFR (2011) | 5.7 | 7.0 | 4.7 | 4.9 | 6.3 |
| HDI value (2012) | 0.304 | 0.304 | 0.470 | 0.359 | 0.448 |
| Inequality-adjusted HDI value (2012) | 0.183 | 0.200 | 0.315 | 0.210 | 0.283 |
| net ODA received, % of GNI (2012) | 38.5 | 10.8 | 7.3 | 14.6 | 5.8 |
| geographic region (UN classification)  | Middle Africa | Western Africa | Western Africa | Western Africa | Eastern Africa |
| access to improved water sources, % of population with access (2010) | 79 | 100 | 93 | 87 | 87 |
| prevalence of stunting amongst children (% of children under 5) | n/a | n/a | 28.7 (2011) | 37.4 (2008) | n/a |

Table 2: Sample size by country

|  |  |
| --- | --- |
| **Country and DHS date** |  **n** |
| Burkina Faso (2010) | 3,243 |
| Burundi (2010) | 1,361 |
| DRC (2007) | 3,575 |
| Mozambique (2011) | 3,608 |
| Nepal (2011) | 1,091 |
| Niger (2006) | 2,607 |
| Rwanda (2010) | 1,225 |
| Senegal (2010-11) | 3,645 |
| Sierra Leone (2008) | 1,920 |
| Zambia (2007) | 2,073 |
| Total sample size: | 24,348 |

**Table 3 Key variables used in the analysis**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Scale** | **Coding** |
| wealth quintile | categorical | 1 - poorest, 2-poor, 3-medium, 4-richer, 5-richest |
| household size | categorical | 1 – between 1 and 5, 2-between 6 and 10, 3 - more than 10 |
| **Mother's socio-educational characteristics** |  |
| years of education | continuous |  |
| working status | binary | 0 – not working, 1 - working |
| regular exposure to media\*  | binary | 0 – no, 1-yes |
| **Child's background characteristics** |  |
| gender | binary | 1 - male, 2-female |
| birth weight | binary | 1 – low, 2-normal |

Note: It has been assumed that regular exposure to media occurs when one or more of the following conditions are satisfied: reading newspaper or magazine (at least once a week), listening to the radio (at least once a week) or watching television (at least once a week).

**Table 4 Descriptive statistics for key variables used in the analysis**

|  |  |
| --- | --- |
| **Variable** | **Descriptive statistics** |
|  | Most rapidly urbanising LDCs | Less rapidly urbanising LDCs |
| household size |  |  |
| 1-5 | 45.8% | 26.9% |
| 6-0 | 45.9% | 44.3% |
| More than 10 | 8.4% | 28.9% |
| **Mother's socio-educational characteristics** |  |  |
| Mother has been working | 63.6% | 46.8% |
| Mother has been regularly exposed to media | 73.5% | 26.6% |
| Years of education | 5.0 (4.3) | 4.7 (4.6) |
| **Child's background characteristics** |  |  |
| Gender: female | 48.5% | 49.0% |
| Low birth weight | 11.6% | 10.4% |

Table 5 Prevalence of child undernutrition (stunting and underweight) by household wealth and pace of urbanisation

|  |  |
| --- | --- |
| **Most rapidly urbanising LDCs** | **Less rapidly urbanising LDCs** |
|   | Household’s wealth | Household’s wealth |
| **Child underweight** | poorest | poorer | middle | richer | richest | Total | poorest | poorer | middle | richer | richest | Total |
|   |   |  |  |  |  |   |  |  |  |  |  |   |
| not underweight (frequency) | 940 | 946 | 1,055 | 1,107 | 1,037 | 5,085 | 796 | 946 | 895 | 903 | 972 | 4,512 |
| % | 78.27 | 85.46 | 87.84 | 91.49 | 93.59 | 87.27 | 77.81 | 80.79 | 81.96 | 84.39 | 90.42 | 83.08 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| underweight (frequency) | 261 | 161 | 146 | 103 | 71 | 742 | 227 | 225 | 197 | 167 | 103 | 919 |
| % | 21.73 | 14.54 | 12.16 | 8.51 | 6.41 | 12.73 | 22.19 | 19.21 | 18.04 | 15.61 | 9.58 | 16.92 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total | 1,201 | 1,107 | 1,201 | 1,210 | 1,108 | 5,827 | 1,023 | 1,171 | 1,092 | 1,071 | 1,075 | 5,431 |
| % | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
|   |   |  |  |  |  |   |  |  |  |  |  |   |
| Pearson χ2  |  χ2=150, p<0.01 |  χ2=68, p<0.01 |
|   |   |  |  |  |  |   |  |  |  |  |  |   |
| **Child stunting** |   |  |  |  |  |   |  |  |  |  |  |   |
| not stunted (frequency) | 672 | 694 | 850 | 948 | 944 | 4,108 | 610 | 720 | 731 | 811 | 866 | 3,738 |
| % | 56.05 | 62.69 | 70.83 | 78.54 | 85.2 | 70.57 | 59.69 | 61.54 | 67.00 | 75.94 | 80.63 | 68.90 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| stunted (frequency) | 527 | 413 | 350 | 259 | 164 | 1,713 | 412 | 450 | 360 | 257 | 208 | 1,687 |
| % | 43.95 | 37.31 | 29.17 | 21.46 | 14.8 | 29.43 | 40.31 | 38.46 | 33.00 | 24.06 | 19.37 | 31.10 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total | 1,199 | 1,107 | 1,200 | 1,207 | 1,108 | 5,821 | 1,022 | 1,170 | 1,091 | 1,068 | 1,074 | 5,425 |
| % | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
|   |   |  |  |  |  |   |  |  |  |  |  |   |
| Pearson χ2 |  χ2 = 306, p<0.01 |  χ2 = 166, p<0.01 |
|   |   |   |   |   |   |   |   |   |   |   |   |   |

Table 6 Inequalities in nutritional status (stunting and underweight) in selected most rapidly and less rapidly urbanising countries.

|  |  |  |  |
| --- | --- | --- | --- |
| **Countries’ pace of urbanisation** | **Country** | **Stunting** | **Underweight** |
| quintile ratio (poorest to richest) | concentration index | logistic regression OR (richest compared to poorest) | quintile ratio (poorest to richest) | concentration index | logistic regression OR (richest compared to poorest) |
| **Most rapidly urbanising** | Burkina Faso | 1.68 | -0.13 | 0.51 (10)\*\*\* | 2.22 | -0.15 | 0.38 (0.09)\*\*\* |
| Burundi | 4.15 | -0.27 | 0.12 (0.04)\*\*\* | 6.49 | -0.36 | 0.11 (0.05)\*\*\* |
| Mozambique | 3.24 | -0.2 | 0.19 (0.03)\*\*\* | 6.84 | -0.3 | 0.12 (0.04)\*\*\* |
| Nepal | 3.74 | -0.21 | 0.16 (0.06)\*\*\* | 3.33 | -0.24 | 0.21 (0.08)\*\*\* |
| Rwanda | 3.76 | -0.26 | 0.17 (0.07)\*\*\* | 1.92 | -0.17 | 0.49 (0.28) |
| 5 LDCs | 2.97 | -0.2 | 0.22 (0.02)\*\*\* | 3.39 | -0.23 | 0.25 (0.03)\*\*\* |
| 5 LDCs' | 3.42 | -0.22 | 0.19 (0.02)\*\*\* | 3.76 | -0.24 | 0.22 (0.03)\*\*\* |
| **Less rapidly urbanising** | Congo (DRC) | 2.5 | -0.17 | 0.26 (0.06)\*\*\* | 2.18 | -0.12 | 0.40 (0.11)\*\*\* |
| Niger | 2.49 | -0.17 | 0.29 (0.07)\*\*\* | 2.64 | -0.17 | 0.29 (0.07)\*\*\* |
| Senegal | 2.44 | -0.15 | 0.33 (0.09)\*\*\* | 1.69 | -0.08 | 0.55 (0.18)\* |
| Sierra Leone | 1.42 | -0.09 | 0.63 (0.19) | 2.51 | -0.12 | 0.33 (0.12)\*\*\* |
| Zambia | 1.92 | -0.12 | 0.36 (0.06)\*\*\* | 2.58 | -0.16 | 0.35 (0.09)\*\*\* |
| 5 LDCs | 2.13 | -0.14 | 0.36 (0.00)\*\*\* | 2.32 | -0.13 | 0.37 (0.00)\*\*\* |
| 5 LDCs' | 2.39 | -0.16 | 0.29 (0.00)\*\*\* | 2.84 | -0.17 | 0.29 (0.00)\*\*\* |

Notes: the results in the last column “**5 LDCs’”** have been computed based on the modified assets index, which also included parents’ educational attainment. \*\*\* denotes highly significant (p<0.01).

Table ‎7 Determinants of child undernutrition (underweight) by pace of urbanisation

|  |  |  |
| --- | --- | --- |
| **Child underweight** | **Most rapidly urbanising LDCs** | **Less rapidly urbanising LDCs** |
| Variable | OR (CI) | OR (CI) |
| **Household assets** |  |   |
| Poorer | 0.72 (0.56; 0.94)\*\* | 1.02 (0.77; 1.34) |
| Middle | 0.65 (0.49; 0.84)\*\*\* | 0.95 (0.72; 1.26) |
| Richer | 0.46 (0.34; 0.62)\*\*\* | 0.94 (0.70; 1.27) |
| Richest | 0.36 (0.25; 0.51)\*\*\* | 0.62 (0.44; 0.87)\*\*\* |
|  Baseline: poorest | 1.00 | 1.00 |
| **Number of household members** |  |   |
| 6-10 | 0.94 (0.78; 1.14) | 0.95 (0.78; 1.17) |
| more than 10 | 1.46 (1.06; 2.02)\*\* | 1.01 (0.79; 1.29) |
|  Baseline: 1-5 | 1.00 | 1.00 |
| **Mother's socio-economic characteristics** |  |   |
| Years of education | 0.92 (0.90; 0.94)\*\*\* | 0.93 (0.91; 0.95)\*\*\* |
| Mother works: mother doesn't work | 1.10 (0.92; 1.33) | 0.98 (0.82; 1.17) |
| Regular exposure to media: no exposure | 1.04 (0.85; 1.28) | 0.77 (0.62; 0.94)\*\* |
| **Child's background characteristics** |  |   |
| Child is a girl: child is a boy | 0.84 (0.70; 1.00)\* | 0.87 (0.73; 1.03) |
| Low birth weight: normal birth weight | 3.22 (2.58; 4.02)\*\*\* | 2.35 (1.83; 3.02)\*\*\* |
|   |  |   |
| Constant |  0.27 (0.20; 0.35)\*\*\* | 0.35 (0.26; 0.48)\*\*\* |
|   |   |   |
| Log likelihood  | -1,633 | -1,691 |
| number of observations  | 4,841 | 4,214 |

Notes: \*\*\* denotes p<0.01, \*\* denotes p<0.05, \* denotes p<0.1, OR stands for Odds Ratio and CI stands for 95% Confidence Intervals.

Table A.1 Variables used in PCA.

|  |  |  |
| --- | --- | --- |
| **Variable** | **scale** | **coding** |
|  |   |   |
| has electricity | binary | 1 - no, 2-yes |
| toilet type | categorical | 1 - no toilet, 2- shared other, 3-shared flush, 4-private other, 5-private flush |
| wall material | categorical | 1 - natural, 2 - rudimentary, 3 - finished |
| roof material | categorical | 1 - natural, 2 - rudimentary, 3 - finished |
| floor material | categorical | 1 - natural, 2 - rudimentary, 3 - finished |
| has radio  | binary | 1 - no, 2-yes |
| has television | binary | 1 - no, 2-yes |
| has refrigerator | binary | 1 - no, 2-yes |
| has motorcycle/ scooter | binary | 1 - no, 2-yes |
| has car/track | binary | 1 - no, 2-yes |
| ***parents’ educational capital*** |   |   |
| mother’s education  | categorical | 1 - no education, 2 - incomplete primary, 3 - complete primary, 4- incomplete secondary, 5- complete secondary, 6- higher |
| father’s education | categorical | 1 - no education, 2 - incomplete primary, 3 - complete primary, 4- incomplete secondary, 5- complete secondary, 6- higher |

Table B.1 Regression results for child stunting (most rapidly urbanising and less rapidly urbanising LDCs)

|  |  |  |
| --- | --- | --- |
| **Child stunting** | **Most rapidly urbanising LDCs** | **Less rapidly urbanising LDCs** |
| variable | OR (CI) | OR (CI) |
| **Wealth quintile** |  |   |
| Poorer | 0.81 (0.66; 0.99)\*\* | 1.01 (0.81; 1.26) |
| Middle | 0.56 (0.46; 0.69)\*\*\* | 0.78 (0.62; 0.97)\*\* |
| Richer | 0.42 (0.33; 0.52)\*\*\* | 0.53 (0.41; 0.67)\*\*\* |
| Richest | 0.26 (0.21; 0.34)\*\*\* | 0.40 (0.31; 0.51)\*\*\* |
|  Baseline: poorest | 1.00 | 1.00 |
| **Number of household members** |  |  |
| 6-10 | 1.10 (0.96; 1.26) | 0.89 (0.76; 1.04) |
| more than 10 | 1.28 (0.99;1.65)\* | 0.86 (0.70; 1.04) |
|  Baseline: 1-5 | 1.00 | 1.00 |
| **Mother's socio-educational characteristics** |  |  |
| Years of education | 0.95 (0.94; 0.97)\*\*\* | 1.00 (0.98; 1.02) |
| Mother works: mother doesn’t work | 0.83 (0.73; 0.95)\*\*\* | 0.96 (0.84; 1.10) |
| Regular exposure to media: no exposure | 1.05 (0.90; 1.22) | 0.72 (0.61; 0.85)\*\*\* |
| **Child's background characteristics** |  |  |
| Child is a girl: child is a boy | 0.75 (0.66; 0.86)\*\*\* | 0.77 (0.68; 0.89)\*\*\* |
| Low birth weight: normal birth weight | 2.02 (1.66; 2.44)\*\*\* | 1.95 (1.57; 2.44)\*\*\* |
| Constant | 0.93 (0.75; 1.15) | 0.92 (0.72; 1.18) |
|   |  |   |
| Log likelihood  | -2,673 | -2,461 |
| number of observations  | 4,837 | 4,208 |
|  |  |  |

Notes: \*\*\* denotes p<0.01, \*\* denotes p<0.05, \* denotes p<0.1, OR stands for Odds Ratio and CI stands for 95% Confidence Intervals.

**FIGURES**

Fig. 1. Trends in child undernutrition (stunting) in LDCs by pace of urbanisation (more rapid vs. less rapid)

Note: As specified in the *Introduction*, more rapidly urbanising LDCs include Burkina Faso, Burundi, Mozambique, Nepal, and Rwanda, while less rapidly urbanising countries are Congo (DRC), Niger, Senegal, Sierra Leone and Zambia.

Fig. 2. Intra-urban inequalities in child nutritional outcomes in the most rapidly urbanising LDCs

Fig. 3. Intra-urban inequalities in child nutritional outcomes in the less rapidly urbanising LDCs

Fig. 4. Intra-urban inequalities in child nutritional outcomes in the most rapidly urbanising LDCs (accounting for parents' education)

Fig. 5. Intra-urban inequalities in child nutritional outcomes in the less rapidly urbanising LDCs (accounting for parents' education)



Fig. 2.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

1. All most rapidly urbanised countries (based on the pace of urbanisation criterion) have also experienced high average annual urban growth (1890-2010); while all less rapidly urbanising countries have experienced average or below average annual urban growth (1980-2010). Only LDCs have been considered. [↑](#footnote-ref-1)
2. Some rapidly urbanising countries, such as Bhutan, are not part of the DHS project, while others, like Laos, had not released their datasets at the time this study was written. [↑](#footnote-ref-2)
3. For example, in Rwanda only 76 per cent of the urban population benefit from access to improved water sources, while in Niger the equivalent coverage has now reached 100 per cent (World Bank, 2015). [↑](#footnote-ref-3)