Moving towards a better future for your children? The impact of maternal migration on child nutrition in Tanzania

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1. Introduction

Migration is increasingly recognised as a salient part of livelihood strategies in developing countries. Yet, research on the micro-level impact of internal migration flows has mostly focused on (monetary) outcomes for the migrants themselves. Migrant parents may, however, be able to not only improve their own welfare, but also enhance the human capital of their children and, as such, break the intergenerational transmission of poverty and contribute to longer-term rural transformation. At the same time, migration itself can also be considered a disruptive process which may interfere with child care and food security. Though child nutrition and health are therefore of intrinsic interest, both as a current measure of well-being and a source of future human capital, the crucially important question of how parental migration affects child growth remains largely unanswered.

Food insecurity and malnutrition have proven to be particularly persistent problems in Tanzania. Despite strong economic growth, there has been no clear declining trend in the prevalence of undernourishment and the change in the rate of stunting was modest (World Bank, 2017; WHO, 2014). While there was more pronounced progress in recent years, over one third of children under five were still estimated to be too short for their age in 2015/16 (MoHCDGEC et al., 2016). In addition, there is substantial spatial heterogeneity in child nutrition outcomes, giving even more prominence to the question whether migration, is a viable strategy for parents to improve their children's wellbeing.

As with any empirical estimation of the returns to migration, the endogeneity of migration poses a problem. Parents' migration is likely to be related to some of the same factors that will determine their children's well-being, either because of biological or genetic reasons or because of other characteristics, such as wealth and education, that can influence both the process of migration and how children are cared for. The current evidence base is small and inconclusive. Existing studies have mainly focused on child survival and are based upon cross-sectional designs that do not allow us to disentangle the impact of migration from migrant selection. It is important to note that this distinction is not solely of scholarly interest. The existence of a causal impact of parental migration on child growth would imply that population movements can affect current living standards as well as intergenerational mobility and future development. Not only does this shed light on the desirability of policies encouraging or restricting such moves, it will also provide some important insights for the design and targeting of food security and health policies.

Using panel data from the Kagera Health and Development Survey covering the period between 1991 and 2010, which tracked out-migrating respondents, this paper aims to improve our understanding of how children are affected by their parents' migration in a developing country setting. More specifically, we assess how maternal migration out of rural Kagera affects child growth. To the best of our knowledge, only two studies on the impact of maternal migration on child well-being included measurements of child growth (Choudhary and Parthasarathy, 2009; Mansuri, 2006). In addition, the panel nature of the data and the tracking of individuals to new locations allow us to go further than previous research in addressing selection bias since we can restrict the comparison to children of mothers originating from the same baseline family. As such, this identification strategy effectively addresses concerns that observed or unobserved heterogeneity across migrant and non-migrant families may distort the results. In addition, the detailed nature of these panel data allows us to control for a large number of observable characteristics of the mother before migration.

The remainder of this paper is organised as follows. The next Section, briefly reviews the available literature on the intergenerational impact of internal migration. The data and setting are described in Section 3. Section 4 presents the identification strategy and regression results and Section 5 concludes.

2. Parental migration and child growth

The literature has identified many potential channels through which parental migration may affect different dimensions of child well-being and child growth in particular. It is important to note that the impact of parental migration on children that are left behind will not be considered for the purpose of this paper.[1] The discussion here below is concentrated on how internal migration affects children who moved alongside their parent(s) or were born after migration at the new place of residence.

Migration is generally assumed to be disruptive. The physical process of moving can be associated with hardship for young children or pregnant women (Brockerhoff, 1990). Moving can also imply temporary unavailability of health services and interfere with health seeking behaviour (Antai, 2010; Brockerhoff, 1994; Kiros and White, 2004; Kusuma et al., 2010). Especially during the early phases of in-migration, relocation to the host community can involve residence in crowded dwellings, which may, for example, facilitate the spread of diseases (Brockerhoff, 1994). In addition, due to the cost of moving and loss of earnings, migrant families can be placed under financial strain in the short-term (Smith-Greenaway and Madhavan, 2015). This, in turn, affects a household's ability to purchase food and other inputs that influence child growth. Moreover, the subsequent need to find new employment and housing may divert attention and time away from childcare and food preparation (Omariba and Boyle, 2010; Smith-Greenaway and Madhavan, 2015). Next to these relatively short-term disruptions, moving away from home can result in a break in the mother's networks and support groups. A migrant mother is likely to be physically separated from additional caregivers and stands to lose contact with people who would give her (financial) support and advice on childcare (Brockerhoff, 1994; Ssengozi et al. 2002). More generally, leaving home and coping with conflicting norms at the destination may cause psychological stress (Brockerhoff, 1994). The next phase in the migration process requires the mother to familiarise herself with, locate and gain access to health, and other services at the destination (Brockerhoff, 1994; Smith-Greenaway and Thomas, 2014). It is not unlikely that this process is strained by legal, language or cultural barriers, or even discrimination (Smith-Greenaway and Madhavan, 2015).

A common argument is that, despite these disruptions, migrants will gradually adapt to their new environment. This adjustment is assumed to be facilitated by greater duration of residence (i.e. the '*disruption and adaptation*' hypothesis). Smith-Greenaway and Thomas (2014) further argue that the adaptation process will vary according to the similarity of the origin and destination. At this point, the advantages or disadvantages of the destination— often referred to as '*contextual effects*'—come into play. Migration may, for example, directly promote or harm child health by exposing children to a different epidemiological environment (Brockerhoff, 1990). In addition, there is considerable variation in income-earning opportunities as well as the availability

[1] Though a relatively small number of children appears to have been left behind in this sample, this occurs more widely in other settings and is the subject of several research papers (e.g. Davis and Brazil, 2016; Nguyen, 2016; De Brauw and Mu, 2011; Liang and Chen, 2007).

and access to foods as well as modern health and social services, electricity and potable water (e.g. Smith et al., 2005; Van de Poel et al., 2007).

Large rural-urban discrepancies, in particular, raise the question whether rural mothers can improve their children's well-being by moving to urban areas (Omariba and Boyle, 2010; Ssengozi et al., 2002). Brockerhoff (1994:145) in fact posits that "*millions of children's lives were saved in the late 1970s and 1980s as a result of mothers leaving the countryside and settling in towns and cities of developing countries*". However, at the same time there are concerns that rural migrants are often unable to fully integrate into urban society and end up living in crowded dwellings in slum areas with poor infrastructure and services (Mberu and Mutua, 2015; Omariba and Boyle, 2010). Moreover, even if migrants can fully integrate, some aspects of urban living may actually undermine child health and nutrition. Not only are cities more prone to health hazards, such as air and water pollution, increased employment opportunities may raise the cost of time spent on rearing children. Finally, living in an urban area is commonly assumed to introduce some unhealthy lifestyle patterns including decreased physical activity and dietary excess, both of which are believed to contribute to the rising prevalence of overweight and several other nutrition-related non-communicable diseases in cities (e.g. Popkin, 1999; 2001; Popkin and Gordon-Larsen, 2004). Migration to urban areas in Tanzania has, for example, been shown to be associated with increased intakes of high-sugar and processed and prepared foods (Cockx et al., 2017).

As mentioned above, relatively few studies assess the relationship between parental migration and child-wellbeing. In addition, much of the available evidence derives from studies primarily aimed at drawing attention to the vulnerability of migrant children at their destinations and in cities in particular (e.g. Brockerhoff, 1995; Issaka et al., 2016). While relevant for developing inclusive food security and health policies, the comparison between children of migrants and those born to native parents at their destination sheds no light on the question whether migration is a successful strategy to improve (future) children's well-being. That is to say that their disadvantaged position in the current place of residence does not hold any information on how children of migrants would have fared had their parents stayed in their original community. Non-migrant children in the source community therefore arguably represent a more relevant group of comparison. The overview of available evidence is thus restricted to studies that include a comparison of migrant children with children living in communities similar to their origin.

The majority of research on the impact of internal migration on child-wellbeing focusses on child survival until the age of five. Using Demographic and Health Survey (DHS) data from 17 developing countries, Brockerhoff (1994) finds that children born after their mother moved from a rural to an urban area, in North Africa, Latin America and South East Asia in particular, appear to have significantly improved survival chances compared to their rural native counterparts.[2] Omariba and Boyle (2010) pool data from 52 least developed countries and similarly find a survival advantage for children of rural-urban migrants. Several individual country studies also point to a

[2] The North African sample includes Egypt, Morocco, North Sudan and Tunisia; the Latin-American sample covers Bolivia, Ecuador, Guatemala, Mexico and Peru; the South East Asian sample consists of Indonesia and Thailand.

survival advantage for children of rural-urban migrant mothers as compared to rural natives. Earlier research by Brockerhoff (1990), for example, demonstrates that the risk of dying before the age of five is dramatically lower for children of rural-urban mothers than for rural non-migrants in Senegal. This is confirmed for South Africa (Thomas, 2007) and Bangladesh (Islam and Azad, 2008) and appears to hold for under-two mortality in India (Stephenson et al., 2003), Bolivia and Peru (Tam, 1994). However, other studies find no evidence of any beneficial impact of maternal migration (Smith-Greenaway and Thomas, 2014; Ssengozi et al., 2002). Few of these studies take other types of migration into account. Smith-Greenaway and Thomas (2014) document a survival advantage for children of urban-urban migrant children in Haiti. The same studies also demonstrate a positive effect of having a rural-rural migrant mother. Ssengozi et al. (2002), then again, find that children born to rural-rural migrant mothers in Uganda appear to have poorer chances of survival. In line with the disruption and adaptation hypothesis, Brockerhoff (1994) further demonstrates that rural-urban migration is significantly associated with a dramatic short-term increase in mortality for children born up to two years before their mother's migration. Children born after migration, however, gradually experience better survival chances. The latter is confirmed by Islam and Azad (2008) and Mberu and Mutua (2015). Several studies also find that children of long-term migrants enjoy a significant advantage over children of short-term migrants (Brockerhoff, 1990; Tam, 1994). Others, however, find no support for any gradual improvement over time spent at the destination (Omariba and Boyle, 2010; Ssengozi et al., 2002; Stephenson et al., 2003).

To the best of our knowledge, only two studies compare child growth patterns according to maternal migration status. Choudhary and Parthasarathy (2009) find that children born to urban-urban migrant mothers are comparable to Mumbai natives' children in terms of the likelihood of being stunted, wasted, or underweight and each additional year a mother spends in Mumbai city reduces the probability of her child being stunted. Mansuri (2006) demonstrates that, even when restricting the comparison to children in the same household, girls born after migration in rural Pakistan enjoy a significant growth advantage.

As mentioned above, the majority of studies discussed in this section are based on simple comparisons of children of migrants with non-migrant children. This difference is, however, unlikely to reflect the impact of migration since migrants and their families tend to differ from non-migrants and their respective families along a host of observed and unobserved dimensions, some of which will be related to their children's nutrition and health. In an attempt to address the issue of selectivity, several studies include mother or household characteristics after migration (Smith-Greenaway and Thomas, 2014; Ssengozi et al., 2002; Stephenson et al., 2003; Omariba and Boyle, 2010). However, in order to know whether selection is driving the differences, pre-migration rather than post-migration characteristics are of interest since these will influence both the decision to migrate and future child growth. With cross-sectional data it is therefore "*difficult to identify measures of migrant selection, since most of the data pertaining to current status also reflect the adaptation of migrants post-migration*" (Brockerhoff, 1990: 606). Panel data tracking migrants over time, however, offer some interesting opportunities to limit potential sources of unobserved heterogeneity. As Omariba and

Boyle (2010:294) put it, "*addressing the question of compositional (selection) versus contextual effects conclusively, requires the collection of person-level data in a longitudinal study.*" To the best of our knowledge, this paper is the first to use longitudinal data to study the impact of maternal migration on child growth in a developing country setting.

3. Data

3.1 Kagera Health and Development Survey (KHDS)

We use the Kagera Health and Development Survey (KHDS) spanning the period between 1991 and 2010. Kagera is one of the least developed and urbanised regions of the United Republic of Tanzania, a low-income, low human development country in East Africa (THDR, 2014). Located far from the capital and the coast, Kagera is characteristic of many landlocked parts of Africa that are largely dependent on agriculture (De Weerdt, 2010). An estimated 42% of the population was living below the national poverty line in 2010, with the rate going up to 72.2% according to the UN Multidimensional Poverty Index (THDR, 2014). Though substantive progress has been made, Kagera is also characterised by the highest infant and child mortality rates (62 and 93 deaths per 1000 live births respectively) in the country (NBS, 2015). A staggering 41.7% of children under five in the region were estimated to be stunted.

In general, poverty in Tanzania is overwhelmingly rural. More than 80 per cent of the poor live in rural areas. Over half of the rural poor rely on subsistence agriculture for their livelihoods (World Bank, 2015). While there have been considerable improvements, rural living standards remain low. Not more than 5 % of rural households in mainland Tanzania reported to have access to electricity and less than 10 % have access to improved (not shared) toilet facilities (compared to 56 % and 35 % of urban households) (MoHCDGEC et al., 2016). As mentioned above, the presence of stark rural-urban discrepancies in living conditions in Tanzania gives prominence to the question whether relocating to towns and cities, in particular, is a viable strategy for parents to improve their children's wellbeing. Yet, it is important to note that Beegle et al. (2011) and Wineman and Jayne (2016) find that intra-rural migration in Tanzania is significantly associated with greater consumption growth for the migrants themselves. Population movements between rural areas therefore appear to play a an important role in rural development and structural transformation and merit equal attention when studying the impact of parental migration.

Tanzania is increasingly characterised by large internal migration movements. According to the 2012 census, about 7.8 million Tanzanians were living outside their place of birth and over 1.5 million people moved to a different region between 2011 and 2012 (NBS, 2015). Over the past decades, there has been substantial migration within and outside Kagera as well (Beegle et al., 2011). The Census reveals that 222,404 individuals born in the region were residing elsewhere in the country in 2012 and 29,573 had moved in the preceding year (NBS, 2015).

While initially designed to assess the impact of the health crisis linked to the HIV/AIDS epidemic in the area[3], later rounds of the KHDS aimed to provide data to understand economic mobility and changes in living standards. From autumn 1991 to January 1994, 915 households from 51 villages in all five districts of Kagera were interviewed up to four times. In the second and third rounds in 2004 and 2010, the survey team attempted to track and re-interview all baseline household members including those who had moved out of their original village, region, or country, or were residing in a new household (Beegle et al., 2006). This effectively meant turning the original household survey into an individual longitudinal survey. Excluding households in which all previous members were deceased, 93 and 92% of the baseline households were re-contacted in the KHDS in 2004 and 2010 respectively (De Weerdt et al., 2012). Beegle et al. (2012) note that the KHDS panel thus has a remarkably low attrition rate when compared to other well-known panel surveys with most of these surveys covering considerably shorter periods.

In all survey round, respondents were measured and weighed. Child growth is captured by height and weight. More specifically, we calculate height-for-age and weight-for-age z-scores, showing how many standard deviations a child is away from the age- and gender-specific median height or weight in a reference population of well-nourished children (WHO, 2007; WHO, 2011).

3.2 Sample

Out of the 3,343 women interviewed between 1991 and 1994, a total of 1,507 were mothers to at least one child surveyed in 2010 who was no older than 14 at the time of migration or baseline. For the purpose of this analysis, the focus lies on the 1,409 mothers who were living in rural Kagera during the first Survey round. Whereas 784 of them stayed in the same or a nearby village, 377 had moved to a different rural area and 248 to an urban area by 2010. Respondents were asked about the main motivation of each move. For this sample of women, marriage was the most cited reason (53.3%) for moving, followed by work (12.3%) and improved living conditions (11.8%). The baseline characteristics summarised in Table 1 further suggest that younger, unmarried daughters of the household head were significantly more likely to migrate. Furthermore, rural-urban migrant women, in particular, appear to have attained more schooling for their age and come from larger, more educated and wealthier families.

Table 1: Mother's baseline descriptive statistics according to migration status

	Non-migrant	*Migrant*					
		All		Rural-rural		Rural-urban	
	(784)	(625)		(377)		(248)	
	mean	mean	t-stat	mean	t-stat	mean	t-stat
Age	19.046	13.125	10.604***	12.891	9.040***	13.480	6.790***
Married (1=yes)	0.335	0.090	11.446***	0.095	9.053***	0.081	8.077***
Child of hh. Head (1=yes)	0.425	0.534	-4.117	0.552	-4.087***	0.508	-2.305**
Schooling for-age	-0.061	0.069	-2.618***	-0.010	-0.889	0.190	-3.706***
Household size	7.931	8.330	-1.880*	8	-0.287	8.831	-3.065***
Highest schooling in hh.	6.480	6.734	-2.083**	6.403	0.562	7.238	-4.516***
Cons. pc (million 2010 TZS)	2.842	3.082	-2.601	2.986	-1.360	3.229	-3.217**

Notes: The t-statistic is calculated for the difference between each group of migrant mothers and non-migrant mothers respectively.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[3] Kagera is known for being one of the early epicenters of HIV/AIDS. Today, the prevalence is below the national average (TACAIDS, 2013) .

The unit of analysis for this paper are the 3,962 children of these 1,409 women (2,271 and 1,691 children of non-migrant and migrant mothers respectively). Table 2 summarises the 2010 average height-for-age, prevalence of stunting, weight-for-age and prevalence of underweight for children of non-migrant mothers or migrant mothers[4] .

Table 2: Descriptive statistics according to maternal migration status (2010)

	Non-migrant		Migrant								
			All			Rural-rural			Rural Urban		
	mean	n	mean	n	t-stat	mean	n	t-stat	mean	n	t-stat
Height-for-age (≤19 years)	-1.731	1880	-1.543	1509	-3.928***	-1.744	1010	0.248	-1.137	499	-8.617***
Stunted (≤19 years)	0.428	1880	0.391	1509	2.157**	0.444	1010	-0.823	0.285	499	5.845***
Weight-for-age (≤10 years)	-1.205	1251	-1.012	1163	-4112***	-1.213	783	0.156	-0.598	380	-9.028***
Underweight (≤10 years)	0.221	1251	0.1849	1163	2.229**	0.229	783	-0.378	0.095	380	5.540***

Notes: Standard errors in parentheses
The t-statistic is calculated for the difference between children of each group of migrant mothers and children of non-migrant mothers respectively.
* p < 0.10, ** p < 0.05, *** p < 0.01

On average, children of migrant mothers appear to be taller and heavier for their age. This is reflected in a significantly lower prevalence of stunting and underweight in children of migrant mothers. However, the migration destination and associated contextual factors seem to matter. In line with general rural-urban discrepancies in child health in Sub-Saharan Africa (e.g. Van de Poel et al., 2007), the most striking differences in average child growth and education outcomes appear when comparing children of rural-urban migrant mothers and children whose mothers remained in their rural baseline location. The prevalence of stunting is 14% lower among children of rural-urban migrant mothers and the likelihood of being underweight is more than half that of children born to women who stayed in their baseline villages in Kagera.

Though these summary statistics, clearly demonstrate that migration out of rural Kagera is associated with improved child nutrition outcomes, it is important to note that these relations need not be causal. Migrant selectivity could very well explain some, if not all, of these differences. The mere fact that rural-urban migrant mothers tend to be wealthier, younger and more educated could, for example, easily imply that their children would have been taller and heavier even if their mothers had stayed in their rural baseline villages. In Section 4, we will demonstrate that some of these differences do not survive a tighter identification of the impact of maternal migration.

4. Assessing the impact of maternal migration on child health and education

4.1 Identification strategy

Identifying the causal impact of maternal migration on child well-being requires comparing the current nutrition and health of migrant children to what it would have been had their mothers stayed in their community of origin. This counterfactual is, of course, not observed and a double-selection issue generating observed and unobserved heterogeneity across migrant and non-migrant

[4] A woman is considered a migrant if she was found to no longer reside in her baseline or a nearby village in 2010. Only individuals residing with their mother during the survey round after the time of migration and until the age of 14 are considered "children" of a migrant mother.

families and migrating and non-migrating household members complicates finding an appropriate group of comparison.

In line with Beegle et al. (2011), this study attempts to address the first issue of heterogeneity across migrant and non-migrant families by including mothers' initial family fixed effects.[5] This approach effectively restricts the comparison to children whose mothers are biologically related to and lived in the same baseline household. In practice, this means that we are comparing the children of migrant mothers with their cousins whose mothers stayed in their baseline or a nearby village. This specification thus controls for all observed and unobserved time-invariant baseline family characteristics ranging from certain genetic predispositions to household wealth and attitudes. As for the heterogeneity within families, we control for a number of personal attributes of the mother that could influence her decision to migrate as well as affect her child's nutrition outcomes by including observed individual baseline characteristics. Finally, to account for potential time trends, we include age cohort fixed effects. It is important to acknowledge, however, that despite being an important improvement over existing strategies employed in the literature, this approach does not resolve the problem of unobserved heterogeneity across household members and time-variant differences that may influence maternal migration as well as child well-being.

In sum, the regression model[6] looks as follows:

$$Y_{i,t+1} = \alpha + \beta_1 M_{i,\,t+1}^{Mother} + \gamma X_{i,t+1} + \delta Y_{i,t}^{Mother} + F_{i,t}^{Mother} + \epsilon_{i,\,t+1}$$

Where $Y_{i,t+1}$ represents the nutrition outcome of individual i assessed in 2010 $(t+1)$. $M_{i,\,t+1}^{Mother}$ is a dummy variable that equals one when individual i is the child of a mother who physically moved[7] out of her baseline rural community between 1991(t) and 2010 $(t+1)$. Whereas the term $X_{i,t+1}$ represents a vector of individual level characteristics of the child in 2010 $(t+1)$; $Y_{i,t}^{Mother}$ is a vector of the mother's baseline (1991/94) characteristics. Finally, $F_{i,t}^{Mother}$ stands for mother's initial family fixed effects and $\epsilon_{i,t+1}$ represents the error term. The main interest of this paper lies in establishing the sign, size and statistical significance of β_1, comparing children of migrant mothers to those born to mothers who remained in their baseline villages.

4.2 Regression results

Table 3 depicts the results of the regressions of different child nutrition outcomes in 2010 on maternal migration status. Compared to their cousins living in their mothers' baseline rural community, children of migrant mothers appear to be significantly heavier for their age. This is also reflected in a significant reduction in the likelihood of the child being underweight (weight-

[5] Women are considered family when they are residing in the same household and are related to the household head (spouse, mother, sister, daughter, granddaughter). The inclusion of the initial family fixed effects therefore implies that we restrict the sample to the 3,606 children of whom we can assume that their mothers living under the same roof in 1991/94 are biologically related.

[6] Since immunisation is a binomial variable, we thus estimate this equation using a Linear Probability Model following Angrist and Pischke (2009: p.102-107).

[7] A strict definition of migration was employed. Only individuals that were no longer residing in their baseline village or a nearby village are considered migrants.

for-age z-score < -2SD). These results suggest that by moving, mothers in Tanzania are able to improve their child's nutritional and health experience. We, however, find no significant difference between the children of mothers who moved and the children of their female relatives who stayed in their baseline rural community in terms of height, which is generally considered a crucial indicator of longer-term health and nutrition.

Table 3: Maternal migration status and child-wellbeing in 2010

	Height-for-age (≤19)	Stunting (≤19)	Weight-for-age (≤10)	Underweight (≤10)
M^{Mother}	0.112	-0.023	0.228**	-0.097***
	(0.092)	(0.033)	(0.089)	(0.036)
Const.	-2.979***	0.844***	-2.229***	0.569***
	(0.519)	(0.173)	(0.468)	(0.171)
Controls [a]	✓	✓	✓	✓
MIFFE	✓	✓	✓	✓
N	2766	2766	1888	1888

Notes: Standard errors in parentheses.
MIFFE stands for mother's initial family fixed effects.
[a] We control for the child's sex, birth order, relation to the household head, age group (0-2; 3-5; 6-10; 11-15; 16-19), mother's age group (0-2; 3-5; 6-10; 11-15; 16-25; 26-35; 36-45; 46-55; 56-65), relation to household head, schooling-for-age, marital status and height at baseline.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Because this is the impact comparing within families, it nets out any transfers from migrants to those who stayed in rural Kagera. That is, if migrants sent remittances back to their origin households, then the previously reported estimates are a lower bound of the impact of having a migrant mother since remittances may relax liquidity constraints and allow households to invest more in food and health inputs. In our sample, 65% of mothers who stayed behind in rural Kagera had received remittances from their previous household members during the year preceding the survey. Controlling for the total value of remittances received does not, however, alter our results (See Appendix, Table A2).

4.3 Unpacking the effects

A simple dichotomy (child of non-migrant vs migrant) may, however, not be appropriate when assessing the impact of a multifaceted process such as migration. More specifically, the characteristics of the destination are of particular interest. As mentioned above, contextual effects are likely to determine a considerable part of the impact of maternal migration on child well-being. The vast differences in living conditions between rural areas and urban zones in Tanzania could, for example, imply that relocation to towns and cities as opposed to different rural areas may have a distinct impact. Table 4 therefore summarises the results of the regressions including dummy variables for having a mother who migrated to a different rural area or to an urban area respectively. We perform an F-test comparing the coefficients for these dummies to formally assess whether children of rural-urban migrant mothers have different outcomes compared to children of rural-rural migrant mothers.[8]

Table 4: Maternal migration status according to destination and child-wellbeing in in 2010

	Height-for-age (≤19)	Stunting (≤19)	Weight-for-age (≤10)	Underw. (≤10)
$M^{Mother}_{Rural-rural}$	0.024	-0.002	0.190**	-0.085**
	(0.099)	(0.036)	(0.095)	(0.039)
	0.376**	-0.087*	0.337**	-0.131**
$M^{Mother}_{Rural-urban}$	(0.160)	(0.053)	(0.152)	(0.053)
Const.	-2.926***	0.831***	-2.202***	0.561***
	(0.515)	(0.173)	(0.469)	(0.172)
Controls[a]	✓	✓	✓	✓
MIFFE	✓	✓	✓	✓
N	2766	2766	1888	1888
Ha: $M^{Mother}_{Rural-rural} \neq M^{Mother}_{Rural-urban}$	4.459**	2.320	0.887	0.694

Notes: Standard errors in parentheses.
MIFFE stands for mother's initial family fixed effects.
[a] We control for the child's sex, birth order, relation to the household head, age group (0-2; 3-5; 6-10;11-15;16-19), mother's age group (0-2; 3-5; 6-10;11-15;16-25; 26-35; 36-45; 46-55; 56-65), relation to household head, years of school completed relative to age-specific peers, marital status and height at baseline.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In line with the descriptive comparison, these results demonstrate that even when restricting the analysis to children whose mothers originate from the same baseline family, those born to rural-urban migrant mothers are significantly taller for their age and less likely to be stunted. The hypothesis that the migration destination matters is further confirmed by the results of the F-test. Furthermore, being born to a migrant mother appears to be associated with improved weight-for-age scores and a lower likelihood of being underweight regardless of the type of destination. Since child growth and height in particular, is widely accepted as an important indicator of nutrition status and predictor of long-term health and even future labour market outcomes (e.g. Alderman et al., 2006; Thomas and Strauss, 1997; Victora et al., 2007), these results seem to suggest that by relocating from a rural to an urban area in particular, Tanzanian mothers could be moving towards a better future for their children.

It is important to note, however, that there is great diversity in the characteristics of urban environments as well. Dorosh and Thurlow (2013) show that the urban population in sub-Saharan Africa is bimodally distributed, with roughly 40% living in major cities with a population exceeding 1,000,000 and 40% in small towns with less than 250,000 people. The analysis summarised in Table 5 therefore explores the heterogeneity of our results by the type of urban locality the mother moves to. More specifically, we distinguish the cities of Dar es Salaam and Mwanza from smaller secondary towns. [9] In this sample, 34 % of rural-urban migrant mothers moved to one of these two primary cities.

[8] The F-statistic for the equality of the coefficients for having a rural-rural and rural-urban migrant mother is equal to the square of the T-statistic testing for whether the coefficient for rural-urban migration is significantly different from zero in the regression $C_{i,t} = \alpha + \beta_1 M^{Mother}_{Stayed,i,t+1} + \beta_2 M^{Mother}_{Rural-urban,i,t+1} + \gamma X_{i,t+1} + \delta Y^{Mother}_{i,t} + F^{Mother}_{i,t} + \epsilon_{i,t+1}$.

[9] The census classification of locations of areas into urban or rural was used. Mwanza city—which consists of the Ilemela (343,001 inhabitants) and Nyamanga districts (363,452 inhabitants)—and DSM (4,364,541 inhabitants) are the only cities if we consider the common threshold of a population exceeding 500,000 (e.g. OECD, 2012).

Table 5: Maternal migration status according to destination and child-wellbeing in in 2010

	Height-for-age (≤19)	Stunting (≤19)	Weight-for-age (≤10)	Underw. (≤10)
$M^{Mother}_{Rural-rural}$	0.017	0.002	0.185*	-0.082**
	(0.099)	(0.036)	(0.095)	(0.040)
$M^{Mother}_{Rural-town}$	0.293*	-0.032	0.272*	-0.101*
	(0.172)	(0.057)	(0.164)	(0.057)
$M^{Mother}_{Rural-city}$	0.771**	-0.349***	0.609**	-0.257**
	(0.316)	(0.097)	(0.280)	(0.105)
Const.	-2.966***	0.858***	-2.235***	0.576***
	(0.505)	(0.167)	(0.465)	(0.169)
Controls[a]	✓	✓	✓	✓
MIFFE	✓	✓	✓	✓
N	2766	2766	1888	1888
Ha: $M^{Mother}_{Rural-town} \neq M^{Mother}_{Rural-city}$	2.046	9.388***	1.303	2.002

Notes: Standard errors in parentheses.
MIFFE stands for mother's initial family fixed effects.
[a] We control for the child's sex, birth order, relation to the household head, age group (0-2; 3-5; 6-10;11-15;16-19),), mother's age group (0-2; 3-5; 6-10;11-15;16-25; 26-35; 36-45; 46-55; 56-65), relation to household head, years of school completed relative to age-specific peers, marital status and height at baseline.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

These results suggest that previously established effect on height-for-age and stunting, mostly derives from children whose mother migrated from their rural villages in Kagera to Dar es Salaam or Mwanza. There is a sizeable difference of 0.771 standard deviations between children of mothers who moved to the largest cities and their cousins who stayed behind. The F-test further indicates that the effect is significantly different compared to children whose mother relocated to smaller, secondary towns. Though the magnitude of the effect is much smaller, children of mothers who migrated to smaller secondary towns however, also have significantly higher height-for-age z-scores. The improvement in weight-for-age and reduction in the rate of underweight also appears to be more pronounced for children of migrants to cities. For these nutrition indicators, the F-test however fails to reject the similarity of the coefficients for the different types of rural-urban migration.

Finally, in line with Smith-Greenaway and Madhavan (2015), we also assess whether migration has a different impact depending on whether the child moved alongside its mother or was born after her relocation. As mentioned above, the physical process of migration can be assumed to be particularly disruptive. It stands to reason that any (temporary) harmful impact could therefore mostly affect children who were born before migration and actively experience this disruptive phase of the migration process. These results, however, show no support for this hypothesis as the F-tests fail to reject the null hypothesis of similarity of the coefficients for being born before or after the relocation of the mother (see Appendix, Table A3).

5. Conclusion

In spite of the growing recognition of the importance of migration as a livelihood strategy in developing countries and mounting evidence of substantial effects on the living standards of migrants themselves (e.g. Beegle et al., 2011; Christiaensen et al., 2013; De Brauw et al., 2013; Garlick et al., 2016; Nguyen et al., 2015), the impact of parental migration on children remains poorly understood. Yet, this is a crucial determinant of the longer-term effects of this ongoing spatial transformation of developing country populations. The existence of a causal impact of parental migration on child growth would imply that population movements can raise current living standards as well as contribute to intergenerational mobility and development.

Using data from the Kagera Health and Development Survey that traced household members who moved between 1991/94 and 2010, this paper provides empirical evidence on the impact of maternal migration on child health and education outcomes. The panel nature of these data combined with the tracking exercise in this survey allows us to address concerns about observed or unobserved heterogeneity across migrant and non-migrant families by restricting the comparison to children of mothers originating from the same baseline family.

The results summarised in this paper indicate that, maternal migration is associated with important improvements in child nutritional status. Compared to their cousins who stayed behind in rural Kagera, children of migrant mothers have improved weight-for-age z-scores. This is reflected in a significant lower probability of being severely malnourished or underweight. Moreover, children born to rural-urban migrant mothers are significantly taller for their age and less likely to be stunted. This effect derives mostly from children of mothers who relocated to the two largest cities in Tanzania, Dar es Salaam and Mwanza. Overall, these findings thus point to a sizeable growth advantage for children of migrant mothers. In light of the importance of height as an indicator of nutrition status and predictor of long-term health and future labour market outcomes, the results suggest that by relocating from a rural to an urban area in particular, Tanzanian mothers could be moving towards a better future for their children. Given the large and growing internal migration flows in the country—in particular towards cities, Dar es Salaam above all— the impact of parental migration on child nutrition and health, however, requires additional research and policy attention.

References

Alderman, H., Hoddinott, J., & Kinsey, B. (2006). Long term consequences of early childhood malnutrition. *Oxford economic papers*, 58(3), 450-474.

Angrist, J.D., Pischke, J.-S. (2009). Mostly Harmless Econometrics: An Empiricist's Companion, 1 edition. ed. Princeton University Press, Princeton

Antai, D. (2010). Migration and child immunization in Nigeria: individual-and community-level contexts. *BMC public health*, 10(1), 116.

Beegle, K., De Weerdt, J., & Dercon, S. (2011). Migration and economic mobility in Tanzania: Evidence from a tracking survey. *Review of Economics and Statistics*, 93(3), 1010-1033.

Bender, D. E., Rivera, T., & Madonna, D. (1993). Rural origin as a risk factor for maternal and child health in periurban Bolivia. *Social Science & Medicine*, 37(11), 1345-1349.

Brockerhoff, M. (1990). Rural-to-urban migration and child survival in Senegal. *Demography*, *27*(4), 601-616.

Brockerhoff, M. (1994). The impact of rural-urban migration on child survival. *Health transition review*, 127-149.

Brockerhoff, M. (1995). Child survival in big cities: the disadvantages of migrants. *Social Science & Medicine*, *40*(10), 1371-1383.

Choudhary, N., & Parthasarathy, D. (2009). Is migration status a determinant of urban nutrition insecurity? Empirical evidence from Mumbai city, India. *Journal of biosocial science*, 41(05), 583-605.

De Brauw, A., Mueller, V., & Woldehanna, T. (2013). Does internal migration improve overall well-being in Ethiopia?. IFPRI Ethiopia Strategy Support Program II, 55.

De Weerdt, J. (2010). Moving out of poverty in Tanzania: Evidence from Kagera. *The Journal of Development Studies*, 46(2), 331-349.

Garlick, J., Leibbrandt, M., & Levinsohn, J. (2016). Individual migration and household incomes (No. w22326). National Bureau of Economic Research.

Islam, M. M., & Azad, K. M. A. K. (2008). Rural–urban migration and child survival in urban Bangladesh: Are the urban migrants and poor disadvantaged?. *Journal of biosocial science*, 40(01), 83-96.

Issaka, A. I., Agho, K. E., & Renzaho, A. M. (2016). The Impact of Internal Migration on under-Five Mortality in 27 Sub-Saharan African Countries. *PloS one*, 11(10), e0163179.

Kiros, G. E., & White, M. J. (2004). Migration, community context, and child immunization in Ethiopia. Social Science & Medicine, 59(12), 2603-2616.

Kusuma, Y. S., Kumari, R., Pandav, C. S., & Gupta, S. K. (2010). Migration and immunization: determinants of childhood immunization uptake among socioeconomically disadvantaged migrants in Delhi, India. *Tropical Medicine & International Health*, 15(11), 1326-1332.

Liang, Z., & Chen, Y. P. (2007). The educational consequences of migration for children in China. *Social science research*, 36(1), 28-47.

Lu, Y. (2015). Internal migration, international migration, and physical growth of left-behind children: a study of two settings. *Health & place*, 36, 118-126.

Mansuri, G. (2006). Migration, sex bias, and child growth in rural Pakistan. World Bank Policy Research Working Paper 3946.

Mberu, B. U., & Mutua, M. (2015). Internal migration and early life mortality in Kenya and Nigeria. Population, *Space and Place*, 21(8), 788-808.

Moffat, T. (1998). Urbanization and child growth in Nepal. *American journal of human biology*, 10(3), 307-315.

Mueller, V., & Shariff, A. (2011). Preliminary evidence on internal migration, remittances, and teen schooling in India. Contemporary Economic Policy, 29(2), 207-217.

Mugisha, F. (2006). School enrollment among urban non-slum, slum and rural children in Kenya: Is the urban advantage eroding?. International Journal of Educational Development, 26(5), 471-482.

Nguyen, L. D., Raabe, K., & Grote, U. (2015). Rural–urban migration, household vulnerability, and welfare in Vietnam. World Development, 71, 79-93.

Omariba, D. W. R., & Boyle, M. H. (2010). Rural–urban migration and cross-national variation in infant mortality in less developed countries. *Population Research and Policy Review*, 29(3), 275-296.

Smith-Greenaway, E., & Madhavan, S. (2015). Maternal migration and child health: An analysis of disruption and adaptation processes in Benin. *Social science research*, 54, 146-158.

Smith-Greenaway, E., & Thomas, K. J. (2014). Exploring child mortality risks associated with diverse patterns of maternal migration in Haiti. *Population research and policy review*, 33(6), 873-895.

Ssengonzi, R., De Jong, G. F., & Shannon Stokes, C. (2002). The effect of female migration on infant and child survival in Uganda. *Population Research and Policy Review*, 21(5), 403-431.

Stephenson, R., Matthews, Z., & McDonald, J. W. (2003). The impact of rural–urban migration on under-two mortality in India. *Journal of Biosocial Science*, 35(01), 15-31.

Stillman, S., Gibson, J., & McKenzie, D. (2012). The impact of immigration on child health: experimental evidence from a migration lottery program. *Economic Inquiry*, 50(1), 62-81.

Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS Commission (ZAC), National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), and ICF International 2013.Tanzania HIV/AIDS and Malaria Indicator Survey 2011-12. Dar es Salaam, Tanzania: TACAIDS, ZAC, NBS, OCGS, and ICF International.

Tam, L. (1994). Rural-to-urban migration in Bolivia and Peru: Association with child mortality, breastfeeding cessation, maternal care, and contraception. DHS Working Papers.

THDR (2015). Tanzania Human Development Report 2014. UNDP

THDS-MIS (2016). Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) 2015-16. Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC), Ministry of Health (MoH), National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), and ICF.

Thomas, K. J. (2007). Child Mortality and Socioeconomic Status: An Examination of Differentials by Migration Status in South Africa1. *International Migration Review*, *41*(1), 40-74.

Thomas, D., & Strauss, J. (1997). Health and wages: Evidence on men and women in urban Brazil. *Journal of econometrics*, 77(1), 159-185.

Victora, C. G., Adair, L., Fall, C., Hallal, P. C., Martorell, R., Richter, L., ... & Maternal and Child Undernutrition Study Group. (2008). Maternal and child undernutrition: consequences for adult health and human capital. *The lancet*, 371(9609), 340-357.

Appendix

Table A1: Variables

Height-for-age	Height-for-age z-score The number of standard deviations the child is away from the age- and gender-specific median height in a reference population of well-nourished children (WHO, 2007; WHO, 2011). Z-scores were calculated for children aged 0 to 5 and 5 to 19, using the STATA igrowup package (WHO,2011) and WHO 2007 package (WHO, 2007) respectively. Children with biologically implausible values, as defined by the WHO growth standards, were excluded.
Stunting	Dummy variable equal to one when the individual's height-for-age is more than two standard deviations below the WHO Child Growth Standards median.
Weight-for-age	Weight-for-age z-score The number of standard deviations the child is away from the age- and gender-specific median weight in a reference population of well-nourished children (WHO, 2007; WHO, 2011). Z-scores were calculated for children aged 0 to 5 and 5 to 10, using the STATA igrowup package (WHO,2011) and WHO 2007 package (WHO, 2007) respectively. Children with biologically implausible values, as defined by the WHO growth standards, were excluded. For children above the age of 5 in 2010, we include the information from the previous survey round if they were above the age of 1 (it is recommended that children are fully immunised by this age) when they responded to the questions on immunisation in 2004.
Underweight	Dummy variable equal to one when the individual's weight-for-age is more than two standard deviations below the WHO Child Growth Standards median.
M^{Mother}	Maternal migration status Dummy variable equal to one when the individual's reported mother (who he or she resided with during the survey round closest to the time of migration and at least until the age of 14) was no longer living in her baseline (1991/94) or a nearby village in 2010.
$M^{Mother}_{Rural-rural}$	Maternal migration to different rural area Dummy variable equal to one when the individual's reported mother (who he or she resided with during the survey round closest to the time of migration and at least until the age of 14) was no longer living in her baseline (1991/94) or a nearby village and was found to reside in a rural (as defined by the 2002 Census classification) area than during the 2010 round.
$M^{Mother}_{Rural-urban}$	Maternal migration to urban area Dummy variable equal to one when the individual's reported mother (who he or she resided with during the survey round closest to the time of migration and at least until the age of 14) was no longer living in her baseline (1991/94) or a nearby village and was found to reside in a rural (as defined by the 2002 Census classification) area than during the 2010 round.
$M^{Mother}_{After\ birth}$	Dummy variable equal to one when the individual's reported mother (who he or she resided with during the survey round closest to the time of migration and at least until the age of 14) was no longer living in her baseline (1991/94) or a nearby village in 2010 and the year and reports to have moved before of in the year of the birth of the child.
$M^{Mother}_{Before\ birth}$	Dummy variable equal to one when the individual's reported mother (who he or she resided with during the survey round closest to the time of migration and at least until the age of 14) was no longer living in her baseline (1991/94) or a nearby village in 2010 and the year and reports to have moved after the year of the birth of the child.
Controls	- Age group Reported age expressed in years with dummies for ages 0-2; 3-5; 6-10; 11-15; 16-25). - Birth order Rank according to age for children who reported the same women as mother. - Sex 1 = male, 2 = female - Mother's age at birth Difference between the mother's age and the child's age. - Mother's age group at baseline Individual's mother's reported age expressed in years with dummies for ages 0-2; 3-5; 6-10; 11-15; 16-25; 26-35; 36-45; 46-55; 56-65) - Mother's schooling-for-age at baseline Based on the information on the highest grade obtained reported for the individual's mother we derive the years of schooling completed and calculate the number of standard deviations the child is away from the age-specific median years of schooling completed in the sample. - Mother's relationship to the household head at baseline o Daughter of the household head Dummy equal to one when the individual's mother was the daughter of the head of the household she was residing in at the baseline. o Household head or spouse

	Dummy equal to one when the individual's mother was the spouse of or the head of the household she was residing in at the baseline. - Mother's marital status at baseline Dummy variable equal to one when the individual's mother was married. Marital status was assumed to be unmarried when not reported for respondents below the legal age of marriage (14). Other missing values were also assumed to be zero and we include an additional dummy variable that equals one when the observation was originally reported as missing - Mother's height at baseline The height of the individual's mother expressed in cm measured at baseline. If height was not measured and the mother was above the age of 18 at baseline, we assume that it was equal to the height measured in the subsequent survey rounds.

Table A2: Maternal migration status and child-wellbeing in 2010 (incl. remittances)

	Height-for-age (≤19)	Stunting (≤19)	Weight-for-age (≤10)	Underweight (≤10)
M^{Mother}	0.106	-0.021	0.225**	-0.096***
	(0.092)	(0.033)	(0.089)	(0.036)
Remittances	-0.005	0.002	-0.003	0.000
(in 10,000. TZS)	(0.005)	(0.002)	(0.006)	(0.002)
Const.	-2.975***	0.848***	-2.230***	0.572***
	(0.516)	(0.173)	(0.467)	(0.171)
Controls [a]	✓	✓	✓	✓
MIFFE	✓	✓	✓	✓
N	2712	2712	1853	1853

Notes: Standard errors in parentheses.

MIFFE stands for mother's initial family fixed effects.

[a] We control for the child's sex, birth order, relation to the household head, age group (0-2; 3-5; 6-10; 11-15; 16-19), mother's age group (0-2; 3-5; 6-10; 11-15; 16-25; 26-35; 36-45; 46-55; 56-65), relation to household head, schooling-for-age, marital status and height at baseline.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A3: Maternal migration status (before/after birth) and child-wellbeing in 2010

	Height-for-age (≤19)	Stunting (≤19)	Weight-for-age (≤10)	Underw. (≤10)
$M_{After\ birth}^{Mother}$	0.115	-0.022	0.381***	-0.078
	(0.123)	(0.045)	(0.133)	(0.056)
$M_{Before\ birth}^{Mother}$	0.111	-0.024	0.190**	-0.101***
	(0.099)	(0.035)	(0.093)	(0.037)
Const.	-2.987***	0.848***	-2.191***	0.582***
	(0.520)	(0.173)	(0.474)	(0.171)
Controls[a]	✓	✓	✓	✓
MIFFE	✓	✓	✓	✓
N	2757	2757	1883	1883
Ha: $M_{After\ birth}^{Mother} \neq M_{Before\ birth}^{Mother}$	0.001	0.001	2.321	0.200

Notes: Standard errors in parentheses.
MIFFE stands for mother's initial family fixed effects.
[a] We control for the child's sex, birth order, relation to the household head, age group (0-2; 3-5; 6-10;11-15;16-19), mother's age group (0-2; 3-5; 6-10;11-15;16-25; 26-35; 36-45; 46-55; 56-65), relation to household head, schooling-for-age, marital status and height at baseline.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$