Impact of Cross-Border Trade in Food Staples on Child Nutrition in East Africa

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Abstract

This paper aims at investigating whether increased regional trade in food staples among the countries of East Africa translates to household welfare gains or not. This is against the backdrop of increased investment by the individual countries and development partners to facilitate easy cross-border flow of food staples to enhance food and nutritional security, and income, especially among the poor households. Our findings show that trade improves child nutrition among households in food deficit areas. Other important factors in explaining child nutritional outcomes include: birth-spacing, age of the household head, mothers' level of education, ease of access to water, gender of the child, and access to improved toilet facilities. The policy implication of this is that investment in measures that encourage freer regional trade would be a milestone in the right direction towards the realization of food and nutritional security.

Keywords: Welfare, Cross-border trade, Food staples, East Africa
JEL Codes: F14, Q17

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1. Introduction

Cross-border trade in food staples among East African countries is important for achieving regional food and nutritional security. It is also important for alleviating poverty. Specifically, food markets ensure income for farmers, sustainable and affordable supply of food for consumers, and employment opportunities for the entire economy. Trade flows in food staples are driven by factors such as comparative advantage in production, demand dynamics, and differences in growing seasons.

Trade in food staples takes place through formal and informal channels. Although estimates vary across sources and for different products, informal trade forms a substantial portion of trade in food staples. For agricultural products, informal trade could be as high as 80% of the total trade (Pannhausen and Untied, 2010). While informal trade is concentrated within the areas closer to the borders, much of the formal trade targets major urban areas with higher demands arising from population concentrations (Guthiga et al., 2011).

Despite the obvious benefits of freer trade in agricultural commodities, barriers to trade still persist. Some of the key barriers to trade in food staples include: occasional export bans, complicated customs procedures, taxes and tariffs, corruption, poor infrastructure, and poor flow of information among market players. These barriers limit the potential gains from cross-border trade. For example, the cost of non-tariff barriers (NTBs) in maize trade per kilometre per ton has been estimated at USD 0.09, USD 0.15 and USD 0.11 for Kenya, Uganda and Tanzania, respectively (Karugia et al., 2009). The same study estimated the cost NTBs per kilometre per ton in beef trade at USD 0.17, USD 0.31, and USD 0.23 for Kenya, Uganda and Tanzania, respectively.

In an effort to fully realize the potential of increased trade in food staples in the region, various actors have made efforts to facilitate increased regional trade. The actors include the East African Community (EAC), individual partner states, development partners, farmer organizations, and regional business councils. Deliberate efforts have been made to improve service delivery at the border points, reduce both tariff and NTBs, and link markets across the borders. Automation and one-stop border posts are some of the measures that have been initiated. For example, a one-stop border post has been introduced between Kenya and Uganda at Malaba border town (Nathan Associates, 2010). To address the problem of poor transport infrastructure, the World Bank, the African Development Bank and other international donors are currently financing upgrading of various roads in the region to develop a network of national and regional transport corridors (Nathan Associates, 2011).

While it is difficult to attribute results to specific interventions, intra-EAC trade has increased tremendously. Total trade volume increased by 37.6% in 2008 (EAC, 2010). Trade in agricultural commodities increased even more steeply, from USD 26 million in 2005 to USD 46 million in 2008 (EAC, 2009). Kenya was the main recipient of the informal exports from the rest of the EAC members in the same period (ASARECA, 2009). Although investments have been made to enhance cross-border trade in food staples, the impact of this increased trade on household welfare remains under-studied. Previous studies have provided insights into correlation between increased cross-border trade in food staples and household welfare (see

Guthiga et al., 2011; 2012 for details). However, to the best of our knowledge, no empirical study has examined the impact of cross-border trade on nutritional outcomes in East Africa.

Understanding nutritional impacts is essential for justifying the substantial investments required to facilitate cross-border trade. Positive nutritional outcomes would provide the impetus for further investments while negative impacts, if any, would provide lessons on why the investments have not worked or point to the essential areas that might have been neglected. Furthermore, as with any other development intervention, the gains from trade are likely to be distributed differently among different stakeholders. Understanding these dynamics is important from a social perspective to inform any re-distributive policies that would be essential to compensate the losers. While recognizing that impacts of trade are rather diffuse and the pathways of impact complex, this study used existing information on agricultural production potential of different areas in the region, the observed trade flow patterns and related proxy indicators to sample and classify households and analyse how the observed trade patterns in the region might have affected the well-being of households.

The rest of the paper is organized as follows: section 2 discusses the possible impact pathways of cross-border trade on household nutrition; section 3 examines the data used and the methodology adopted; section 4 discusses the results while section 5 provides conclusion and the policy implications.

2. Possible Impact Pathways

To analyse whether cross-border trade in maize enhances household child nutritional status, it was important to isolate the households that were likely to benefit directly from the trade from those that were either unlikely to be directly affected by cross-border trade at all or those likely to be negatively affected. We made the assumption that households from maize (the main and most widely traded food staple in the region) deficit regions in net maize importing countries would benefit from increased maize imports, thus benefitting from fairly low maize prices. Their savings would therefore be used to diversify household diet, leading to positive household nutritional outcomes. On the contrary, the maize surplus regions of the same countries were expected to lose through the same price transmission process. The reverse was assumed true for the net maize exporting countries. The regions were delineated using geographic information systems (GIS) techniques and historical information on production and consumption.

Kenya was considered a net maize importer while Tanzania and Uganda were considered net maize exporters (see ASARECA, 2009). On the basis of the available data, the most feasible approach was to broadly group the households into two categories based on their geographical location and production/consumption data. Consequently, being in a maize deficit region in a net maize importing country was considered as the treatment while being in a maize surplus region in the same country was considered as control. For the net maize exporting countries, households in maize surplus regions were designated as treated while their counterparts in maize deficit regions as control groups.

3. Methodology
3.1 Data
To analyse the impact of trade on nutrition, comprehensive data must be available for at least two time periods that contain relevant information in sufficient detail. The first period would form the baseline data against which future changes in welfare would be measured. Collecting such data for the three countries is a very expensive and time-consuming endeavour. The authors acknowledge there were no publicly available data sets specific to the impact of trade on nutrition. However, the standard Demographic and Health Surveys (DHS) data, though not specifically collected to measure trade impact, had enough information for this study.

The DHS data were collected under the USAID funded, MEASURE *DHS+* program. The aim of the program is to create an internationally comparable body of data on the demographic and health characteristics of populations in developing countries. The standard DHS data were collected as cross-sectional repeat data in more than 90 countries across the world. The study used the second wave of the DHS panel data for Kenya, Uganda and Tanzania. This was informed by the fact that the second wave was rich in variables that would allow meaningful computation of anthropometric variables for each household, and overall analysis. Moreover, the longer interval between surveys would not make it possible to track the same children per household. That is, in a subsequent survey the children that were under 5 would have transited to a different age category.

A total of 2416 households were included in the analysis. The distribution of the households across the three countries is summarized in Table 1.

Table 1: Distribution of sample households

Country	Number of households		
	Treatment	Control	TOTAL
Kenya	308	152	460
Uganda	124	90	214
Tanzania	954	788	1742
	1386	1030	2416

Source: Authors computation based on DHS

The DHS data contain various variables that are relevant for the analysis envisaged in this study. However, there were slight variations in type of variables that were captured in the different countries. Consequently, there were variations in the type of explanatory variables used for the country-level models depending on the details captured by each country’s survey. Overall, Tanzania had the highest number of variables captured while Uganda had the lowest. Summary statistics of the variables used in the country-level models are provided in Appendix A.

3.2 Anthropometric indicators (stunting and underweight)

The study used child anthropometric indicators to analyse the household-level child nutritional status. Height-for-age Z-scores (stunting) and weight-for-age Z-scores (underweight) were computed[1] for the children under the age of 5 years in the sample households. Econometric tests were carried out to determine the suitability of the possible regression models. Ordinary least squares (OLS) regression was found appropriate[2].

Anthropometric indicators were regressed on a set of socio-economic variables and individual level variables such as child sex, age and mother's education level. Mean household anthropometric indicators were also analysed. The regression models estimated were in the following form:

$$outcome_i = \alpha + \beta X + \varepsilon \qquad (1)$$

where $outcome_i$ refers to nutritional outcome measures (two types of outcomes are considered here, i.e., the average household Z-score for wasting and stunting, and the individual child Z-scores for wasting and stunting), X is a vector of characteristics that describes the sample which includes: Dependency ratio, Mean age of children under 5 years, Gender of the household head, Age of the household head, Location of the household (i.e. urban or rural), Time taken to the nearest water source, Education level of the mother, Distance to the nearest market, Distance to the nearest health facility, Whether they own a latrine or not, Age of the child, and Gender of the child. β is a vector of coefficients that measure the differences in child nutritional outcomes associated with the characteristics listed (*X's)* while ε is the error term.

4. Results and discussion

4.1 Descriptive analysis

This section provides a summary of the results of the descriptive analysis of the sample households with emphasis on the difference between the treatment and control groups. For the sample households from Kenya, weight-for-age index, height-for-age index and time to the water source differed significantly between the treatment and the control groups. The treatment group had higher means in all the three variables. The test of proportions indicated that sex of children, economic class and mother's level of education differed significantly between the two groups. Specifically, male children dominated the treatment group while female children dominated the control group. The percentage of poor households was higher in the control group. The proportion of mothers with no education and primary level of education was higher in the treatment group while the proportion of mothers with post-primary level of education was dominant in the control group (see Appendix A1).

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[1] The height-for-age Z-score was calculated as Z = (X – m)/r, where X is the child's height-for-age, m is the median height-for-age of the reference population of children of the same age and sex group, and r is the standard deviation of the reference population. Stunting was defined as height-for-age Z-score less than _2, underweight as weight-for-age Z-score less than _2, and wasting as weight-for-height Z-score less than _2 (WHO 1995).

[2] The Durbin-Wu-Hausman test could not reject the exogeneity hypothesis for the treatment variable. The effect of the treatment on household nutritional outcomes was, thus, estimated through ordinary least squares (OLS). The same approach has been used by Miller and Rodgers (2009) and Geale (2010).

In the case of Uganda, age of children, height-for-age index, dependency ratio and time to the water source differed significantly between the treatment and the control groups. The control group had higher means in all the four variables. The test of proportions indicated that mother's level of education differed significantly between the two groups. The proportion of mothers with no education and primary level of education was higher for the control group while the proportion of mothers with post primary level of education was higher for the treatment group (Appendix A2).

In the sample from Tanzania, weight-for-age index, height-for-age index, age of household head, dependency ratio, time to water source and distance to the market were significantly different between the treatment and the control groups. The treatment group had lower means in all except dependency ratio, time to water source and distance to the market. The test of proportions showed that gender of household head, economic class, ownership of improved toilet and mother's level of education differed across the groups. Overall, a larger percentage of households were headed by men. However, in the treatment group, the proportion of households headed by women was higher. Non-poor households dominated the treatment group while poor households dominated the control group. A large proportion of households across the groups lacked toilet facilities although the proportion of households with toilet was higher for the treatment group. The proportion of mothers with primary level of education was dominant across the groups. However, the control group had a higher proportion of mothers with no education while the treatment group had a higher proportion of mothers with post-primary education (Appendix A3).

4.2 Results of regression analysis

Results showed that cross-border trade in maize in East Africa had a positive effect on child nutritional outcomes for the maize-deficit importers and a negative effect for the net exporters (see Appendix B). A cursory interpretation would indicate that free trade is more beneficial to maize deficit regions across the three countries. While this shows that trade is more useful to the vulnerable, it is important to interrogate why the producers of maize in the region seem to be disadvantaged by free trade over their non-producing or deficit-producing regions. An exploratory study by Guthiga *et al*. (2011) provides insights into this observation. Most maize surplus regions in Kenya, Uganda and Tanzania are located away from the country borders. The implication of this is that the border communities are more likely to engage in cross-border trade more directly. Consequently, their off-farm incomes are boosted by the free trade in maize. Better child nutritional outcomes among the maize deficit areas could therefore be attributed to improved off-farm incomes. Similar results have previously been observed by Babatunde and Qaim (2010). In this respect, cross-border trade is important not only for alleviating poverty, but also for enhancing food and nutritional security of the region. These results do not necessarily mean that households in maize surplus areas are losing out; the study is not able to show it. What is clear is that the maize deficit regions are gaining more.

Child spacing (as measured by the mean age of children under the age of 5 years in a household) is also important in explaining child nutritional outcomes. The results show that the higher the mean age of the children under 5 years the better the nutritional outcome. This is rather expected because a household with very young children, and particularly when the children are closely spaced, spends more time caring for the children. This limits the household's time to participate in trade or agricultural activities. Such a household may be too resource constrained to meet the nutritional requirements of the children and even of the entire family. A closely related finding is the direct relationship between the age of the child and nutritional outcomes. This is plausible because parents do not need to spend as much time fending for older children as they do for younger ones. Similar results were observed by Miller and Rodgers (2009). This has been attributed to cessation of breast feeding and transition to exclusive reliance on solid foods particularly among children under 1 year old (see Miller and Rodgers 2009).

Age of the household head was positively correlated with child nutritional outcomes. The relationship was, however, significant only for Tanzania. This could be attributed to wealth accumulation by the head overtime. The age may also be associated with experience in child care, leading to better outcomes.

Access to water was important in explaining child nutritional outcomes. Households that are far from water sources registered negative outcomes. This could be due to two reasons. Such households could spend longer hours looking for water, reducing time available for income and food production and scarcity of water could subject the households to diseases.

Gender of the child was only important in explaining weight-for-age in Kenya. Male children were associated with a higher Z-score. This is consistent with international patterns that girls weigh less than boys at birth. For Tanzania and Uganda, the gender differences in the nutritional indicators were not statistically significant.

The effect of mother's education on nutritional outcomes was not universal. For Uganda no statistically different nutritional outcomes were found among mothers of all levels of education. In Kenya, the effect of mother's education on child nutrition manifested at post primary level. Mothers with this level of education had their children registering better nutritional outcomes than their counterparts with no education. For Tanzania, children whose mothers had either primary or post-primary level of education recorded better nutritional outcomes than those whose mothers had no formal education at all.

In Tanzania, the non-poor households had better child nutritional outcomes than their poor counterparts. For Kenya and Uganda, the effect of economic class on child nutrition was either weak or lacking. This looks perverse at first sight. However, a close examination of the data reveals that the Kenya data do not capture the urban non-poor at all while the Tanzania data have the urban non-poor dominating the urban poor. The rural non-poor may be able to meet their food requirements, but lack of nutrition awareness limits the difference between them and the poor in terms of child nutritional outcomes. Uganda's case could be similar to Kenya's although the nature of the data did not allow profiling the economic class.

Households with improved toilet facilities registered better child nutritional outcomes than those without. This information was, however, available only for Tanzania and may not be generalized for the other countries. Improved toilets could reduce spread of infectious diseases among children, curtailing chances of wasting and stunting.

5. Summary and conclusion

This study analysed the impact of cross-border trade in food staples on the child nutrition status of households in three East African countries—Kenya, Tanzania and Uganda. The study used the second wave of the DHS data for each country. In each country, two sets of households were selected, maize surplus producing areas and maize deficit producing areas. Based on available information on the regional trade flows, Tanzania and Uganda were designated as net exporters while Kenya was designated as a net importer.

The nutritional outcome measures were constructed as the average household Z-score for wasting and stunting and regressed against a range of location and socio-economic characteristics. The results of the study showed that trade had a positive impact on nutritional outcomes for households in maize deficit areas.

In general, trade liberalization contributes positively and significantly to improved household nutritional outcomes. Other factors such as child spacing, age of the household head, mothers' level of education, ease of access to water, gender of the child and access to improved toilet facilities were also important in influencing child nutritional outcomes.

Overall, the study findings support the hypothesis that measures put in place to facilitate trade are having positive results not only at the outcome level (increased trade flows), but also at the impact level (child nutrition). However, it is also important to note that other household characteristics have an influence on child nutrition outcomes. Therefore, besides improving trade, other complimentary measures such family planning, adult education and improving access to clean water are all important in enhancing child nutrition.

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Appendices

Appendix A: Summary statistics of household characteristics

Appendix A1: Characteristics of the Kenyan Households

	Treatment N = 308		Control N = 152		(A-B)	t -value
	A		B			
Variables	Mean	SD	Mean	SD	Mean diff	
Age of child (months)	28.02	17.29	29.61	17.48	-1.59	-0.92
Weight-for-age (z-score)	0.00	1.20	-0.27	0.96	0.27^{**}	2.44
Height-for-age (z-score)	0.07	0.78	-0.07	0.69	0.13^{*}	1.78
Age of head (years)	41.28	14.70	40.16	14.52	1.12	0.78
Dependency ratio (count)	1.84	0.92	1.90	1.05	-0.06	-0.62
Time to water (minutes)	21.88	20.08	15.17	16.41	6.71^{***}	3.57
Sex of child						
0. Female	143 (46.43%)		86 (56.58%)		**	4.19
1. Male	165 (53.57%)		66 (43.42%)			
Sex of head						
0. Female	92 (29.87%)		42 (27.63%)			0.25
1. Male	216 (70.13%)		110 (72.37%)			
Economic class						
0. Poor	172 (55.84%)		100 (65.79%)		**	4.17
1. Non-poor	136 (44.16%)		52 (34.21%)			
Residence type						
0. Rural	239 (77.60%)		121 (79.61%)			0.24
1. Urban	69 (22.40%)		31 (20.39%)			
Mother's education						
0. No education	44 (14.29 %)		16 (10.53%)		***	11.45
1. Primary	211 (68.51%)		89 (58.55%)			
2. Post-primary	53 (17.21%)		47 (30.92%)			

NB: * ssignificant at 1% level; ** ssignificant at 5% level; *** ssignificant at 10% level; SD = standard deviation.
Source: Authors' calculation from DHS data

Appendix A2: Characteristics of Ugandan households

	Treatment N = 124		Control N = 90		(A-B)	t-value
	A		B			
Variables	Mean	SD.	Mean	SD	Mean diff	
Age of child (months)	26.61	15.73	30.44	17.17	-3.83*	-1.68
Weight-for-age (z-score)	-0.00	0.83	0.05	0.88	-0.05	-0.44
Height-for-age (z-score)	-0.15	0.86	0.09	0.89	-0.25*	-2.02
Age of head (years)	38.11	12.63	36.11	13.20	2.00	1.12
Dependency ratio (count)	1.92	0.84	2.21	0.87	-0.29**	-2.49
Time to water (minutes)	31.75	19.27	47.79	28.65	-16.05***	-4.61
Sex of child						
0. Female	66 (53.23%)		40 (44.44%)			1.61
1. Male	58 (46.77%)		50 (55.56%)			
Sex of head						0.16
0. Female	13(10.48%)		11(12.22%)			
1. Male	111(89.52%)		79 (87.78%)			
Economic class						
0. Poor	55 (44.35%)		46 (51.11%)			0.96
1. Non-poor	69 (55.65%)		44 (48.89%)			
Mother's education	8 (6.45%)		22 (24.44%)			
0. No education	75 (60.48%)		56 (62.22%)		***	20.267
1. Primary	41 (33.06%)		12 (13.33%)			
2. Post-primary						

NB: * ssignificant at 1% level; ** ssignificant at 5% level; *** ssignificant at 10% level; SD = standard deviation.
Source: Authors' calculation from DHS data

Appendix A3: Characteristics of the Tanzanian households

NB: * ssignificant at 1% level; ** ssignificant at 5% level; and *** significant at 10% level; SD = standard deviation.

	Treatment N = 954 A		Control N = 788 B		(A-B)	t-value
Variables	Mean	Std. Dev.	Mean	Std. Dev.	Mean diff	
Age of child (months)	29.92	17.12	29.05	17.19	0.87	1.05
Weight-for-age (z-score)	-0.07	0.89	0.07	0.85	-0.13***	-3.19
Height-for-age (z-score)	-0.08	0.85	0.00	0.83	-0.08*	-1.86
Age of head (years)	42.48	13.92	44.06	14.40	-1.58**	-2.36
Dependency ratio (count)	2.11	1.22	2.02	1.07	0.09*	1.69
Time to water (minutes)	32.70	29.39	26.46	24.25	6.24***	4.77
Distance to Health (Km)	4.42	3.95	4.12	4.14	0.30	1.51
Distance to market (Km)	33.62	23.33	28.77	26.22	4.85***	4.07
Sex of child						
0. Female	479 (50.21%)		397 (50.38%)			0.00
1. Male	475 (49.79%)		391 (49.62%)			
Sex of head						
0. Female	175 (18.34%)		121 (15.36%)		*	2.73
1. Male	779 (81.66%)		667 (84.64%)			
Economic class						
0. Poor	398 (41.72%)		465 (59.01%)		***	51.60
1. Non-poor	556 (58.28%)		323 (40.99%)			
Residence type						
0. Rural	798 (83.65%)		673 (85.41%)			1.02
1. Urban	156 (16.35%)		115 (14.59%)			
Have toilet						
0. No	839 (87.95%)		718 (91.12%)		**	4.57
1. Yes	115 (12.05%)		70 (8.88%)			
Mother's education						
0. No education	179 (20.23%)		266 (37.41%)			
1. Primary	660 (74.58%)		412 (57.95%)		***	58.24
2. Post-primary	46 (5.20%)		33 (4.64%)			

Source: Authors' calculation from DHS data

Appendix B: Child nutritional outcome models

Variable	Kenya				Uganda				Tanzania			
	Mean Z-score for wasting	Mean Z-score for stunting	Wasting	Stunting	Mean Z-score for wasting	Mean Z-score for stunting	Wasting	Stunting	Mean Z-score for wasting	Mean Z-score for stunting	Wasting	Stunting
Treatment	0.38*** (4.19)	0.28*** (3.88)	0.38*** (3.51)	0.17** (2.21)	-0.24** (-1.98)	-0.33*** (-2.85)	-0.17 (-1.3)	-0.32** (-2.41)	-0.25*** (-6.43)	-0.14*** (-3.97)	-0.23*** (-4.99)	-0.14*** (-3.26)
Dependency ratio	-0.06 (-1.17)	-0.03 (-0.74)	-0.05 (-0.92)	-0.03 (-0.77)	-0.07 (-0.99)	-0.13* (-1.90)	-0.12 (-1.54)	-0.146* (-1.87)	0.026 (1.53)	-0.005 (-0.32)	0.003 (0.15)	-0.007 (-0.37)
Mean age of under 5 children	0.02*** (4.46)	0.02*** (6.89)			0.013** (2.34)	0.023*** (4.44)			0.016*** (8.09)	0.13*** (8.11)		
Gender of head (0: Female; 1: male)	-0.11 (-1.06)	0.02 (0.25)	-0.13 (-1.07)	-0.01 (-0.16)	0.164 (0.98)	0.034 (0.22)	0.073 (0.40)	0.048 (0.26)	-0.116** (-2.18)	-0.055 (-1.23)	-0.12* (-1.93)	-0.077 (-1.31)
Age of head	0.004 (1.39)	0.002 (0.87)	0.004 (1.01)	0.002 (0.82)	0.003 (0.57)	0.004 (1.05)	-0.001 (-0.12)	0.003 (0.67)	0.003** (2.02)	0.003*** (2.95)	0.002 (1.43)	0.004** (2.39)
Residence type (0: rural; 1: urban)	0.16 (1.33)	-0.02 (-0.24)	0.15 (1.08)	0.03 (0.31)					-0.036 (-0.48)	0.095 (1.55)	-0.12 (-1.58)	-0.04 (-0.54)
Time to water	-0.1** (-	-0.002 (-	-0.01*	0.0005	-0.005**	-0.002 (-	-0.005**	-0.003 (-	-0.001* (-	-0.0007 (-	-0.002*	-0.0003

source	2.48)	1.34)	(-1.74)	(0.26)	(-2.23)	1.13)	(-2.15)	1.37)	1.90)	1.15)	(-1.87)	(-0.41)
Mother's education level (0: No education; 1: Primary; 2: post-primary)	0.13 (0.82)	-0.09 (-0.79)	0.08 (0.47)	-0.08 (-0.72)	0.205 (1.22)	0.104 (0.65)	0.17 (0.95)	0.108 (0.59)	0.19*** (4.41)	0.68* (1.76)	0.19*** (3.57)	0.056 (1.12)
	0.36** (2.06)	0.13 (0.98)	0.31* (1.66)	0.05 (0.34)	0.23 (1.14)	0.051 (0.27)	0.204 (0.93)	0.149 (0.67)	0.37*** (3.80)	0.22** (2.29)	0.31*** (2.71)	0.31*** (2.87)
Economic class (0: poor; 1: non-poor)	-0.09 (-0.91)	-0.13 (-1.64)	-0.09 (-0.77)	-0.14* (-1.75)	-0.24** (-2.11)	-0.127 (-1.18)	-0.226* (-1.84)	-0.178 (-1.44)	0.089** (2.08)	0.03 (0.93)	0.101** (2.02)	0.06 (1.19)
Distance to market (km)									0.0002 (0.26)	0.002*** (2.65)	-0.0003 (-0.30)	0.0001 (0.12)
Distance to health facility (km)									-0.002 (-0.45)	0.002 (0.49)	-0.003 (-0.49)	0.002 (0.42)
Owns toilet (0: No; 1:Yes)									0.148* (1.82)	0.11 (1.57)	0.16* (1.90)	0.17** (2.12)
Age of child			0.01*** (4.07)	0.008*** (4.12)			0.007* (1.85)	0.015*** (4.16)			0.01*** (9.99)	0.01*** (8.02)

Gender of child			0.27*** (2.66)	0.02 (0.26)			0.025 (0.21)	0.115 (1.00)			-0.034 (-0.78)	-0.014 (-0.33)
Intercept	-0.86** (-2.91)	-0.64*** (-2.8)	-0.76** (-2.39)	-0.28 (-1.20)	-0.175 (-0.50)	-0.36 (-1.07)	0.27 (0.68)	-0.198 (-0.50)	-0.59*** (-5.23)	-0.6*** (-6.19)	-0.29** (-2.32)	-.42*** (-3.59)

NB: *, **, *** significant at 10%, 5% and 1% respectively; t-values in parentheses.

Source: Authors' calculation from DHS data.