

Refugees, Children's Health and Malaria Transmission in Africa

Olivier Dagnelie (U de Pau, Bayonne)

Anna Maria Mayda (Georgetown and CEPR)

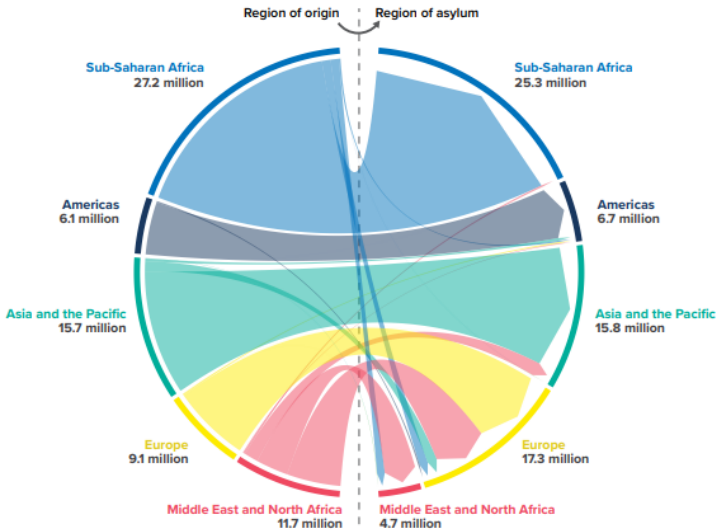
Jean-François Maystadt (IRES/LIDAM/UCLouvain, FNRS, Lancaster)

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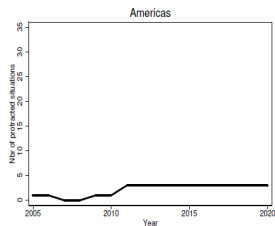
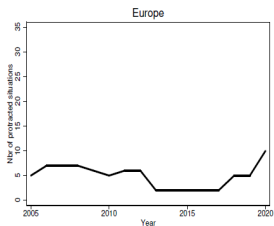
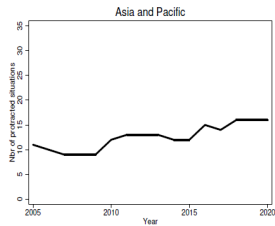
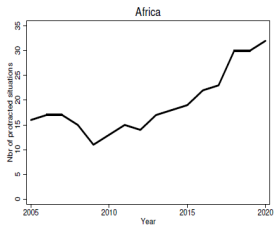
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Refugees in Africa

Figure 4 | Flows of refugees, people in refugee-like situations and other people in need of international protection from their region of origin to their region of asylum | 1975 - 2022



Protracted Refugee Situations



Source: UNHCR, 2020.

Introduction

- Low- and middle-income countries host 76 per cent of the world's refugees and other people in need of international protection.
- Refugees often move to areas where health outcomes are below average.
- Sub Saharan Africa: from 2.2 to 7 millions in 2010 vs. 2021 (UNHCR, 2020).
- How does the arrival of refugees affect the health of the local population?
- Quantitative studies mainly focus on the impact of refugee inflows through the labor and good markets.
- Limited evidence on their health impact.

The impact of refugees in labor and goods markets

- Maystadt and Verwimp (2014) analyze the impact on local communities of refugees from Burundi and Rwanda to the Kagera region of Tanzania, using data for 1991 and 2004.
 - The paper finds evidence of a **positive effect on average economic welfare**.
 - **Uneven gains** among native workers: The arrival of refugees hurt agricultural workers but benefited the self-employed farmers who employed these workers.
- These same refugees had a **long-run, positive welfare impact** on the local population, almost twenty years after the refugee inflow. The effect was driven by investment in infrastructure by international organizations, such as roads to serve refugee camps (Maystadt and Duranton, 2019).
- These economic effects have been confirmed in other African contexts, more specifically in Kenya (Alix-Garcia et al., 2018), Rwanda (Taylor et al., 2016; Loschmann et al., 2019), and Uganda (Kreibaum, 2016; d'Errico M. et al., 2022; Kadigo and Maystadt, 2023).

The impact of refugees in labor and goods markets (cont.)

Price effects:

- In Tanzania, the refugee influx led to large price spikes on some agricultural products, mainly non-aid food goods (e.g., plantains, legumes, milk, and beans) and nonfood goods (e.g., housing).
- However, the increased supply of maize through the food aid delivered by the World Food Programme (WFP) mitigated the increase in price, causing the net effect for maize to be close to zero (Alix-Garcia and Saah 2010).
- Other impacts of forced displacement on host communities in low and middle-income countries (Verme and Schuettler (2021); Maystadt et al. (2019); Ruiz and Vargas-Silva (2013); Becker and Ferrara (2019)).

What we do

- We assess the causal impact of refugees on the health of host communities, focusing in particular on children's anthropometrics scores.
- We estimate the effect of refugee inflows on around 400,000 children's anthropometrics (height-for-age and weight-for-age scores) based on data from 84 Demographic and Health Surveys (DHS) in 34 African countries.
- We exploit comprehensive information on the location, size and composition by country of origin of refugee camps between 2000 and 2016.
- We identify an important channel of impact.

Preview of results

- We document a **robust negative impact of refugees' arrival on height-for-age and weight-for-age scores** of the under-5-year-old children.
- We estimate an elasticity of about -0.02 , which means that doubling the presence of refugees decreases the height-for-age or weight-for-age z-scores of children in affected areas by about 2 percent.
- We interpret our results as causal on the basis of an extensive set of tests.
- We highlight the **important role of malaria** in explaining our results.
- By exploiting annual information on the composition by origin country of refugee camps, we show that the negative effect is mainly driven by refugees from high malaria prevalence countries to low prevalence areas.

Preview of results (cont.)

Additional pieces of evidence consistent with the malaria channel:

- The negative impact of refugees from high-malaria countries is greatly attenuated in locations where bednets are used.
- Refugees coming from malaria countries increase the likelihood that children at destination have typical malaria symptoms, such as fever and diarrhea, which can lead to long-term developmental consequences and malnutrition.
- These symptoms do not arise when refugees come from countries where malaria is not prevalent.

Malaria transmission

- Malaria is a disease caused by parasites that are transmitted to people through the bites of infected female *Anopheles* mosquitoes (WHO, 2022).
- Human-to-mosquito malaria transmission takes place as well (Mbewe, 2023).
- If infected refugees arrive to a location where malaria is not yet prevalent – yet there are female *Anopheles* mosquitoes – they can infect mosquitoes and the latter can infect local people.

Related Literature

- A few economic papers investigate the impact of refugees on health outcomes and their role in spreading infectious diseases (Montalvo and Reynal-Querol 2007, Baez 2011, Tatah et al 2016, Desai 2020, Anti and Salemi 2019, Ibanez and Rozo 2020, Ozden et al 2022).
- They provide evidence of negative health consequences of large refugee inflows.

Main contributions

- We advance the literature analyzing the impact of refugees on health outcomes using **micro-level data for the entire Sub-Saharan Africa**.
- We shed light on the **mechanism of impact** and, by doing so, reconcile the somewhat inconsistent findings in the literature (aggregate positive economic effect, negative health effect). We show that the detrimental health impact does not work through economic channels, rather it is driven by malaria transmission.
- We revisit the questions analyzed in Montalvo and Reynal-Querol (2007)'s seminal contribution using individual and geo-referenced data.
- We add to the literature on the determinants of malaria transmission (Sachs and Warner 2001, Acemoglu and Johnson 2007, Milusheva 2020).

Conceptual framework and related literature

The impact of refugees on anthropometrics scores of children in the host community can take place through various channels:

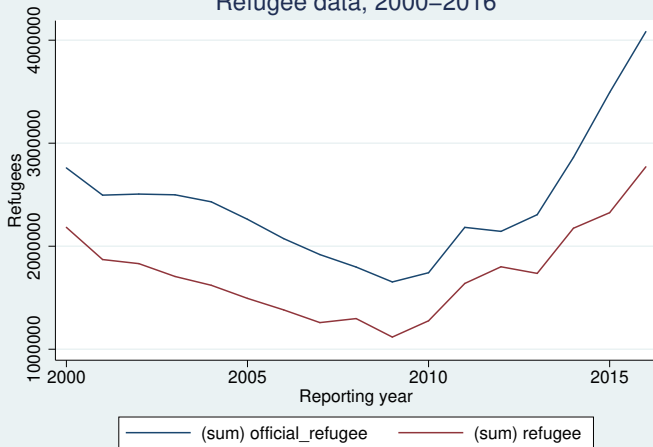
- Indirect effects (+)
 - Labor-market effects (Maystadt and Verwimp 2014; Ruiz and Vargas-Silva 2013; Maystadt et al. 2019; ; Verme and Schuettler 2021)
 - Humanitarian assistance (Kreibaum 2016, Taylor et al. 2016, Maystadt and Duranton 2019)
- Direct health effects (−)
 - Spread of infectious diseases (Montalvo and Reynal-Querol 2007)
 - Changes in access to health clinics (small-N or qualitative)

Data sources and definitions (1)

Refugees

- UNHCR dataset containing detailed time-series information on the geo-referenced location, composition and size of refugee camps across the world, covering the years 2000-16.
- Main analysis is restricted to 307 camps in Africa with GPS coordinates (and within a distance of 150 kms from DHS clusters)
- In some specifications, we add 67 additional camps without GPS but with information on regional location.

Refugee data, 2000–2016



Data sources and definitions (2)

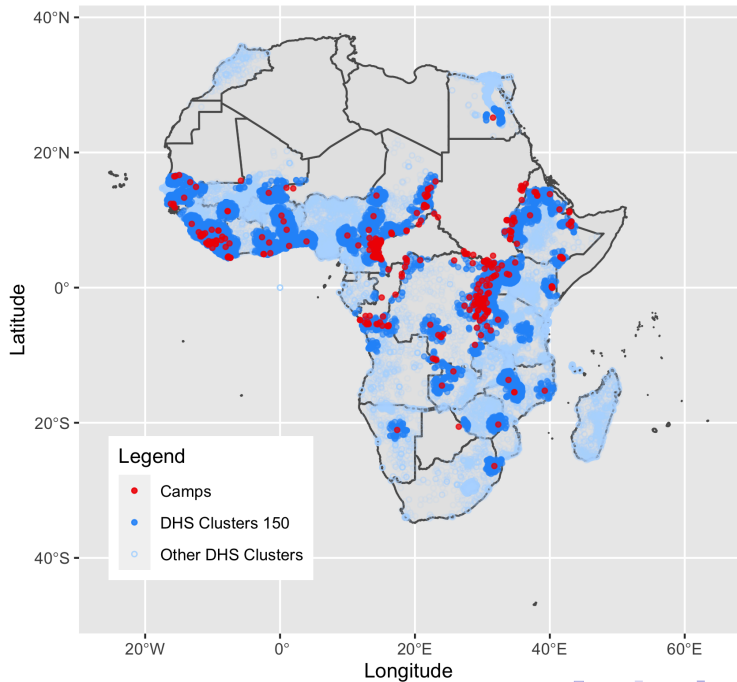
Host communities

- Demographic and Health Surveys (DHS): nationally representative and georeferenced data on women aged 15 to 49 and their children.
 - The anthropometric measures (height-for-age and weight-for-age scores) are available for under-5-year-old children born between 2000 and 2016.
 - Both measures, especially height-for-age, are greatly impacted in the first year of life.
 - We exclude about 2,755 children with scores outside of biologically plausible values (WHO).
 - We exclude children from clearly identified non-resident households.

Data sources and definitions (3)

Host communities

- Control variables: Uppsala Conflict Data Program (UCDP): Conflicts; Berkeley Earth: Temperature; Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS): Precipitation; GADM : Administrative subdivisions by country; World Bank Open Databases: Malaria.
- We end up with a sample of around 400,000 children, in 84 DHS, for 34 countries.



Specification

$$Y_{ijcmys} = \beta_1 \text{Refugees}_{jy} + \beta_2 X_{ijs} + \beta_3 \text{Shocks}_{jy} + \delta_{my} + t_{cy} + \alpha_{cs} + \alpha_j + \epsilon_{ijcmys} \quad (1)$$

- i is individual, j is village (DHS cluster), c is country, m is month of birth, y year of birth, s is survey year.
- Y_{ijcmys} is the child health outcome (height-for-age and weight-for-age scores)
- Refugee_{jy} is the distance-weighted sum of refugees :

$$\text{Refugee}_{jy} = \sum_{k: \text{dist}_{jk} < 150 \text{ km}} \frac{\text{Refugee}_{ky}}{\text{dist}_{jk}}$$

- inverse hyperbolic sine transformation: $IHS(x) = \ln[x + (x^2 + 1)^{1/2}]$
- SE clustered at the village level.

Observed and unobserved heterogeneity

$$Y_{ijcmys} = \beta_1 \text{Refugees}_{jy} + \beta_2 X_{ijs} + \beta_3 \text{Shocks}_{jy} + \delta_{my} + t_{cy} + \alpha_{cs} + \alpha_j + \epsilon_{ijcmys} \quad (2)$$

Control for observed characteristics:

X_{ijs} Individual and HH: the gender of the child, being the first child, being part of a multiple birth, being in a female headed household, the number of brothers and sisters, the mother's education, age (and square) and literacy level, and the wealth index.

Shocks_{jy} Village-level weather shocks and violence

Control for unobserved characteristics:

δ_{my} Year-month (of birth) fixed effects

t_{cy} Country-specific time trends (based on year of birth)

α_{cs} country-survey fixed effects

α_j village fixed effect

Detrimental effects on health

Table 1: Refugees and health

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| <u>Panel A:</u> | Height-for-age z-score | | | Weight-for-age z-score | | |
| Refugees (IHS, 150km) | -0.0200*** (0.0077) | -0.0213*** (0.0078) | -0.0267*** (0.0084) | -0.0153** (0.0063) | -0.0165*** (0.0063) | -0.0187*** (0.0067) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| Elasticity | -0.0170 | -0.0179 | -0.0225 | -0.0150 | -0.0160 | -0.0182 |
| Mean dep. var. | -1.174 | -1.186 | -1.188 | -1.019 | -1.028 | -1.025 |
| <u>Panel B:</u> | Stunting | | | Wasting | | |
| Refugees (IHS, 150km) | 0.0054** (0.0023) | 0.0057** (0.0023) | 0.0069*** (0.0025) | 0.0037* (0.0020) | 0.0038* (0.0020) | 0.0034* (0.0021) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| Elasticity | 0.0186 | 0.0194 | 0.0232 | 0.0169 | 0.0174 | 0.0154 |
| Mean dep. var. | 0.291 | 0.295 | 0.296 | 0.220 | 0.221 | 0.221 |
| Year & month of birth | Y | Y | Y | Y | Y | Y |
| Country trends | Y | Y | Y | Y | Y | Y |
| Country-survey FE | Y | Y | Y | Y | Y | Y |
| Village FE | Y | Y | Y | Y | Y | Y |
| Climatic controls | Y | Y | Y | Y | Y | Y |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | Y | Y |

Threats to identification of a causal effect

- Pre-treatment trends
- Unobserved time-varying factors
- Heterogeneous treatment effects
- Selection issues

Pre-treatment trends

Table 2: Pre-treatment trends

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|--|--------------------|---------------------|------------------------|----------------------|---------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| <u>Panel A:</u> | Opening $t + 1$, without village fixed effects | | | | | |
| Opening (> 0 at $t + 1, = 0$ up to t) | 0.0277 (0.1006) | 0.0329 (0.1120) | 0.0794 (0.1034) | -0.0516 (0.0851) | -0.0433 (0.1003) | -0.0669 (0.1058) |
| Observations | 37,424 | 33,222 | 31,740 | 37,256 | 33,048 | 31,561 |
| <u>Panel A bis:</u> | Opening $t + 1$, no sample restriction | | | | | |
| Opening (> 0 at $t + 1, = 0$ up to t) | -0.0018 (0.0325) | 0.0000 (0.0328) | -0.0077 (0.0346) | -0.0272 (0.0263) | -0.0306 (0.0263) | -0.0434 (0.0273) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| <u>Panel B:</u> | Opening $t + 2$ | | | | | |
| Opening (> 0 at $t + 2, = 0$ up to $t + 1$) | 0.0075 (0.0832) | 0.0385 (0.0819) | 0.0058 (0.0841) | 0.1380* (0.0775) | 0.1683** (0.0768) | 0.1420* (0.0782) |
| Observations | 103,640 | 96,504 | 92,002 | 103,444 | 96,259 | 91,710 |
| <u>Panel C:</u> | Opening $t + 3$ | | | | | |
| Opening (> 0 at $t + 3, = 0$ up to $t + 2$) | 0.0806 (0.0590) | 0.0810 (0.0577) | 0.0690 (0.0614) | -0.0143 (0.0548) | -0.0338 (0.0535) | -0.0077 (0.0565) |
| Observations | 166,693 | 158,489 | 151,139 | 166,550 | 158,291 | 150,862 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Children born one year, or two years, or three years *before* the opening of a refugee camp do not have worse health outcomes.

Threats to identification of a causal effect

- Pre-treatment trends
- Unobserved time-varying factors
- Heterogeneous treatment effects
- Selection issues

Unobserved time-varying factors

Table 3: Controlling for unobserved time-varying factors

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------|-------------------------------|-----------|-----------|------------------------|----------|-----------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| Panel A: | Distance to borders * time FE | | | | | |
| Refugees (IHS, 150km) | -0.0145* | -0.0159** | -0.0208** | -0.0112* | -0.0123* | -0.0144** |
| | (0.0077) | (0.0078) | (0.0084) | (0.0063) | (0.0063) | (0.0067) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| Elasticity | -0.0123 | -0.0134 | -0.0175 | -0.0110 | -0.0120 | -0.0140 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Threats to identification of a causal effect

- Pre-treatment trends
- Unobserved time-varying factors
- Heterogeneous treatment effects
- Selection issues

Heterogeneous treatment effects

- 1 Jakiela (2021)'s simple diagnostics
 - **negative weights** mostly in last three years
 - **robust** to dropping 2016, 2015-2016, or 2014-2016
- 2 Alternative indicators. Only de Chaisemartin and D'Haultfeuille (2020) and Gardner (2021) deal with continuous treatment that switches on and off
 - Robust to Gardner (2021) even if larger magnitude

Heterogeneous treatment effects (cont.)

Table 4: Applying Gardner (2021)

| | (1) | (2) | (3) | (4) |
|--|------------------------|-----------------------|------------------------|-----------------------|
| | TWFE | Gardner (2021) | TWFE | Gardner (2021) |
| Dependent variable: Refugees Index (IHS, 150km) | Height-for-age z-score | | Weight-for-age z-score | |
| | -0.0262*** (0.0083) | -0.0615** (0.0264) | -0.0183*** (0.0066) | -0.0491** (0.0211) |
| Observations | 385,707 | 322,087 | 386,246 | 321,981 |
| Climate and conflict | Y | Y | Y | Y |
| Ind. and HH | Y | Y | Y | Y |
| Year of birth | Y | Y | Y | Y |
| Country-survey FE | Y | Y | Y | Y |
| Country trends | Y | Y | Y | Y |
| Village FE | Y | Y | Y | Y |

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; robust standard errors clustered at the village level; Ind. and HH controls are described below Table 2. FE = fixed effects.

Potential selection issues

- Selection at the *individual* (child) level: because of selective mortality.
- Selection at the *household* level, because of in- and out-migration, and because of changes in fertility decisions.
- Selection at the *village* level:

Potential selection issues: at the individual level

Table 5: Selective mortality (adding the lagged presence of refugees, i.e. potentially effect in utero or before conception)

| | (1) | (2) | (3) | (4) |
|---------------------------------|-----------------------------|----------|---------|----------|
| | Coef. | (SE) | Coef. | (SE) |
| <u>Panel A:</u> | Probability to die by age 1 | | | |
| Refugees (IHS, 150km) | -0.0004 | (0.0007) | -0.0001 | (0.0008) |
| Refugees (IHS, 150km, $t - 1$) | | | -0.0009 | (0.0008) |
| Observations | 620,912 | | 613,207 | |
| <u>Panel B:</u> | Probability to die by age 2 | | | |
| Refugees (IHS, 150km) | -0.0006 | (0.0008) | -0.0001 | (0.0009) |
| Refugees (IHS, 150km, $t - 1$) | | | -0.0007 | (0.0008) |
| Observations | 620,912 | | 613,207 | |
| <u>Panel C:</u> | Probability to die by age 3 | | | |
| Refugees (IHS, 150km) | -0.0005 | (0.0008) | -0.0001 | (0.0009) |
| Refugees (IHS, 150km, $t - 1$) | | | -0.0007 | (0.0007) |
| Observations | 620,912 | | 613,207 | |
| <u>Panel D:</u> | Probability to die by age 4 | | | |
| Refugees (IHS, 150km) | -0.0004 | (0.0008) | -0.0000 | (0.0009) |
| Refugees (IHS, 150km, $t - 1$) | | | -0.0007 | (0.0007) |
| Observations | 620,912 | | 613,207 | |
| <u>Panel E:</u> | Probability to die by age 5 | | | |
| Refugees (IHS, 150km) | -0.0005 | (0.0008) | -0.0000 | (0.0009) |
| Refugees (IHS, 150km, $t - 1$) | | | -0.0007 | (0.0007) |
| Observations | 620,912 | | 613,207 | |

Potential selection issues

- Selection at the *individual* (child) level: because of selective mortality and/or selective fertility.
- Selection at the *household* level: because of in- and out-migration, and because of changes in fertility decisions of different types of households.
- Selection at the *village* level:

Potential selection issues: at the household level

Table 6: Including non-residents

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------|-----------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| <u>Panel A:</u> | Including non-resident households | | | | | |
| Refugees Index (IHS, 150km) | -0.0199*** (0.0076) | -0.0212*** (0.0077) | -0.0267*** (0.0083) | -0.0152** (0.0063) | -0.0164*** (0.0063) | -0.0187*** (0.0066) |
| Observations | 422,967 | 411,490 | 393,401 | 423,822 | 412,272 | 393,963 |
| Elasticity | -0.0170 | -0.0180 | -0.0226 | -0.0150 | -0.0161 | -0.0183 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Potential selection issues: at the household level (cont.)

Table 7: Refugees and fertility (collapsed at village-year of birth level)

| | (1) | (2) | (3) | (4) |
|----------------------|---------------------|---------------------|---------------------|---------------------|
| Dependent variable: | | Nbr of births (IHS) | | |
| Refugees (IHS) | -0.0024 (0.0021) | -0.0024 (0.0022) | -0.0016 (0.0022) | -0.0023 (0.0023) |
| Refugees (IHS, t-1) | | 0.0000* (0.0000) | | 0.0000* (0.0000) |
| Observations | 159,111 | 156,226 | 149,873 | 147,795 |
| Ind. and HH controls | N | N | Y | Y |
| Conflict controls | N | N | Y | Y |

Potential selection issues: at the household level (cont.)

Table 8: Using the height of mothers as dep. var.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|------------------------------|-----------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Dependent variable: | Maternal Height | | | Maternal Height | | |
| Dropping implausible values: | Drop if < 100cm | | | Drop if < 120cm | | |
| <u>Panel A:</u> | With all children | | | | | |
| Refugees (IHS, 150km) | 0.0077 (0.0246) | 0.0020 (0.0245) | -0.0071 (0.0263) | 0.0097 (0.0243) | 0.0041 (0.0243) | -0.0048 (0.0261) |
| Observations | 361,697 | 351,351 | 337,563 | 361,406 | 351,064 | 337,289 |
| <u>Panel B:</u> | With only first child | | | | | |
| Refugees (IHS, 150km) | -0.0427 (0.1025) | -0.0549 (0.1022) | -0.0553 (0.1080) | -0.0417 (0.1023) | -0.0533 (0.1019) | -0.0539 (0.1076) |
| Observations | 65,973 | 64,485 | 61,755 | 65,925 | 64,437 | 61,709 |
| Dependent variable: | Maternal BMI | | | Maternal BMI | | |
| Dropping implausible values: | Drop if < 100cm | | | Drop if < 120cm | | |
| <u>Panel C:</u> | With all children | | | | | |
| Refugees (IHS, 150km) | -0.0000 (0.0001) | -0.0001 (0.0001) | -0.0001 (0.0001) | -0.0000 (0.0001) | -0.0000 (0.0001) | -0.0001 (0.0001) |
| Observations | 369,107 | 361,463 | 351,109 | 369,550 | 361,899 | 351,539 |
| <u>Panel D:</u> | With only first child | | | | | |
| Refugees (IHS, 150km) | 0.0000 (0.0004) | 0.0000 (0.0004) | -0.0000 (0.0004) | 0.0003 (0.0005) | 0.0003 (0.0005) | 0.0003 (0.0005) |
| Observations | 67,306 | 65,936 | 64,447 | 67,383 | 66,010 | 64,521 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Same results with Weight, Rohrer and Anemia

Potential selection issues: at the household level (cont.)

Table 9: Exploiting variation within households

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------|------------------------|---------------------|-----------------------|------------------------|---------------------|----------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| Panel A: | Mother fixed effects | | | | | |
| Refugees (IHS, 150km) | -0.0152* (0.0089) | -0.0131 (0.0087) | -0.0205** (0.0095) | -0.0150* (0.0082) | -0.0131 (0.0080) | -0.0164* (0.0087) |
| Elasticity | -0.0126 | -0.0108 | -0.0169 | -0.0143 | -0.0125 | -0.0156 |
| Observations | 193,994 | 192,796 | 177,973 | 196,147 | 194,913 | 179,728 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Potential selection issues

- Selection at the *individual* (child) level: because of selective mortality.
- Selection at the *household* level, because of in- and out-migration, and because of changes in fertility decisions.
- Selection at the *village* level:
 - we find no significant differences between observable characteristics of treatment and control villages, after we partial out village, year fixed effects and country-specific linear trends. [Descriptive statistics](#)
 - However, villages in the two groups might differ according to unobservable characteristics.

Potential selection issues: at the village level

Table 10: Alternative samples

| | (1) | (2) | (3) | (4) |
|---------------------------------|------------------------|----------|------------------------|----------|
| Dependent variable: | Coef. | (SE) | Coef. | (SE) |
| | Height-for-age z-score | | Weight-for-age z-score | |
| <u>Panel A:</u> | Sample < 200 km | | | |
| Refugees (IHS, buffer of 200km) | -0.0174** | (0.0072) | -0.0132** | (0.0059) |
| Observations | 135,112 | | 136,688 | |
| <u>Panel B:</u> | Sample < 150 km | | | |
| Refugees (IHS, buffer of 150km) | -0.0264*** | (0.0087) | -0.0223*** | (0.0066) |
| Observations | 106,314 | | 107,550 | |
| <u>Panel C:</u> | Sample < 140 km | | | |
| Refugees (IHS, buffer of 140km) | -0.0169** | (0.0078) | -0.0165*** | (0.0063) |
| Observations | 99,674 | | 100,823 | |
| <u>Panel D:</u> | Sample < 130 km | | | |
| Refugees (IHS, buffer of 130km) | -0.0148* | (0.0079) | -0.0161** | (0.0063) |
| Observations | 94,203 | | 95,288 | |
| <u>Panel E:</u> | Sample < 120 km | | | |
| Refugees (IHS, buffer of 120km) | -0.0152* | (0.0079) | -0.0162** | (0.0065) |
| Observations | 88,609 | | 89,620 | |
| <u>Panel F:</u> | Sample < 110 km | | | |
| Refugees (IHS, buffer of 110km) | -0.0142* | (0.0080) | -0.0163** | (0.0066) |

Robustness tests

- alternative **treatment** (including alternative transformation, non-IHS)
- quadratic term: U-shaped but mostly negative
- **buffer** at 200km and 100Km
- buffer from 150km to 10km
- dividing the 150 km buffer into bins
- Effect concentrated during the year of **birth**
- Controlling for country-year-of-birth **fixed effects**
- Controlling for inclusion of camps outside of national borders
- controlling for the child's age at the time of measurement (year-month of interview)
- alternative **aggregations**

Channels

- Both our paper and others in the literature (for example Baez 2011) find evidence of the detrimental impact of refugees on the health of the hosting population.
- What are the channels of impact?
- It is unlikely that the negative health effect works through economic channels since a few papers show that refugees increase welfare on average (e.g. Alix Garcia et al. 2018; Taylor et al. 2016; Maystadt and Verwimp 2014, Maystadt and Durantou 2019 or Kreibaum 2016)

The malaria channel

- Population movements are often associated with malaria transmission in historical case studies (Curtin 1989, 1998, Marques 1987, Bioland and Williams 2003). “Population movement (due to political conflicts or civil wars) is potentially the most important factor in the transmission of malaria (conditional on the dynamics between vector, parasite, and environment)” Montalvo and Reynal-Querol 2007: 166).
- “The contact of a nonimmune individual with an immune rural population in a high-risk area also increases the risk of transmission .. Paradoxically, it is in low-endemicity areas where the risk of severe infection is highest among the adult population, because they may grow up without developing immunity ...” (Montalvo and Reynal-Querol 2007: 166)
- Using data for 130 countries between 1962 and 1997, Montalvo and Reynal-Querol (2007) show that refugees increase the incidence of malaria in the receiving country, only when they originate from a tropical country (with high incidence of malaria) ... the results are particularly strong for Africa.

The malaria channel (cont.)

- We exploit information about the country of origin of the refugees, which is available in the dataset on refugee camps.
- We construct the following measure of the number of refugees originating from a country with a *high incidence of malaria*:

$$Refugee(Malaria) = \frac{\sum_{O,k:dist_{jk} < 150} Refugee_{kOy}}{dist_{jk}} \times HighMalariaRisk_{Oy} \quad (3)$$

- We construct a measure of the number of refugees originating from a country with a *low incidence of malaria*.
- We also interact the above measures with *Low malaria at dest.* (similar to cross-country study by Montalvo and Reynal-Querol 2007, but using local measures of malaria risk at destination).

The malaria channel (cont.)

Table 11: Refugees and health: refugees from high vs. low incidence of malaria at origin

| | (1) | (2) | (3) | (4) |
|---|-----------------------------|------------------------|------------------------|------------------------|
| Dependent variable: | Height-for-age z-score | | Weight-for-age z-score | |
| <u>Panel A:</u> | Only with climatic controls | | | |
| Refugees (IHS, malaria) | -0.0283*** (0.0105) | 0.0009 (0.0093) | -0.0206*** (0.0074) | 0.0026 (0.0073) |
| Refugees (IHS, malaria) × Low malaria at dest. | | -0.0561*** (0.0136) | | -0.0449*** (0.0099) |
| Refugees (IHS, Non malaria) | -0.0021 (0.0071) | -0.0055 (0.0071) | -0.0005 (0.0065) | -0.0032 (0.0066) |
| Low malaria at dest. (Dummy, t) | 0.0349 (0.0575) | 0.1441** (0.0648) | -0.0426 (0.0457) | 0.0445 (0.0511) |
| Observations | 414,388 | 414,388 | 415,214 | 415,214 |
| <u>Panel B:</u> | With all controls | | | |
| Refugees (IHS, malaria) | -0.0326*** (0.0115) | -0.0011 (0.0099) | -0.0225*** (0.0079) | 0.0006 (0.0077) |
| Refugees (IHS, malaria) × Low malaria at dest. | | -0.0604*** (0.0146) | | -0.0444*** (0.0106) |
| Refugees (IHS, Non malaria) | -0.0069 (0.0074) | -0.0106 (0.0074) | -0.0041 (0.0069) | -0.0068 (0.0070) |
| Low malaria at dest. | 0.0631 (0.0593) | 0.1785*** (0.0680) | -0.0277 (0.0479) | 0.0570 (0.0538) |
| Observations | 385,707 | 385,707 | 386,246 | 386,246 |

The malaria channel (cont.)

Are we capturing something else?

- We construct “Fake” malaria index

$$Fake(Malaria) = \frac{\sum_{O,k: dist_{jk} < 150} Refugee_{kOy}}{dist_{jk}} \times MalariaCorrelates_{Oy} \quad (4)$$

- where *MalariaCorrelates* identify
 - Refugees from unemployment above median
 - Refugees from above-median GDP growth
 - Refugees from above-median literacy rate
 - Refugees from above-median poverty rate
 - Refugees from above-median Gini coefficient
 - Refugees from above-median GDP
 - Refugees from above-median Rule of law
 - Refugees from above-median Life expectancy
 - Refugees from landlocked countries
- Results are robust to controlling for these “Fake malaria” one-by-one

The malaria channel (cont.)

Table 12: Selective mortality in the malaria context

| | (1) | (2) | (3) | (4) |
|-----------------------------|-----------------------------|----------|------------------------|----------|
| Dependent variable: | Coef. | (SE) | Coef. | (SE) |
| | All controls | | Only climatic controls | |
| Panel A: | Probability to die by age 1 | | | |
| Refugees (IHS, malaria) | -0.0007 | (0.0009) | -0.0009 | (0.0009) |
| Refugees (IHS, Non malaria) | 0.0004 | (0.0008) | 0.0002 | (0.0008) |
| Observations | 620,912 | | 661,891 | |
| Panel B: | Probability to die by age 2 | | | |
| Refugees (IHS, malaria) | -0.0004 | (0.0010) | -0.0007 | (0.0009) |
| Refugees (IHS, Non malaria) | 0.0001 | (0.0008) | -0.0001 | (0.0008) |
| Observations | 620,912 | | 661,891 | |
| Panel C: | Probability to die by age 3 | | | |
| Refugees (IHS, malaria) | -0.0005 | (0.0010) | -0.0008 | (0.0010) |
| Refugees (IHS, Non malaria) | 0.0003 | (0.0008) | 0.0000 | (0.0008) |
| Observations | 620,912 | | 661,891 | |
| Panel D: | Probability to die by age 4 | | | |
| Refugees (IHS, malaria) | -0.0002 | (0.0011) | -0.0005 | (0.0010) |
| Refugees (IHS, Non malaria) | 0.0000 | (0.0009) | -0.0002 | (0.0008) |
| Observations | 620,912 | | 661,891 | |
| Panel E: | Probability to die by age 5 | | | |
| Refugees (IHS, malaria) | -0.0002 | (0.0011) | -0.0004 | (0.0010) |
| Refugees (IHS, Non malaria) | -0.0000 | (0.0009) | -0.0002 | (0.0008) |
| Observations | 620,912 | | 661,891 | |

Other possible channels

- **Direct health effects**: **no evidence** of Δ^+ of diarrhea, cough and fever (rather Δ^-) ... Increased effect on diarrhea and fever if refugees come from high malaria countries
- **Health services** : **no evidence** of crowding out (rather Δ^+ accessibility)
- Income shocks : **no evidence** (wealth index, BMI)
- Absence of mothers due to increased work opportunities : **no evidence** on the probability the mother is working
- **Quantity-quality trade-offs** : **no credible explanation** since Δ^0 births and improved vaccination
- **Distributional effects**: **no evidence** of heterogeneous effects for poor households

Conclusion

- We find evidence of a negative impact of refugee inflows on anthropometric measures of under-5-year-old children.
- Causal inference interpretation rests on evidence of homogenous treatment effects, exogenous presence of refugees, common trends and constant composition among treated and control groups.
- We identify malaria as the main transmission channel!
 - Our results point to the risk of malaria transmission, in particular when refugees move from highly-endemic countries to areas with low malaria incidence (where population is largely non-immune)

Table 13: Descriptive Statistics

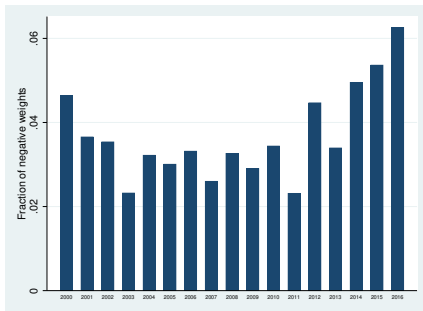
| Variable | Obs | Mean | Std. Dev. | Min | Max |
|------------------------|--------|--------|-----------|-------|----------|
| Height-for-age z-score | 385707 | -1.189 | 1.57 | -5 | 5 |
| Weight-for-age z-score | 386246 | -1.02 | 1.3 | -5 | 5 |
| Refugees (IHS, 150 km) | 385707 | 0.89 | 2.19 | 0 | 12.86 |
| Refugees (150 km) | 385707 | 86.11 | 1037.60 | 0 | 193275.5 |
| Rainfall anomaly | 385707 | 0.18 | 0.76 | -2.87 | 3.35 |
| Temperature anomaly | 385707 | 0.91 | 0.29 | -0.39 | 2.54 |
| Violence Intensity | 385707 | 0.72 | 20.64 | 0 | 4429.57 |
| Distance to border | 385707 | 137.7 | 154.39 | .0008 | 886.21 |
| Male | 385707 | 0.51 | 0.45 | 0 | 1 |
| Multi | 385707 | 0.03 | 0.17 | 0 | 1 |
| First Order | 385707 | 0.21 | 0.41 | 0 | 1 |
| Nbr Brothers Alive | 385707 | 1.11 | 1.27 | 0 | 11 |
| Nbr Sisters Alive | 385707 | 1.12 | 1.27 | 0 | 10 |
| Female Headed | 385707 | 0.18 | 0.38 | 0 | 1 |
| Wealth index | 385707 | 2.79 | 1.39 | 1 | 5 |
| Mother Age | 385707 | 29.6 | 6.84 | 15 | 49.92 |
| Primary Education | 385707 | 0.33 | 0.47 | 0 | 1 |
| Secondary Education | 385707 | 0.22 | 0.42 | 0 | 1 |
| Tertiary Education | 385707 | 0.03 | 0.18 | 0 | 1 |
| Literacy | 385707 | 0.08 | 0.27 | 0 | 1 |

Summary Statistics (cont.)

Table 14: Descriptive Statistics (2)

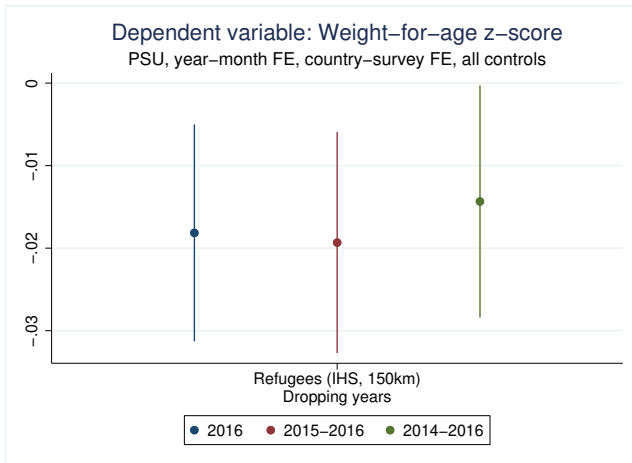
| Variable | Treated villages | | | | | Control villages | | | | | t-test | |
|------------------------|------------------|--------|-----------|-------|----------|------------------|--------|-----------|---------|----------|---------|------------|
| | Obs | Mean | Std. Dev. | Min | Max | Obs | Mean | Std. Dev. | Min | Max | Diff | SE |
| Height-for-age z-score | 106314 | -1.29 | 1.51 | -5 | 4.99 | 279393 | -1.14 | 1.57 | -5 | 5 | 0.15 | (0.006)*** |
| Weight-for-age z-score | 107550 | -1.11 | 1.26 | -5 | 5 | 278696 | -.99 | 1.31 | -5 | 5 | 0.115 | (0.005)*** |
| Refugees (IHS, 150 km) | 106314 | 3.22 | 3.15 | 0 | 12.865 | 279393 | 0 | 0 | 0 | 0 | -3.22 | (0.006)*** |
| Refugees (150 km) | 106314 | 312.41 | 1958.39 | 0 | 193275.5 | 279393 | 0 | 0 | 0 | 0 | -312.4 | (3.705)*** |
| Male | 106314 | .50 | .5 | 0 | 1 | 279393 | .51 | .5 | 0 | 1 | 0.002 | (0.002) |
| Multi | 106314 | .03 | .17 | 0 | 1 | 279393 | .03 | .17 | 0 | 1 | 0.001 | (0.001)*** |
| First Order | 106314 | .20 | .40 | 0 | 1 | 279393 | .21 | .41 | 0 | 1 | 0.014 | (0.001)*** |
| Nbr Brothers Alive | 106314 | 1.15 | 1.28 | 0 | 9 | 279393 | 1.10 | 1.26 | 0 | 11 | -0.045 | (0.005)*** |
| Nbr Sisters Alive | 106314 | 1.14 | 1.27 | 0 | 9 | 279393 | 1.11 | 1.27 | 0 | 10 | -0.033 | (0.005)*** |
| Female Headed | 106314 | .19 | .39 | 0 | 1 | 279393 | .17 | .38 | 0 | 1 | -0.018 | (0.001)*** |
| Wealth index | 106314 | 2.8 | 1.41 | 1 | 5 | 279393 | 2.78 | 1.39 | 1 | 5 | -0.018 | (0.005)*** |
| Mother Age | 106314 | 29.85 | 6.85 | 15 | 49.92 | 279393 | 29.5 | 6.83 | 15 | 49.92 | -0.355 | (0.025)*** |
| Primary Education | 106314 | .36 | .48 | 0 | 1 | 279393 | .32 | .47 | 0 | 1 | -0.042 | (0.002)*** |
| Secondary Education | 106314 | .17 | .38 | 0 | 1 | 279393 | .24 | .43 | 0 | 1 | 0.067 | (0.001)*** |
| Tertiary Education | 106314 | .02 | .15 | 0 | 1 | 279393 | .04 | .19 | 0 | 1 | 0.016 | (0.001)*** |
| Literacy | 106314 | .08 | .27 | 0 | 1 | 279393 | .08 | .27 | 0 | 1 | 0.0004 | (0.001) |
| Rainfall anomaly | 106314 | .21 | .78 | -2.63 | 3.09 | 279393 | .17 | .76 | -28.709 | 3.35 | -0.0498 | (0.003)*** |
| Temperature anomaly | 106314 | .92 | .27 | -.34 | 2.54 | 279393 | .91 | .30 | -.39 | 2.54 | -0.015 | (0.001)*** |
| Violence Intensity | 106314 | .76 | 51.49 | 0 | 315.7077 | 279393 | .71 | 24.03 | 0 | 4429.566 | -0.0499 | (0.074) |
| Distance to border | 106314 | 79.97 | 90.68 | .0008 | 473.25 | 279393 | 159.66 | 167.41 | .008 | 886.21 | 79.687 | (0.541)*** |

Figure 1: Distribution of negative weights by year



Note: Distribution of the proportion of negative weights overtime. Weights are the residuals from a regression of the treatment on location (PSU) and time (year-month) fixed effects, augmented with country-specific time trends, and scaled by the sum of squared residuals across all observations.

Figure 3: Robustness to exclusion of later post-treatment years



Robustness tests (cont.) Back

Table 16: Stunting and Wasting

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------|-----------------------|-----------------------|-----------------------|---------------------|---------------------|--------------------|
| Panel A: | | Stunting | | | Wasting | |
| Refugees (IHS, 150km) | 0.0053** (0.0023) | 0.0056** (0.0023) | 0.0067*** (0.0025) | 0.0037* (0.0020) | 0.0038* (0.0020) | 0.0033 (0.0020) |
| Elasticity | 0.00532 | 0.00562 | 0.00675 | 0.00366 | 0.00379 | 0.00335 |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| Panel B: | | Severe Stunting | | | Severe Wasting | |
| Refugees (IHS, 150km) | 0.0055*** (0.0017) | 0.0056*** (0.0017) | 0.0063*** (0.0017) | 0.0014 (0.0011) | 0.0015 (0.0011) | 0.0017 (0.0011) |
| Elasticity | 0.00547 | 0.00560 | 0.00635 | 0.00144 | 0.00148 | 0.00167 |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| Year & month of birth | Y | Y | Y | Y | Y | Y |
| Country trends | Y | Y | Y | Y | Y | Y |
| Country-survey FE | Y | Y | Y | Y | Y | Y |
| Village FE | Y | Y | Y | Y | Y | Y |
| Climatic controls | Y | Y | Y | Y | Y | Y |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Robustness tests (cont.) [Back](#)

Table 17: Alternative treatment variables

| | (1) | (2) | (3) | (4) | (5) | (6) |
|--------------------------|--------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| <u>Panel A:</u> | log transformation (1+Refugee index) | | | | | |
| Nbr Refugees (log) | -0.0202** (0.0088) | -0.0216** (0.0088) | -0.0278*** (0.0095) | -0.0151** (0.0071) | -0.0164** (0.0071) | -0.0190** (0.0075) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| <u>Panel B:</u> | Refugee Density | | | | | |
| Refugee/Pop (IHS, 150km) | -0.0198** (0.0086) | -0.0200** (0.0087) | -0.0219** (0.0087) | -0.0194*** (0.0058) | -0.0196*** (0.0059) | -0.0214*** (0.0060) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| <u>Panel C:</u> | Dummy for the presence of refugees | | | | | |
| Refugees (Dummy if > 0) | -0.1593*** (0.0356) | -0.1625*** (0.0359) | -0.1866*** (0.0375) | -0.1431*** (0.0293) | -0.1416*** (0.0293) | -0.1524*** (0.0307) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| <u>Panel D:</u> | Opening (> 0 at t, = 0 at t - 1) | | | | | |
| Opening | -0.1998*** (0.0448) | -0.2065*** (0.0441) | -0.2307*** (0.0455) | -0.2013*** (0.0350) | -0.2057*** (0.0345) | -0.2202*** (0.0354) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| <u>Panel F:</u> | Opening*Refugees (IHS, 150km) | | | | | |
| Opening*Refugees | -0.0436*** (0.0114) | -0.0444*** (0.0112) | -0.0524*** (0.0119) | -0.0416*** (0.0089) | -0.0418*** (0.0087) | -0.0470*** (0.0089) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Robustness tests (cont.) Back

Table 18: Refugees and health, a non-linear relationship?

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| Panel A: | Quadratic term | | | | | |
| Refugees (IHS, 150km) | -0.0746*** (0.0205) | -0.0750*** (0.0205) | -0.0805*** (0.0208) | -0.0731*** (0.0166) | -0.0731*** (0.0166) | -0.0745*** (0.0171) |
| Refugees ² (IHS, 150km) | 0.0094*** (0.0032) | 0.0093*** (0.0032) | 0.0094*** (0.0033) | 0.0101*** (0.0024) | 0.0100*** (0.0024) | 0.0099*** (0.0025) |
| Observations | 403,438 | 403,438 | 385,707 | 398,450 | 398,450 | 380,740 |
| Turning point | 3.968 | 4.032 | 4.282 | 3.619 | 3.655 | 3.763 |
| Panel B: | Using Bins (equal intervals) | | | | | |
| Nbr refugees 0 – 20 kilometers (IHS) | -0.0195** (0.0097) | -0.0218** (0.0103) | -0.0280** (0.0142) | -0.0155** (0.0078) | -0.0175** (0.0082) | -0.0198** (0.0086) |
| Nbr refugees 20 – 40 kilometers (IHS) | 0.0006 (0.0089) | 0.0009 (0.0089) | -0.0013 (0.0095) | -0.0151** (0.0069) | -0.0147** (0.0070) | -0.0188*** (0.0071) |
| Nbr refugees 40 – 60 kilometers (IHS) | -0.0091 (0.0084) | -0.0086 (0.0084) | -0.0133 (0.0088) | -0.0120 (0.0088) | -0.0117 (0.0086) | -0.0138 (0.0087) |
| Nbr refugees 60 – 80 kilometers (IHS) | -0.0180 (0.0116) | -0.0189 (0.0115) | -0.0148 (0.0109) | -0.0118 (0.0096) | -0.0120 (0.0096) | -0.0096 (0.0097) |
| Nbr refugees 80 – 100 kilometers (IHS) | -0.0275** (0.0111) | -0.0283** (0.0111) | -0.0289** (0.0114) | -0.0145 (0.0099) | -0.0153 (0.0098) | -0.0134 (0.0103) |
| Nbr refugees 100 – 120 kilometers (IHS) | 0.0023 (0.0103) | -0.0006 (0.0101) | 0.0002 (0.0099) | -0.0034 (0.0094) | -0.0058 (0.0097) | -0.0053 (0.0097) |
| Nbr refugees 120 – 150 kilometers (IHS) | -0.0219* (0.0125) | -0.0209 (0.0127) | -0.0285** (0.0136) | -0.0070 (0.0094) | -0.0063 (0.0097) | -0.0097 (0.0105) |
| Observations | 403,438 | 403,438 | 385,707 | 398,450 | 398,450 | 380,740 |

Robustness tests (cont.) Back

Table 19: Alternative buffers

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------|------------------------|-----------------------|------------------------|------------------------|-----------------------|-----------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| Panel A: | Buffer of 200km | | | | | |
| Refugees (IHS, 200km) | -0.0149** (0.0067) | -0.0161** (0.0066) | -0.0175** (0.0070) | -0.0070 (0.0057) | -0.0078 (0.0057) | -0.0079 (0.0059) |
| Observations | 403,438 | 403,438 | 385,707 | 398,450 | 398,450 | 380,740 |
| Panel B: | Buffer of 100km | | | | | |
| Refugees (IHS, 100km) | -0.0153** (0.0067) | -0.0167** (0.0068) | -0.0211*** (0.0074) | -0.0126** (0.0062) | -0.0135** (0.0062) | -0.0152** (0.0064) |
| Observations | 403,438 | 403,438 | 385,707 | 398,450 | 398,450 | 380,740 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Robustness tests (cont.) [Back](#)

Table 20: Alternative buffers (150 to 10 km)

| | (1) | (2) | (3) | (4) |
|-----------------------|------------------------|----------|------------------------|----------|
| Dependent variable: | Coef. | (SE) | Coef. | (SE) |
| <u>Panel A:</u> | Height-for-age z-score | | Weight-for-age z-score | |
| Refugees (IHS, 150km) | -0.0262*** | (0.0083) | -0.0172*** | (0.0065) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel B:</u> | Buffer of 140 km | | | |
| Refugees (IHS, 140km) | -0.0179** | (0.0073) | -0.0119** | (0.0059) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel C:</u> | Buffer of 130 km | | | |
| Refugees (IHS, 130km) | -0.0163** | (0.0073) | -0.0122** | (0.0061) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel D:</u> | Buffer of 120 km | | | |
| Refugees (IHS, 120km) | -0.0170** | (0.0072) | -0.0120* | (0.0063) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel E:</u> | Buffer of 110 km | | | |
| Refugees (IHS, 110km) | -0.0167** | (0.0073) | -0.0125** | (0.0064) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel F:</u> | Buffer of 100 km | | | |
| Refugees (IHS, 100km) | -0.0211*** | (0.0074) | -0.0152** | (0.0064) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel G:</u> | Buffer of 90 km | | | |
| Refugees (IHS, 90km) | -0.0186** | (0.0076) | -0.0161** | (0.0066) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel H:</u> | Buffer of 80 km | | | |

Robustness tests (cont.) Back

Cont' Alternative buffers (150 to 10 km)

| | (1) | (2) | (3) | (4) |
|----------------------|------------------------|----------|------------------------|----------|
| | Coef. | (SE) | Coef. | (SE) |
| Dependent variable: | Height-for-age z-score | | Weight-for-age z-score | |
| <u>Panel I:</u> | Buffer of 70 km | | | |
| Refugees (IHS, 70km) | -0.0151* | (0.0079) | -0.0175*** | (0.0064) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel J:</u> | Buffer of 60 km | | | |
| Refugees (IHS, 0km) | -0.0164** | (0.0077) | -0.0212*** | (0.0059) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel K:</u> | Buffer of 50 km | | | |
| Refugees (IHS, 50km) | -0.0133 | (0.0084) | -0.0201*** | (0.0054) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel L:</u> | Buffer of 40 km | | | |
| Refugees (IHS, 40km) | -0.0167* | (0.0093) | -0.0231*** | (0.0057) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel M:</u> | Buffer of 30 km | | | |
| Refugees (IHS, 30km) | -0.0188* | (0.0105) | -0.0167** | (0.0070) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel N:</u> | Buffer of 20 km | | | |
| Refugees (IHS, 20km) | -0.0285** | (0.0140) | -0.0197** | (0.0084) |
| Observations | 385,707 | | 380,740 | |
| <u>Panel O:</u> | Buffer of 10 km | | | |
| Refugees (IHS, 10km) | -0.0083 | (0.0120) | -0.0068 | (0.0098) |
| Observations | 385,707 | | 380,740 | |

Robustness tests (cont.) Back

Table 21: Is the year of birth the right 'window', regression with ind., household, conflict and climatic controls

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------|---------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| <u>Panel A:</u> | Adding up to the first forward | | | | | |
| Refugees (IHS, 150km) | -0.0193*** (0.0074) | -0.0206*** (0.0075) | -0.0255*** (0.0081) | -0.0152** (0.0063) | -0.0161** (0.0063) | -0.0179*** (0.0066) |
| Refugees (IHS) (t+1) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) |
| Observations | 395,377 | 395,377 | 378,338 | 390,393 | 390,393 | 373,373 |
| <u>Panel B:</u> | Adding up to the second forward | | | | | |
| Refugees (IHS, 150km) | -0.0262*** (0.0080) | -0.0270*** (0.0080) | -0.0293*** (0.0086) | -0.0174*** (0.0065) | -0.0181*** (0.0064) | -0.0191*** (0.0068) |
| Refugees (IHS) (t+1) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000* (0.0000) | 0.0000* (0.0000) |
| Refugees (IHS) (t+2) | -0.0000** (0.0000) | -0.0000** (0.0000) | -0.0000** (0.0000) | -0.0000* (0.0000) | -0.0000* (0.0000) | -0.0000* (0.0000) |
| Observations | 383,074 | 383,074 | 367,178 | 378,094 | 378,094 | 362,216 |
| <u>Panel C:</u> | Adding up to the first lag | | | | | |
| Refugees (IHS, 150km) | -0.0190** (0.0080) | -0.0202** (0.0081) | -0.0258*** (0.0087) | -0.0149** (0.0065) | -0.0158** (0.0065) | -0.0182*** (0.0069) |
| Refugees (IHS) (t-1) | 0.0000* (0.0000) | 0.0000* (0.0000) | 0.0000** (0.0000) | 0.0000* (0.0000) | 0.0000** (0.0000) | 0.0000 (0.0000) |
| Observations | 398,801 | 398,801 | 381,166 | 393,814 | 393,814 | 376,200 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |

Robustness tests (cont.) [Back](#)**Table 22:** Is the year of birth the right 'window', regression with ind., household, conflict and climatic controls

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-------------------------------|--|------------------------|------------------------|------------------------|------------------------|------------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| <u>Panel D:</u> | Early life exposure | | | | | |
| Exposure (IHS) | -0.0418*** (0.0082) | -0.0384*** (0.0081) | -0.0404*** (0.0086) | -0.0556*** (0.0072) | -0.0523*** (0.0071) | -0.0508*** (0.0075) |
| Observations | 382,157 | 371,207 | 356,640 | 382,728 | 371,710 | 356,944 |
| <u>Panel E:</u> | Early life exposure and the first year of life | | | | | |
| Refugees (IHS, 150km) | -0.0472*** (0.0084) | -0.0478*** (0.0085) | -0.0516*** (0.0092) | -0.0431*** (0.0069) | -0.0435*** (0.0069) | -0.0428*** (0.0074) |
| Exposure (net of yr of birth) | -0.0301*** (0.0032) | -0.0293*** (0.0032) | -0.0298*** (0.0033) | -0.0309*** (0.0028) | -0.0300*** (0.0027) | -0.0292*** (0.0028) |
| Observations | 382,157 | 371,207 | 356,640 | 382,728 | 371,710 | 356,944 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Robustness tests (cont.) [Back](#)

Table 23: Controlling for country-year of birth fixed effects

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------|-------------------------------------|-----------------------|-----------------------|------------------------|---------------------|---------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| Panel A: | country-year of birth fixed effects | | | | | |
| Refugees (IHS, 150km) | -0.0165* (0.0087) | -0.0176** (0.0087) | -0.0192** (0.0093) | -0.0075 (0.0069) | -0.0083 (0.0069) | -0.0068 (0.0073) |
| Elasticity | -0.0140 | -0.0148 | -0.0162 | -0.00734 | -0.00806 | -0.00661 |
| Observations | 414,365 | 403,418 | 385,686 | 415,191 | 404,176 | 386,225 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Robustness tests (cont.) Back

Table 24: Alternative aggregations

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---------------------------|---|------------------------|------------------------|------------------------|-----------------------|------------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| <u>Panel A:</u> | Including precision 2 | | | | | |
| Refugees (IHS, 150km) | -0.0194** (0.0077) | -0.0207*** (0.0077) | -0.0262*** (0.0083) | -0.0149** (0.0063) | -0.0161** (0.0063) | -0.0183*** (0.0066) |
| <u>Panel B:</u> | Regional exposure to refugees | | | | | |
| Refugees (IHS, agg., GPS) | -0.0198*** (0.0045) | -0.0201*** (0.0044) | -0.0198*** (0.0048) | -0.0148** (0.0039) | -0.0148** (0.0039) | -0.0151** (0.0041) |
| <u>Panel C:</u> | Regional exposure to refugees (including without geo. coord.) | | | | | |
| Refugees (IHS, agg.) | -0.0097** (0.0048) | -0.0103** (0.0047) | -0.0104** (0.0051) | -0.0029 (0.0044) | -0.0032 (0.0044) | -0.0036 (0.0046) |
| Observations | 412,934 | 402,014 | 384,356 | 413,775 | 402,787 | 384,910 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Table 25: Refugees and malaria, controlling for 'fake' malaria [Back](#)

| | (1) | (2) | (3) | (4) | (5) |
|-------------------------|------------------------|------------------------|------------------------|-----------------------|------------------------|
| Control for: | | Unempl | Δ GDP | Literacy | Poverty |
| <u>Panel A:</u> | | Height-for-Age z-score | | | |
| Refugees (IHS, malaria) | -0.0284*** (0.0105) | -0.0185* (0.0104) | -0.0294*** (0.0107) | -0.0178 (0.0110) | -0.0189* (0.0112) |
| Observations | 414,388 | 414,388 | 414,388 | 414,388 | 414,388 |
| | (6) | (7) | (8) | (9) | (10) |
| | Gini | GDP | Law | Life | landlocked |
| Refugees (IHS, malaria) | -0.0194* (0.0107) | -0.0228 (0.0140) | -0.0315*** (0.0109) | -0.0249** (0.0109) | -0.0564*** (0.0101) |
| | 414,388 | 414,388 | 414,388 | 414,388 | 414,388 |

Table 26: Refugees and malaria, controlling for 'fake' malaria [Back](#)

| | (1) | (2) | (3) | (4) | (5) |
|-------------------------|------------------------|------------------------|------------------------|----------------------|------------------------|
| Control for: | | Unempl | Δ GDP | Literacy | Poverty |
| <u>Panel A:</u> | | Weight-for-Age z-score | | | |
| Refugees (IHS, malaria) | -0.0206*** (0.0073) | -0.0082 (0.0079) | -0.0220*** (0.0078) | -0.0074 (0.0081) | -0.0005 (0.0084) |
| Observations | 415,214 | 415,214 | 415,214 | 415,214 | 415,214 |
| | (6) | (7) | (8) | (9) | (10) |
| | Gini | GDP | Law | Life | landlocked |
| | -0.0046 (0.0079) | -0.0222** (0.0091) | -0.0211*** (0.0076) | -0.0147* (0.0078) | -0.0486*** (0.0080) |
| | 415,214 | 415,214 | 415,214 | 415,214 | 415,214 |

Table 27: Refugees and symptoms of infectious diseases (LPM) [Back](#)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|----------------------|---------------------|---------------------|---------------------|-----------------------|-----------------------|---------------------|
| Sample: | Unrestricted | | | Restricted | | |
| Panel A: | | | | | | |
| Dependent variable: | Diarrhea | | | | | |
| Refugees (IHS) | 0.0001 (0.0012) | 0.0001 (0.0012) | 0.0001 (0.0013) | -0.0005 (0.0017) | -0.0003 (0.0017) | 0.0003 (0.0018) |
| Observations | 661,891 | 648,647 | 620,912 | 414,388 | 403,438 | 385,707 |
| Panel B: | | | | | | |
| Dependent variable: | Cough | | | | | |
| Refugees (IHS) | -0.0019 (0.0016) | -0.0019 (0.0016) | -0.0014 (0.0017) | -0.0042** (0.0019) | -0.0040** (0.0019) | -0.0028 (0.0020) |
| Observations | 661,891 | 648,647 | 620,912 | 414,388 | 403,438 | 385,707 |
| Panel C: | | | | | | |
| Dependent variable: | Fever | | | | | |
| Refugees (IHS) | -0.0013 (0.0013) | -0.0012 (0.0013) | -0.0011 (0.0013) | -0.0009 (0.0017) | -0.0007 (0.0018) | 0.0000 (0.0018) |
| Observations | 661,891 | 648,647 | 620,912 | 414,388 | 403,438 | 385,707 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Table 28: Refugees and symptoms of infectious diseases (LPM) [Back](#)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------|-----------------------|-----------------------|----------------------|-----------------------|----------------------|----------------------|
| Sample: | Unrestricted | | | Restricted | | |
| Panel A: | | | | | | |
| Dependent variable: | Diarrhea | | | | | |
| Refugees (IHS, malaria) | 0.0037*** (0.0014) | 0.0037*** (0.0014) | 0.0035** (0.0015) | 0.0046** (0.0019) | 0.0046** (0.0019) | 0.0051** (0.0020) |
| Refugees (IHS, Non malaria) | -0.0021 (0.0014) | -0.0021 (0.0014) | -0.0020 (0.0014) | -0.0034* (0.0019) | -0.0032* (0.0019) | -0.0030 (0.0019) |
| Observations | 661,891 | 648,647 | 620,912 | 414,388 | 403,438 | 385,707 |
| Panel B: | | | | | | |
| Dependent variable: | Cough | | | | | |
| Refugees (IHS, malaria) | 0.0000 (0.0016) | 0.0001 (0.0016) | 0.0013 (0.0017) | -0.0024 (0.0022) | -0.0024 (0.0022) | 0.0000 (0.0023) |
| Refugees (IHS, Non malaria) | -0.0017 (0.0019) | -0.0017 (0.0019) | -0.0020 (0.0020) | -0.0024 (0.0022) | -0.0022 (0.0022) | -0.0024 (0.0023) |
| Observations | 661,891 | 648,647 | 620,912 | 414,388 | 403,438 | 385,707 |
| Panel C: | | | | | | |
| Dependent variable: | Fever | | | | | |
| Refugees (IHS, malaria) | 0.0024 (0.0019) | 0.0024 (0.0019) | 0.0029 (0.0020) | 0.0041* (0.0023) | 0.0041* (0.0023) | 0.0053** (0.0024) |
| Refugees (IHS, Non malaria) | -0.0028* (0.0016) | -0.0028* (0.0016) | -0.0031* (0.0017) | -0.0038** (0.0019) | -0.0035* (0.0019) | -0.0034* (0.0019) |
| Observations | 661,891 | 648,647 | 620,912 | 414,388 | 403,438 | 385,707 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Table 29: Lack of accessibility to health services, wealth and working mothers [Back](#)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|--|--|---------------------|---------------------|----------------------|---------------------|-----------------------|
| Sample: | Unrestricted | | | Restricted | | |
| Panel A: | Problem to find money for the treatment | | | | | |
| Dependent variable: Refugees (IHS) | -0.0016 (0.0014) | -0.0014 (0.0014) | -0.0020 (0.0015) | -0.0038* (0.0022) | -0.0033 (0.0022) | -0.0038* (0.0022) |
| Observations | 579,344 | 571,772 | 549,303 | 351,479 | 345,359 | 332,146 |
| Panel B: | Problem due to the distance to the health center | | | | | |
| Dependent variable: Refugees (IHS) | -0.0002 (0.0013) | -0.0001 (0.0013) | -0.0008 (0.0013) | -0.0032 (0.0020) | -0.0031 (0.0020) | -0.0040** (0.0019) |
| Observations | 579,349 | 571,775 | 549,305 | 351,479 | 345,360 | 332,147 |
| Panel C: | Problem of having to take transport | | | | | |
| Dependent variable: Refugees (IHS) | 0.0005 (0.0016) | 0.0009 (0.0017) | 0.0007 (0.0017) | 0.0004 (0.0026) | 0.0007 (0.0027) | 0.0006 (0.0028) |
| Observations | 249,170 | 241,589 | 236,943 | 168,911 | 162,785 | 159,740 |
| Panel D: | Wealth index factor | | | | | |
| Dependent variable: Refugees (IHS, 150km) | 0.0008 (0.0025) | -0.0000 (0.0000) | -0.0000 (0.0000) | 0.0033 (0.0038) | 0.0000 (0.0000) | 0.0000 (0.0000) |
| Observations | 648,647 | 648,647 | 620,912 | 403,438 | 403,438 | 385,707 |
| Panel E: | Mother is working | | | | | |
| Dependent variable: Refugees (IHS, 150km) | 0.0014 (0.0011) | 0.0014 (0.0011) | 0.0015 (0.0012) | 0.0018 (0.0015) | 0.0012 (0.0015) | 0.0018 (0.0016) |
| Observations | 661,891 | 648,647 | 620,912 | 414,388 | 403,438 | 385,707 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | Y | Y |

Table 30: Lack of accessibility to health services, wealth and working mothers [Back](#)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------|--|---------------------|---------------------|-----------------------|----------------------|-----------------------|
| Sample: | Unrestricted | | | Restricted | | |
| Panel A: | Problem to find money for the treatment | | | | | |
| Dependent variable: | | | | | | |
| Refugees (IHS, malaria) | -0.0003 (0.0018) | -0.0003 (0.0018) | -0.0012 (0.0018) | -0.0016 (0.0029) | -0.0012 (0.0029) | -0.0019 (0.0030) |
| Refugees (IHS, Non malaria) | -0.0024 (0.0014) | -0.0020 (0.0015) | -0.0022 (0.0015) | -0.0038** (0.0019) | -0.0036* (0.0019) | -0.0033* (0.0020) |
| Observations | 579,344 | 571,772 | 549,303 | 351,479 | 345,359 | 332,146 |
| Panel B: | Problem due to the distance to the health center | | | | | |
| Dependent variable: | | | | | | |
| Refugees (IHS, malaria) | 0.0011 (0.0018) | 0.0010 (0.0018) | 0.0008 (0.0018) | -0.0017 (0.0026) | -0.0017 (0.0026) | -0.0019 (0.0026) |
| Refugees (IHS, Non malaria) | -0.0016 (0.0013) | -0.0015 (0.0013) | -0.0020 (0.0014) | -0.0028 (0.0017) | -0.0027 (0.0017) | -0.0034** (0.0017) |
| Observations | 579,349 | 571,775 | 549,305 | 351,479 | 345,360 | 332,147 |
| Panel C: | Problem of having to take transport | | | | | |
| Dependent variable: | | | | | | |
| Refugees (IHS, malaria) | 0.0017 (0.0023) | 0.0018 (0.0024) | 0.0019 (0.0024) | 0.0046 (0.0033) | 0.0048 (0.0033) | 0.0055 (0.0034) |
| Refugees (IHS, Non malaria) | -0.0009 (0.0019) | -0.0007 (0.0019) | -0.0008 (0.0020) | -0.0024 (0.0030) | -0.0022 (0.0032) | -0.0028 (0.0033) |
| Observations | 249,170 | 241,589 | 236,943 | 168,911 | 162,785 | 159,740 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Table 31: Lack of accessibility to health services, wealth and working mothers [Back](#)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------|------------------------|-------------------------|--------------------------|-------------------------|-------------------------|-------------------------|
| Sample: | Unrestricted | | | Restricted | | |
| Panel D: | | | | | | |
| Dependent variable: | Wealth index factor | | | | | |
| Refugees (IHS, malaria) | 240.7946 (215.4119) | 360.1016* (206.2136) | 511.6840** (218.2637) | 235.2835 (332.5333) | -16.4015 (330.5085) | 213.0883 (352.8258) |
| Refugees (IHS, Non malaria) | -51.5975 (347.0325) | -253.4043 (304.3172) | -200.4073 (309.3999) | -178.1869 (547.2354) | -339.8030 (485.7914) | -222.8124 (509.4236) |
| Observations | 648,647 | 648,647 | 620,912 | 403,438 | 403,438 | 385,707 |
| Panel E: | | | | | | |
| Dependent variable: | Mother is working | | | | | |
| Refugees (IHS, malaria) | 0.0006 (0.0016) | 0.0004 (0.0015) | 0.0008 (0.0016) | 0.0026 (0.0023) | 0.0020 (0.0023) | 0.0029 (0.0023) |
| Refugees (IHS, Non malaria) | 0.0008 (0.0011) | 0.0008 (0.0011) | 0.0007 (0.0011) | -0.0001 (0.0014) | -0.0004 (0.0014) | -0.0003 (0.0014) |
| Observations | 661,891 | 648,647 | 620,912 | 414,388 | 403,438 | 385,707 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | N | Y |

Table 32: Refugees and vaccination

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---------------------------------------|--|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|
| Sample: | Unrestricted | | | Restricted | | |
| Panel A: | Has not received any of the 8 basic vaccinations | | | | | |
| Dependent variable: Refugees (IHS) | 0.0004 (0.0013) | 0.0006 (0.0013) | 0.0008 (0.0013) | 0.0013 (0.0016) | 0.0015 (0.0017) | 0.0019 (0.0018) |
| Observations | 544,605 | 532,520 | 510,811 | 373,113 | 362,467 | 347,351 |
| Panel B: | Has received all 8 basic vaccinations | | | | | |
| Dependent variable: Refugees (IHS) | 0.0053*** (0.0020) | 0.0054*** (0.0021) | 0.0066*** (0.0021) | 0.0025 (0.0025) | 0.0027 (0.0025) | 0.0039 (0.0025) |
| Observations | 544,605 | 532,520 | 510,811 | 373,113 | 362,467 | 347,351 |
| Panel C: | Number of the 8 basic vaccinations | | | | | |
| Dependent variable: Refugees (IHS) | 0.0444*** (0.0106) | 0.0437*** (0.0107) | 0.0454*** (0.0111) | 0.0360*** (0.0135) | 0.0357*** (0.0136) | 0.0366** (0.0142) |
| Observations | 544,605 | 532,520 | 510,811 | 373,113 | 362,467 | 347,351 |
| Panel D: | mothers received at least two tetanus injections | | | | | |
| Dependent variable: Refugees (IHS) | 0.0011 (0.0016) | 0.0012 (0.0015) | 0.0017 (0.0016) | 0.0000 (0.0020) | 0.0005 (0.0020) | 0.0010 (0.0021) |
| Observations | 661,891 | 648,647 | 620,912 | 414,388 | 403,438 | 385,707 |
| Panel E: | No post-natal visit | | | | | |
| Dependent variable: Refugees (IHS) | 0.0026 (0.0020) | 0.0026 (0.0020) | 0.0031 (0.0020) | 0.0023 (0.0027) | 0.0024 (0.0027) | 0.0030 (0.0027) |
| Observations | 294,324 | 294,324 | 277,596 | 187,540 | 187,540 | 176,307 |
| Ind. and HH controls | N | Y | Y | N | Y | Y |
| Conflict controls | N | N | Y | N | Y | Y |

Table 33: Malaria Refugees and vaccination

| | (1) | (2) | (3) | (4) | (5) | (6) |
|--------------------------------|--|-----------------------|------------------------|------------|-----------------------|-----------------------|
| Sample: | Unrestricted | | | Restricted | | |
| Panel A: | Dependent variable: Has not received any of the 8 basic vaccinations | | | | | |
| Refugees (IHS, Non malaria, t) | 0.0028** (0.0014) | 0.0029** (0.0014) | 0.0033** (0.0015) | | 0.0032* (0.0019) | 0.0037* (0.0019) |
| Refugees (IHS, malaria) | -0.0039*** (0.0015) | -0.0036** (0.0015) | -0.0041*** (0.0016) | | -0.0022 (0.0018) | -0.0026 (0.0019) |
| Observations | 544,605 | 532,520 | 510,811 | 373,113 | 362,467 | 347,351 |
| Panel B: | Dependent variable: Has received all 8 basic vaccinations | | | | | |
| Refugees (IHS, Non malaria, t) | 0.0016 (0.0023) | 0.0016 (0.0023) | 0.0023 (0.0023) | | -0.0005 (0.0026) | 0.0011 (0.0026) |
| Refugees (IHS, malaria) | 0.0100*** (0.0028) | 0.0103*** (0.0028) | 0.0116*** (0.0029) | | 0.0071** (0.0036) | 0.0076** (0.0038) |
| Observations | 544,605 | 532,520 | 510,811 | 373,113 | 362,467 | 347,351 |
| Panel C: | Dependent variable: Number of the 8 basic vaccinations | | | | | |
| Refugees (IHS, Non malaria, t) | 0.0055 (0.0110) | 0.0049 (0.0112) | -0.0006 (0.0115) | | 0.0012 (0.0133) | -0.0037 (0.0137) |
| Refugees (IHS, malaria) | 0.0848*** (0.0145) | 0.0834*** (0.0145) | 0.0959*** (0.0153) | | 0.0703*** (0.0193) | 0.0828*** (0.0205) |
| Observations | 544,605 | 532,520 | 510,811 | 373,113 | 362,467 | 347,351 |
| Panel D: | Dependent variable: mothers received at least two tetanus injections | | | | | |
| Refugees (IHS, Non malaria, t) | 0.0011 (0.0018) | 0.0011 (0.0018) | 0.0012 (0.0018) | | 0.0003 (0.0021) | 0.0003 (0.0021) |
| Refugees (IHS, malaria) | 0.0006 (0.0021) | 0.0010 (0.0021) | 0.0018 (0.0022) | | 0.0007 (0.0029) | 0.0020 (0.0029) |
| Observations | 661,801 | 648,647 | 620,012 | 414,388 | 403,438 | 385,707 |

Table 34: Refugees and health, interaction terms with poverty indicators

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------|--|------------------------|------------------------|------------------------|------------------------|------------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| <u>Panel A:</u> | Interactions with being poor (below median) | | | | | |
| Refugees (IHS) | -0.0179** (0.0078) | -0.0201** (0.0078) | -0.0258*** (0.0083) | -0.0136** (0.0067) | -0.0155** (0.0067) | -0.0176** (0.0070) |
| Poor | -0.1732*** (0.0144) | -0.0258 (0.0189) | -0.0234 (0.0189) | -0.1430*** (0.0120) | -0.0259* (0.0153) | -0.0199 (0.0155) |
| Refugees (IHS) × Poor | -0.0028 (0.0051) | -0.0012 (0.0050) | -0.0007 (0.0052) | -0.0024 (0.0048) | -0.0012 (0.0048) | -0.0014 (0.0048) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| <u>Panel B:</u> | Interactions with mother low height, drop below 100) | | | | | |
| Refugees (IHS, 150km) | -0.0105 (0.0080) | -0.0126 (0.0080) | -0.0170** (0.0085) | -0.0124* (0.0066) | -0.0146** (0.0066) | -0.0166** (0.0069) |
| Low height | -0.3556*** (0.0102) | -0.3538*** (0.0103) | -0.3520*** (0.0104) | -0.2500*** (0.0083) | -0.2510*** (0.0083) | -0.2503*** (0.0085) |
| Refugees (IHS) × Low height | -0.0191*** (0.0043) | -0.0172*** (0.0043) | -0.0186*** (0.0045) | -0.0063 (0.0038) | -0.0042 (0.0039) | -0.0044 (0.0040) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| <u>Panel C:</u> | Interactions with mother low height, drop below 120 | | | | | |
| Refugees (IHS) | -0.0104 (0.0080) | -0.0126 (0.0080) | -0.0169** (0.0085) | -0.0124* (0.0066) | -0.0146** (0.0066) | -0.0166** (0.0069) |
| Low height | -0.3554*** (0.0102) | -0.3536*** (0.0103) | -0.3516*** (0.0104) | -0.2505*** (0.0082) | -0.2516*** (0.0083) | -0.2510*** (0.0085) |
| Refugees (IHS) × Low height | -0.0193*** (0.0043) | -0.0174*** (0.0043) | -0.0189*** (0.0045) | -0.0063* (0.0038) | -0.0042 (0.0039) | -0.0044 (0.0040) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 386,246 |
| <u>Panel D:</u> | Interactions with No or primary education) | | | | | |
| Refugees (IHS, 150km) | -0.0184** (0.0076) | -0.0184** (0.0077) | -0.0240*** (0.0082) | -0.0147** (0.0063) | -0.0145** (0.0063) | -0.0167** (0.0066) |

Table 35: Refugees and health, interaction terms with poverty indicators

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|--|------------------------|------------------------|------------------------|------------------------|------------------------|
| Dependent variable: | Height-for-age z-score | | | Weight-for-age z-score | | |
| <u>Panel A:</u> | Interactions with being poor (below median) | | | | | |
| Refugees (IHS, Non malaria, t) | -0.0063 (0.0085) | -0.0095 (0.0084) | -0.0118 (0.0088) | -0.0063 (0.0078) | -0.0088 (0.0079) | -0.0133* (0.0078) |
| Refugees (IHS, malaria) | -0.0224** (0.0105) | -0.0217** (0.0106) | -0.0275** (0.0114) | -0.0134* (0.0077) | -0.0133* (0.0078) | -0.0133* (0.0078) |
| Poor | -0.1720*** (0.0144) | -0.0246 (0.0189) | -0.0225 (0.0189) | -0.1416*** (0.0120) | -0.0245 (0.0152) | -0.0245 (0.0152) |
| Refugees (IHS, malaria) × Poor | -0.0119** (0.0059) | -0.0112* (0.0058) | -0.0093 (0.0058) | -0.0143*** (0.0054) | -0.0140** (0.0055) | -0.0140** (0.0055) |
| Refugees (IHS, nonmalaria) × Poor | 0.0065 (0.0083) | 0.0085 (0.0080) | 0.0078 (0.0085) | 0.0096 (0.0072) | 0.0113 (0.0072) | 0.0113 (0.0072) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 385,707 |
| <u>Panel B:</u> | Interactions with mother low height, drop below 100) | | | | | |
| Refugees (IHS, Non malaria, t) | 0.0058 (0.0077) | 0.0030 (0.0077) | 0.0021 (0.0079) | 0.0024 (0.0070) | 0.0000 (0.0070) | -0.0024 (0.0070) |
| Refugees (IHS, malaria) | -0.0188* (0.0109) | -0.0186* (0.0109) | -0.0235** (0.0118) | -0.0159** (0.0080) | -0.0166** (0.0080) | -0.0166** (0.0080) |
| Low height | -0.3547*** (0.0102) | -0.3527*** (0.0103) | -0.3509*** (0.0104) | -0.2483*** (0.0082) | -0.2492*** (0.0083) | -0.2492*** (0.0083) |
| Refugees (IHS, malaria) × Low height | -0.0194*** (0.0051) | -0.0179*** (0.0051) | -0.0168*** (0.0054) | -0.0098** (0.0046) | -0.0081* (0.0046) | -0.0081* (0.0046) |
| Refugees (IHS, nonmalaria) × Low height | -0.0150** (0.0066) | -0.0140** (0.0068) | -0.0175** (0.0069) | -0.0058 (0.0058) | -0.0045 (0.0060) | -0.0045 (0.0060) |
| Observations | 414,388 | 403,438 | 385,707 | 415,214 | 404,196 | 385,707 |