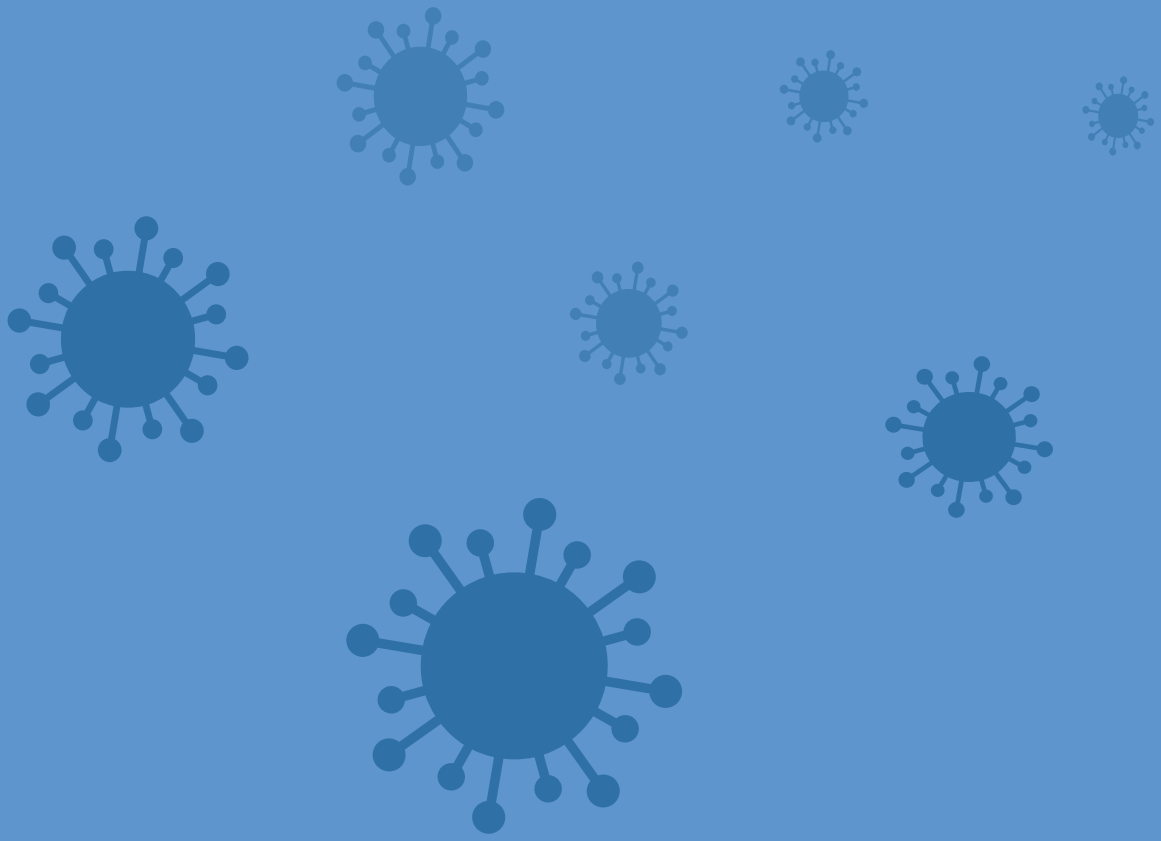
Food and Agriculture Organization
of the United Nations

Simulating rising undernourishment during the COVID-19 pandemic economic downturn

TECHNICAL NOTE



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Summary

This technical note describes the methodology used to obtain estimates of rising undernourishment, under three hypothetical scenarios of gross domestic product (GDP) growth reduction, which are within a range that is aligned with current forecast with regard to GDP growth before and after the COVID-19 pandemic.

First step. Using a sample of 118 low- and middle-income countries observed in the period 1995–2017, the analysis uses a generalized method of moments (GMM) estimator of the elasticity of the food supply with respect to GDP growth, i.e. the percentage change in food supply (expressed in kilocalories per person per day) after a 1 percentage point (p.p.) change in annual GDP growth.

Second step. Using the elasticities from the GMM model estimated over the 1995–2017 period, the per capita food supply is predicted under three hypothetical scenarios regarding GDP growth in 2020: optimistic, mild and pessimistic scenarios prospecting a reduction in GDP growth of, respectively, 2, 5 and 10 percentage points (p.p.), values which are aligned with current (but still highly uncertain) forecasts of GDP growth before and after the COVID-19 pandemic.

Third step. Using a calculator developed by the Food and Agriculture Organization of the United Nations (FAO) Statistic Division that implements the model used to estimate the Prevalence of Undernourishment (PoU) in a population,[1] we estimate how the simulated reduction in food supply translates into an increase of the PoU. The simulated change is applied to the latest PoU and population data in 2016–2018 to compute the number of additional undernourished people under the three hypothetical GDP growth reduction scenarios. This procedure does not take into account possible changes in the inequality of the available food supply that might also affect the PoU, for example as a result of policy responses associated with COVID-19: that is to say, the procedure assumes that the coefficient of variation (CV) remains constant.

Results. With reference only to the 101 net food-importing countries in the low- and middle-income group, for which the elasticity estimated in the first step is statistically significant, this simulation exercise shows that, without protective measures in terms of redistribution of the available food supply, even under the optimistic scenario (-2 p.p. in GDP growth), the prevalence of undernourishment (PoU) might increase by 0.28 p.p., from an average 10.91 percent to 11.19 percent in these countries. This would bring an additional 14.4 million people in the ranks of the undernourished. Within net food-importing countries, low-income food deficit countries will be those suffering more from this recession due to their vulnerable position characterized by low incomes and dependence on food imports for their subsistence.

[1] The PoU is computed as the probability for the average individual in a population that habitual daily dietary energy consumption is below the requirements for a normally active and healthy life. It assumes a lognormal distribution and depends on estimated values of the average and of the coefficient of variation of habitual, daily dietary energy consumption. The simulations presented here assume that the projected changes in food supply due to the COVID-19 crisis will be reflected in changes in the average dietary energy consumption, given countries' population.

Data and variables

Our estimations start with the use of a generalized method of moments (GMM) procedure (Arellano and Bond, 1991)[2] to estimate the elasticity of food supply with respect to GDP growth reductions. The dependent variable used in the GMM model specification is the per capita food supply per person per day (expressed in kilocalories) as reported in the Food Balance Sheets (FBS) compiled by FAO for most countries in the world (www.fao.org/faostat/en/#data/FBS). The analysis focuses on the years from 1995 through 2017, for which data for the food supply is the most updated available at the time of estimating. The annual GDP growth (%) is treated as the independent variable in the model and is taken from the UN National Accounts – Analysis of Main Aggregates for real GDP per capita growth (https://unstats.un.org/unsd/snaama).

To capture heterogeneity in the relationship between the food supply and GDP growth, the GMM model is estimated separately for five groups of countries, taken from the original sample of 118 countries for which food supply and GDP growth data are available. The groups are: a) all low- and middle-income countries; b) net food-importing countries; c) net food-importing countries that are low-income food deficit countries (LIFDCs); d) net food-importing countries that are not LIFDCs; and e) net food-exporting countries. Net food-importing and net food-exporting countries are defined based on their net food trade balance during the period 2000–2017. Data on their trade balance are derived from FAOSTAT (www.fao.org/faostat/en/#data/TP) which reports annual country-level information on production, import and export quantities expressed in million tons for a set of around 250 food commodity items. We use these data to group countries according to their net food trade position. Countries are classified as net food importers when their average value of food imports during 2000–2017 is higher than the average value of food exports. Similarly, countries whose average food exports in million tonnes are higher than food imports are defined as net food exporters.

Low-income food deficit countries (LIFDCs) are classified by FAO following three criteria:

1. A country should have a per capita gross national income (GNI) below the "historical" ceiling used by the World Bank to determine eligibility for International Development Association assistance (IDA) and for 20-year terms established by the International Bank for Reconstruction and Development (IBRD), applied to countries included in World Bank's categories I and II. The 2018 LIFDCs list is based on the gross national income (GNI) for 2016 (estimated by the World Bank using the Atlas method) and the historical ceiling of USD 1 905 for 2016.
2. The net food trade position (i.e. gross imports minus gross exports) of a country is averaged over the preceding three years for which statistics are available (2014, 2015 and 2016 in this case). Trade volumes for a broad basket of basic foodstuffs (cereals, roots and tubers, pulses, oilseeds and oils other than tree crop oils, meat and dairy products) are converted and aggregated by the calorie content of individual commodities.
3. The self-exclusion criterion is applied when countries that meet the above two criteria specifically request FAO to be excluded from the LIFDCs category (FAOSTAT website: www.fao.org/countryprofiles/lifdc).

[2] Arellano, M. & Bond, S. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58: 277–297.

First estimation step: the generalized method of moments (GMM) model and its results

This analysis takes advantage of the generalized method of moments (GMM) estimator developed by Arellano and Bond (1991),[3] which is applied on various combination of countries taken from the overall sample of 118 low- and middle-income countries, observed over the 1995–2017 period. The estimator fits a linear dynamic panel-data model where the unobserved panel-level effects are correlated with the lags of the dependent variable. The empirical strategy handles the issue of endogeneity by removing the fixed effects through a first differencing transformation, and is expressed as follows:

$$Food\ suppy_{it} - Food\ Supply_{i,t-1} = \alpha \Delta Food\ Supply_{i,t-1} + \beta_1 \Delta GDP\ reduction_{it} + \Delta v_{it} \quad (1)$$

where $$\Delta Food\ Supply_{i,t-1} = Food\ Supply_{i,t-1} - Food\ Supply_{i,t-2} \quad (2)$$

and $$\Delta v_{it} = v_{i,t} - v_{i,t-1} \quad (3)$$

The level of per capita food supply for the *i*-th country at time *t*, $Food\ Supply_{it}$, is regressed against its first lag and against GDP per capita reductions. The term Δv_{it} represents the composite error.

Equations (1)–(3) imply that $Food\ Supply_{i,t-2}$ and earlier values are correlated with $\Delta Food\ Suppy_{i,t-1}$ but not with Δv_{it}. Therefore, values of the $Food\ Supply_{it}$ lagged two periods or more may be good instruments in the food supply equation (1). Since in the following analysis we deal with macroeconomic variables that tend to be sticky and with autoregressive error terms, as a precautionary measure we chose to instrument the lagged dependent variable with its 3rd lag.

GMM estimators embody several appealing assumptions that make the strategy particularly suitable under certain conditions. It is suitable when data contains a small number of years and a large number of cross-sectional units; it implies a linear functional relationship; the current realizations of the dependent variable are influenced by past ones; and, importantly, good instruments do not have to be found outside the dataset. This implies that all necessary instruments are internal, i.e. are based on lagged values of the instrumented variables, although the inclusion of external instruments is also allowed. The GDP reduction is the GDP per capita growth inverted in its sign (multiplied by -1). This has been done to facilitate the interpretation of the results, which are presented as follows.

Table 1 shows descriptive statistics for all sample and by country group. On average, net food importers not classified as low-income food deficit countries report higher per capita food supply and higher GDP growth, while net food-importer low-income food deficit countries show the lowest statistics. Results in **Table 2** show that statistically significant GDP elasticities of food supply are estimated for the sample of all countries (column 1) and for the subsample of net food-importing countries (column 2), that can be further disaggregated by net food importers not

[3] Arellano, M. & Bond, S. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, 58: 277–297.

classified as low-income food deficit countries (column 3), and net food importers that are classified as such (column 4). Results are not significant in a statistical sense for net food-exporting countries (column 5) such that they are excluded from the simulation exercise presented below. A log transformation is applied to the dependent variable and its lag. A reduction of 1 percentage points in GDP per capita growth is associated with an average reduction of 0.105 percent in food supply when the sample includes all the countries. While this correlation is significant and higher in magnitude for net food-importing countries as a whole (-0.15), unpacking the effect for LIFDCs vs. non-LIFDCs shows that the estimated coefficient doubles for the former (-0.306) while it is lower for the latter (-0.06).

TABLE 1 | Descriptive statistics – for all countries and by countries' groups

	MEAN	STD. DEV.	MIN	MAX
All countries (n=118)				
Per capita food supply (Kcal)	2 576	396.9	1 684	3 706
GDP per capita growth (%)*	2.7	5.7	-36.8	91.6

MEANS BY COUNTRY GROUPS					
Dependent variables	**All countries (n=118)**	**Net food importers (all) (n=93)**	**Net food importers (non-LIFDCs) (n=49)**	**Net food importers (LIFDCs) (n=44)**	**Net food exporters (n=25)**
Food supply (Kcal)	2 576	2 548	2 748	2 325	2 679
GDP per capita growth (%)*	2.7	2.7	3.01	2.3	2.9

*Note: * this table presents descriptive statistics for per capita GDP growth as it is more intuitive, but in what follows, all results are discussed in terms of per capita GDP reduction, i.e. GDP per capita growth multiplied by -1.*

Source: Authors' own elaboration.

TABLE 2 | Relationships between gross domestic product reduction and food supply (ln)

DEPENDENT VARIABLE: FOOD SUPPLY (ln)					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	**All countries**	**Net food importers (all)**	**Net food importers (non-LIFDCs)**	**Net food importers (LIFDCs)**	**Net food exporters**
Per capita food supply (ln, t-1)	0.949*** (0.014)	0.950*** (0.017)	0.944*** (0.025)	0.926*** (0.028)	0.968*** (0.029)
GDP per capita reduction (1=100%)	-0.105** (0.048)	-0.152*** (0.043)	-0.061* (0.035)	-0.306*** (0.097)	-0.068 (0.059)
Observations	2 439	1 925	1 018	907	514
Number of countries	118	93	49	44	25
AR1 test p-value	0.000	0.000	0.000	0.000	0.000
AR2 test p-value	0.290	0.174	0.735	0.116	0.869
Hansen-test	0.756	0.703	0.284	0.618	0.627

*Note: Robust standard errors in parenthesis and level of significance as follows: *** p<0.01, ** p<0.05, * p<0.1. The dependent variable and its lag are expressed in logarithm. The estimates derive from an Arellano-Bond model in first differences with instrument of the lagged dependent variable set at the 3rd lag. Results are robust to different model specifications that use the 2nd and the 4th lag to instrument the lagged dependent variable.*

Source: Authors' own elaboration.

Second estimation step: hypothetical impacts on the food supply

The estimated elasticities shown in **Table 2** were used for the simulation exercise focusing exclusively in the net food-importing countries: one for the group of LIFDCs (-0.306) and another one for non-LIFDCs (-0.06). Based on the analysis on food trade position from FAOSTAT, 101 low- and middle-income countries are classified as net food importers, of which 47 are LIFDCs – and 54 are not (see **Table A1.1** for the complete list of countries). Thus, estimated elasticities in **Table 2** based on the sample of 93 net food-importing countries are applied to all 101 countries for which information on food trade is available. In order to approximate a potential impact of the economic downturn during the COVID-19 pandemic, a change in the food supply was simulated under three different hypothetical scenarios of GDP growth reduction for all countries of the sample: an optimistic scenario prospecting a reduction in GDP growth of 2 p.p., a mild scenario (-5 p.p.), and a pessimistic scenario (-10 p.p.). The range of variation is guided by the Economic Intelligence Unite (EIU)'s forecast for before and during (through 26 March 2020) the COVID-19 pandemic (see **Table 3**).

TABLE 3 | COVID-19 to send almost all G20 countries into a recession. Revised growth forecasts for G20 countries in 2020 (26 March 2020)

	REAL GDP GROWTH (% in 2020)	PREVIOUS FORECAST (before outbreak)	DIFFERENCE
Brazil	**-5.5**	**2.4**	**-7.9**
Germany	-6.8	0.9	-7.7
Italy	-7.0	0.4	-7.4
Turkey	-3.0	3.8	-6.8
Mexico	-5.4	1.1	-6.5
United Kingdom of Great Britain and Northern Ireland	-5.0	1.1	-6.1
France	-5.0	1.0	-6.0
Saudi Arabia	-5.0	1.0	-6.0
China	1.0	5.9	-4.9
Argentina	-6.7	-2.0	-4.7
Global (market exchange rates)	**-2.2**	**2.3**	**-4.5**
United States of America	-2.8	1.7	-4.5
South Africa	-3.0	1.4	-4.4
Indonesia	1.0	5.1	-4.1
South Korea	-1.8	2.2	-4.0
India (2020/21 fiscal year)	2.1	6.0	-3.9
Russian Federation	-2.0	1.6	-3.6
Canada	-1.3	1.8	-3.1
Austria	-0.4	2.0	-2.4
Japan	**-1.5**	**0.4**	**-1.9**
Average	**-3.0**	**2.0**	**-5.0**

Source: EIU forecast as of 26 March 2020 (available at: www.eiu.com/n/covid-19-to-send-almost-all-g20-countries-into-a-recession).

Thus, the two constant estimated elasticities (**Table 4**, column 1) are applied to each scenario to simulate the percentage reduction in per capita food supply following a hypothetical reduction of 2, 5 and 10 p.p. in GDP growth (**Table 4**, columns 2–4). Percentage reductions simulated in **Table 4** are applied to the average per-capita food supply available in year 2016/2018 for each country, to obtain the amount of reduced per capita kilocalorie under the three scenarios, as further explained below.

TABLE 4 | Estimated elasticities from the generalized method of moments (GMM) model and projected average food supply reduction under the three scenarios

		THREE SCENARIOS		
	Estimated from GMM model (1 p.p. GDP growth reduction)	**Simulated under the optimistic scenario (2 p.p. GDP growth reduction)**	**Simulated under the mild scenario (5 p.p. GDP growth reduction)**	**Simulated under the pessimistic scenario (10 p.p. GDP growth reduction)**
	(1)	(2)	(3)	(4)
Net food-importing countries, excluding LIFDCs (n=54)	0.06	0.12	0.3	0.6
LIFDCs (n=47)	0.306	0.612	1.53	3.06

Source: Authors' own elaboration.

Third estimation step: translating into prevalence of undernourishment (PoU) impacts

Using a calculator developed by the FAO Statistic Division, the simulated reduction in food supply under each scenario, is used to calculate changes in the prevalence of undernourishment (PoU). To obtain PoU estimates from the simulated per capita food supply, we keep the other key parameters that inform the PoU calculation constant. These are: the average dietary energy requirement (ADER) and the minimum dietary energy requirement (MDER) that are, respectively, the average and the lowest limit of the range of energy requirements for the population's representative average individual which depends on the populations structure by sex, age, body mass and physical activity levels; and the coefficient of variation (CV) that accounts for inequality in food consumption within a country. Once PoU estimates are obtained under the three scenarios, the number of undernourished people in each country is calculated by multiplying the simulated PoU by the country population size. Table A2.1 in Annex 2 provides information on all the variables described above that are used to simulate the prevalence of undernourishment and the additional number of undernourished people under the three scenarios, compared to the number estimated in 2016/2018.

Without policy responses to redistribute available food supply (that is, assuming the CV remains constant), this simulation exercise suggests that, under the more optimistic assumption that GDP growth is cut by 2 p.p. in net food-importing countries, there would be around 14 more million people becoming undernourished compared to recent FAO estimates. As can be seen in Table 5, these numbers increase significantly under the assumptions that the GDP growth decelerates by 5 p.p. (mild scenario) or 10 p.p. (pessimistic scenario). In the latter case, for instance, around 80 million people become undernourished. LIFDCs, which are the most vulnerable countries, would have a lot to lose with almost 74 million people joining the ranks of their undernourished population should a scenario such as the most pessimistic being used here prevailed.

TABLE 5 | Rising undernourishment in net food-importing countries, as a result of three GDP growth reduction scenarios (millions of people)

	OPTIMISTIC SCENARIO	MILD SCENARIO	PESSIMISTIC SCENARIO
	(2 p.p. reduction)	(5 p.p. reduction)	(10 p.p. reduction)
Net food-importing countries (n=101)	14.4	38.2	80.3
LIFDCs (n=47)	12.6	35.6	73.6
Net food-importing countries (excluding LIFDCs) (n=54)	1.8	2.6	6.7

Source: Authors' own elaboration.

Caveats

As very dramatic reductions in GDP growth are rare in the panel of data used for estimation, the simulations presented imply out-of-sample predictions. It is thus crucial to explore further the extent in which the relation between GDP growth and food supply is non-linear. As in the more pessimistic scenario most countries will enter into an actual recession, it is not clear that the estimated elasticity would still be valid to predict the impact on food supply, nor that the values of elasticity estimated for the three group of countries would still be correct. Next iterations in the model should also take into account the implication of current levels of food storage and a discontinuity corresponding to recessions as opposed to simple slowdowns.

Annexes

Annex 1. Sample of net food-importing countries and the low-income food deficit countries (LIFDCs) subsample

TABLE A6.1 | List of net food-importing countries and low-income food deficit countries (LIFDCs) on which simulation is performed

Food trade importing countries (2000–2017)	Net food trade balance, millions kcal (2000–2017)	Low-income food deficit countries (LIFDCs)
Afghanistan	-7 529 726	Yes
Albania	-2 252 361	
Algeria	-44 700 000	
Angola	-7 729 080	
Armenia	-2 146 424	
Azerbaijan	-5 789 760	
Bangladesh	-36 700 000	Yes
Belarus	-274 942	
Benin	-3 130 269	Yes
Bhutan	-289 532	
Bosnia and Herzegovina	-3 554 286	
Botswana	-1 469 762	
Burkina Faso	-1 410 524	Yes
Burundi	-406 175	Yes
Cabo Verde	-536 765	
Cambodia	-453 229	
Cameroon	-3 121 964	Yes
Central African Republic	-206 981	Yes
Chad	-637 374	Yes
China	-307 000 000	
Colombia	-16 400 000	
Comoros	-237 276	Yes
Congo	-1 346 452	
Costa Rica	-614 307	
Cuba	-4 195 935	
Democratic People's Republic of Korea	-4 573 842	Yes
Democratic Republic of the Congo	-3 583 699	Yes
Djibouti	-3 152 921	Yes
Dominica	-83 434	
Dominican Republic	-6 333 473	
Egypt	-61 300 000	
El Salvador	-2 436 482	
Equatorial Guinea	-228 030	
Eritrea	-968 937	Yes
Ethiopia	-6 004 023	Yes
Gabon	-948 001	
Gambia	-1 174 656	Yes
Georgia	-3 619 513	
Ghana	-2 654 020	Yes
Grenada	-110 564	

Food trade importing countries (2000–2017)	Net food trade balance, millions kcal (2000–2017)	Low-income food deficit countries (LIFDCs)
Guinea	-2 596 526	Yes
Guinea-Bissau	-159 848	Yes
Haiti	-4 403 527	Yes
Honduras	-271 378	
India	-32 400 000	Yes
Iran (Islamic Republic of)	-45 100 000	
Iraq	-23 400 000	
Jamaica	-2 132 948	
Jordan	-10 600 000	
Kenya	-10 000 000	Yes
Kiribati	-46 270	
Kyrgyzstan	-1 686 157	Yes
Lebanon	-5 719 011	
Lesotho	-1 233 637	Yes
Liberia	-1 279 430	Yes
Libya	-11 100 000	
Madagascar	-2 074 512	Yes
Malawi	-95 808	Yes
Maldives	-327 109	
Mali	-2 029 462	Yes
Mauritania	-3 407 639	Yes
Mexico	-84 000 000	
Mongolia	-1 002 321	
Montenegro	-784 230	
Morocco	-26 200 000	
Mozambique	-3 866 600	Yes
Namibia	-1 121 661	
Nauru	-4 091	
Nepal	-4 005 202	Yes
Niger	-1 918 249	Yes
Nigeria	-28 900 000	Yes
North Macedonia	-1 326 848	
Pakistan	-10 400 000	Yes
Palestine	-2 329 675	
Peru	-16 200 000	
Philippines	-9 361 513	
Rwanda	-881 836	Yes
Saint Lucia	-131 752	
Saint Vincent and the Grenadines	-115 043	
Samoa	-103 645	
Sao Tome and Principe	-81 217	Yes
Senegal	-6 278 027	Yes
Sierra Leone	-1 074 115	Yes
Somalia	-3 531 453	Yes
South Africa	-7 256 228	
South Sudan	-920 930	Yes
Sri Lanka	-8 482 245	
Sudan	-10 400 000	
Suriname	-202 515	
Syrian Arab Republic	-10 300 000	Yes

Food trade importing countries (2000–2017)	Net food trade balance, millions kcal (2000–2017)	Low-income food deficit countries (LIFDCs)
Tajikistan	-3 980 013	Yes
Timor-Leste	-282 974	
Togo	-1 023 380	Yes
Tonga	-54 018	
Tunisia	-12 500 000	
Turkey	-13 700 000	
Turkmenistan	-1 586 354	
Tuvalu	-7 429	
Uganda	-2 117 051	Yes
United Republic of Tanzania	-4 042 738	Yes
Uzbekistan	-6 680 985	Yes
Venezuela (Bolivarian Republic of)	-18 500 000	
Yemen	-16 107 216	Yes
Zimbabwe	-3 155 418	Yes
N=101		**N=47**

Source: Authors' own elaboration.

Annex 2. Variables and data

TABLE A2.7 | Variables and data used to simulate scenarios of undernourishment by country

								SCENARIOS OF PREVALENCE OF UNDERNOURISHMENT (PoU)			SCENARIOS OF VARIATION IN THE NUMBER OF UNDERNOURISHED (NoU)		
	Per capita food supply 2016/18	MDER 2019	ADER 2019	CV 2018	Population 2018	PoU 2016/18	NoU 2016/18	OPTIMISTIC (GDP growth -2 p.p.)	MILD (GDP growth -5 p.p.)	PESSIMISTIC (GDP growth -10 p.p.)	OPTIMISTIC (GDP growth -2 p.p.)	MILD (GDP growth -5 p.p.)	PESSIMISTIC (GDP growth -10 p.p.)
Non-LIFDCs net food-importing countries (n=54)													
Albania	3 159	1 916	2 488	0.28	2 866 376	4.6	131 853.3	4.7	4.9	5.2	2 866.4	8 599.1	17 198.3
Algeria	3 360	1 791	2 299	0.30	42 228 429	2.3	971 253.9	2.4	2.5	2.6	42 228.4	84 456.9	126 685.3
Angola	2 240	1 658	2 111	0.30	30 809 762	19.0	5 853 854.8	19.2	19.6	20.4	61 619.5	184 858.6	431 336.7
Armenia	2 939	1 887	2 441	0.23	2 951 776	3.4	100 360.4	3.5	3.7	3.9	2 951.8	8 855.3	14 758.9
Azerbaijan	3 161	1 869	2 409	0.21	9 942 334	0.8	79 538.7	0.9	0.9	1.0	9 942.3	9 942.3	19 884.7
Belarus	3 275	1 896	2 450	0.21	9 485 386	0.6	56 912.3	0.7	0.7	0.8	9 485.4	9 485.4	18 970.8
Bhutan	2 526	1 811	2 337	0.25	754 394	10.9	82 228.9	11.2	11.5	12.1	2 263.2	4 526.4	9 052.7
Bosnia and Herzegovina	3 284	1 934	2 510	0.21	3 323 929	0.7	23 267.5	0.7	0.8	0.9	0.0	3 323.9	6 647.9
Botswana	2 342	1 836	2 367	0.27	2 254 126	21.6	486 891.2	21.9	22.4	23.3	6 762.4	18 033.0	38 320.1
Cabo Verde	2 681	1 849	2 391	0.26	543 767	9.2	50 026.6	9.4	9.7	10.2	1 087.5	2 718.8	5 437.7
Cambodia	2 477	1 766	2 268	0.27	16 249 798	12.6	2 047 474.5	12.8	13.2	13.8	32 499.6	97 498.8	194 997.6
China	3 224	1 890	2 445	0.32	1 392 730 000	6.0	83 563 800.0	6.1	6.3	6.6	1 392 730.0	4 178 190.0	8 356 380.0
Colombia	3 099	1 827	2 358	0.27	49 648 685	3.1	1 539 109.2	3.2	3.4	3.6	49 648.7	148 946.1	248 243.4
Congo	2 016	1 732	2 218	0.25	5 244 363	30.9	1 620 508.2	31.3	32.0	33.2	20 977.5	57 688.0	120 620.3
Costa Rica	2 915	1 885	2 442	0.22	4 999 441	2.9	144 983.8	3.0	3.1	3.4	4 999.4	9 998.9	24 997.2
Cuba	3 409	1 891	2 446	0.23	11 338 138	0.6	68 028.8	0.7	0.7	0.8	11 338.1	11 338.1	22 676.3
Dominica	2 923	1 887	2 444	0.24	71 625	4.2	3 008.3	4.3	4.5	4.9	71.6	214.9	501.4
Dominican Republic	2 739	1 842	2 381	0.24	10 627 165	6.0	637 629.9	6.2	6.4	6.8	21 254.3	42 508.7	85 017.3
Egypt	3 547	1 808	2 328	0.32	98 423 595	2.3	2 263 742.7	2.3	2.4	2.5	0.0	98 423.6	196 847.2
El Salvador	2 681	1 772	2 282	0.26	6 420 744	6.7	430 189.8	6.8	7.1	7.5	6 420.7	25 683.0	51 366.0
Equatorial Guinea	2 088	1 796	2 314	0.30	1 308 974	35.7	467 303.7	36.0	36.7	37.7	3 926.9	13 089.7	26 179.5
Gabon	2 795	1 786	2 296	0.27	2 119 275	5.9	125 037.2	6.1	6.3	6.7	4 238.5	8 477.1	16 954.2

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Georgia	2 850	1 906	2 463	0.25	3 731 000	6.5	242 515.0	6.7	6.9	7.3	7 462.0	14 924.0	29 848.0
Grenada	2 377	1 874	2 426	0.28	111 454	23.3	25 968.8	23.6	24.1	25.0	334.4	891.6	1 894.7
Honduras	2 731	1 782	2 297	0.30	9 587 522	9.5	910 814.6	9.7	10.0	10.5	19 175.0	47 937.6	95 875.2
Iran (Islamic Republic of)	3 122	1 852	2 387	0.27	81 800 269	3.3	2 699 408.9	3.4	3.5	3.8	81 800.3	163 600.5	409 001.3
Iraq	2 449	1 753	2 251	0.39	38 433 600	24.2	9 300 931.2	24.4	24.8	25.5	76 867.2	230 601.6	499 636.8
Jamaica	2 809	1 893	2 457	0.23	2 934 855	5.2	152 612.5	5.4	5.6	6.0	5 869.7	11 739.4	23 478.8
Jordan	2 615	1 797	2 315	0.25	9 956 011	8.0	796 480.9	8.2	8.5	9.0	19 912.0	49 780.1	99 560.1
Kiribati	3 110	1 715	2 195	0.27	115 847	1.7	1 969.4	1.7	1.8	2.0	0.0	115.8	347.5
Lebanon	2 764	1 873	2 430	0.26	6 848 925	8.1	554 762.9	8.3	8.6	9.0	13 697.9	34 244.6	61 640.3
Libya	3 305	1 855	2 392	0.25	6 678 567	1.3	86 821.4	1.3	1.4	1.5	0.0	6 678.6	13 357.1
Maldives	2 777	1 842	2 378	0.25	515 696	6.1	31 457.5	6.3	6.5	6.9	1 031.4	2 062.8	4 125.6
Mexico	3 151	1 852	2 396	0.26	126 190 788	2.5	3 154 769.7	2.6	2.7	2.9	126 190.8	252 381.6	504 763.2
Mongolia	2 622	1 805	2 320	0.27	3 170 208	10.1	320 191.0	10.3	10.6	11.1	6 340.4	15 851.0	31 702.1
Montenegro	3 491	1 915	2 484	0.21	622 345	0.3	1 867.0	0.3	0.3	0.3	0.0	0.0	0.0
Morocco	3 550	1 839	2 371	0.31	36 029 138	2.1	756 611.9	2.2	2.3	2.4	36 029.1	72 058.3	108 087.4
Namibia	2 218	1 858	2 405	0.23	2 448 255	25.2	616 960.3	25.7	26.3	27.5	12 241.3	26 930.8	56 309.9
North Macedonia	3 003	1 931	2 504	0.21	2 082 958	2.1	43 742.1	2.2	2.3	2.5	2 083.0	4 165.9	8 331.8
Peru	2 695	1 789	2 303	0.26	31 989 256	6.9	2 207 258.7	7.0	7.3	7.7	31 989.3	127 957.0	255 914.0
Philippines	2 677	1 741	2 233	0.31	106 651 922	10.1	10 771 844.1	10.3	10.6	11.1	213 303.8	533 259.6	1 066 519.2
Saint Lucia	2 342	1 931	2 507	0.22	181 889	21.8	39 651.8	22.2	22.9	24.0	727.6	2 000.8	4 001.6
Saint Vincent and the Grenadines	2 982	1 900	2 464	0.24	110 210	3.8	4 188.0	3.9	4.0	4.3	110.2	220.4	551.1
Samoa	3 004	1 787	2 306	0.23	196 130	1.5	2 942.0	1.5	1.6	1.7	0.0	196.1	392.3
South Africa	3 006	1 865	2 415	0.26	57 779 622	4.0	2 311 184.9	4.2	4.3	4.6	115 559.2	173 338.9	346 677.7
Sri Lanka	2 638	1 790	2 302	0.24	21 670 000	6.4	1 386 880.0	6.6	6.8	7.3	43 340.0	86 680.0	195 030.0
Sudan	2 452	1 734	2 221	0.30	41 801 533	15.0	6 270 230.0	15.3	15.6	16.3	125 404.6	250 809.2	543 419.9
Suriname	2 738	1 848	2 387	0.24	575 991	6.2	35 711.4	6.3	6.6	7.0	576.0	2 304.0	4 607.9
Timor-Leste	2 178	1 657	2 117	0.29	1 267 972	20.6	261 202.2	20.9	21.4	22.3	3 803.9	10 143.8	21 555.5

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Tonga	2 957	1 851	2 392	0.23	103 197	2.5	2 579.9	2.6	2.7	3.0	103.2	206.4	516.0
Tunisia	3 374	1 824	2 347	0.29	11 565 204	2.2	254 434.5	2.3	2.3	2.5	11 565.2	11 565.2	34 695.6
Turkey	3 716	1 835	2 368	0.22	82 319 724	0.1	82 319.7	0.1	0.1	0.1	0.0	0.0	0.0
Turkmenistan	2 782	1 789	2 300	0.24	5 850 908	4.0	234 036.3	4.1	4.3	4.6	5 850.9	17 552.7	35 105.4
Venezuela (Bolivarian Republic of)	2 322	1 825	2 352	0.22	28 870 195	15.8	4 561 490.8	16.1	16.7	17.6	86 610.6	259 831.8	519 663.5
LIFDCs net food-importing countries (n=47)													
Afghanistan	2 051	1 685	2 157	0.24	37 172 386	23.7	8 809 855.5	24.6	25.8	28.0	334 551.5	780 620.1	1 598 412.6
Bangladesh	2 514	1 787	2 301	0.26	161 356 039	11.2	18 071 876.4	11.7	12.4	13.7	806 780.2	1 936 272.5	4 033 901.0
Benin	2 786	1 723	2 203	0.30	11 485 048	7.2	826 923.5	7.0	8.7	9.5	-22 970.1	172 275.7	264 156.1
Burkina Faso	2 722	1 726	2 208	0.40	19 751 535	16.2	3 199 748.7	16.5	17.2	18.3	59 254.6	197 515.4	414 782.2
Burundi	2 200	1 655	2 104	0.28	11 175 378	18.5	2 067 444.9	18.8	20.0	21.6	33 526.1	167 630.7	346 436.7
Cameroon	2 732	1 741	2 231	0.28	25 216 237	6.7	1 689 487.9	7.0	7.4	8.3	75 648.7	176 513.7	403 459.8
Central African Republic	1 754	1 710	2 187	0.29	4 666 377	52.1	2 431 182.4	53.0	54.2	56.4	41 997.4	97 993.9	200 654.2
Chad	2 123	1 708	2 181	0.36	15 477 751	32.8	5 076 702.3	33.3	34.4	36.1	77 388.8	247 644.0	510 765.8
Comoros	2 332	1 741	2 233	0.26	832 322	15.5	129 009.9	16.1	17.0	18.6	4 993.9	12 484.8	25 802.0
Democratic People's Republic of Korea	2 019	1 859	2 402	0.26	25 549 819	42.3	10 807 573.4	43.2	44.6	47.0	229 948.4	587 645.8	1 200 841.5
Democratic Republic of the Congo	1 840	1 662	2 115	0.47	84 068 091	49.8	41 865 909.3	50.3	51.2	52.6	420 340.5	1 176 953.3	2 353 906.5
Djibouti	2 611	1 852	2 396	0.30	958 920	15.3	146 714.8	15.8	16.6	18.0	4 794.6	12 466.0	25 890.8
Eritrea	2 200	1 730	2 217	0.26	3 452 786	20.8	718 179.5	21.5	22.6	24.4	24 169.5	62 150.1	124 300.3
Ethiopia	2 340	1 739	2 233	0.27	109 224 559	16.2	17 694 378.6	16.7	17.7	19.3	546 122.8	1 638 368.4	3 385 961.3
Gambia	2 630	1 736	2 221	0.27	2 280 102	7.6	173 287.8	7.8	8.4	9.4	4 560.2	18 240.8	41 041.8
Ghana	3 090	1 772	2 276	0.28	29 767 108	3.0	893 013.2	3.2	3.4	3.8	59 534.2	119 068.4	238 136.9
Guinea	2 649	1 734	2 223	0.33	12 414 318	12.3	1 526 961.1	12.7	13.4	14.4	49 657.3	136 557.5	260 700.7

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Guinea-Bissau	2 220	1 736	2 224	0.28	1 874 309	22.5	421 719.5	23.2	24.1	26.0	13 120.2	29 988.9	65 600.8
Haiti	2 133	1 819	2 347	0.49	11 123 176	45.5	5 061 045.1	46.1	46.9	48.2	66 739.1	155 724.5	300 325.8
India	2 510	1 791	2 307	0.25	1 352 617 328	10.6	143 377 436.8	11.0	11.8	13.1	5 410 469.3	16 231 407.9	33 815 433.2
Kenya	2 152	1 723	2 208	0.26	51 393 010	22.9	11 768 999.3	23.6	24.7	26.8	359 751.1	925 074.2	2 004 327.4
Kyrgyzstan	2 787	1 812	2 330	0.25	6 315 800	5.2	328 421.6	5.4	5.9	6.7	12 631.6	44 210.6	94 737.0
Lesotho	2 557	1 766	2 270	0.27	2 108 132	10.7	225 570.1	10.7	11.8	13.0	0.0	23 189.5	48 487.0
Liberia	2 228	1 721	2 206	0.41	4 818 977	32.4	1 561 348.5	32.9	33.7	35.2	24 094.9	62 646.7	134 931.4
Madagascar	1 909	1 686	2 156	0.28	26 262 368	37.7	9 900 912.7	38.5	39.7	41.9	210 098.9	525 247.4	1 103 019.5
Malawi	2 475	1 695	2 170	0.31	18 143 315	13.5	2 449 347.5	13.9	14.7	15.9	72 573.3	217 719.8	435 439.6
Mali	2 947	1 657	2 102	0.31	19 077 690	4.0	763 107.6	4.1	4.4	5.0	19 077.7	76 310.8	190 776.9
Mauritania	2 781	1 754	2 251	0.30	4 403 319	7.8	343 458.9	8.0	8.6	9.4	8 806.6	35 226.6	70 453.1
Mozambique	2 259	1 679	2 142	0.33	29 495 962	22.3	6 577 599.5	22.8	23.8	25.3	147 479.8	442 439.4	884 878.9
Nepal	2 688	1 766	2 276	0.26	28 087 871	6.5	1 825 711.6	6.8	7.3	8.2	84 263.6	224 703.0	477 493.8
Niger	2 593	1 657	2 103	0.36	22 442 948	13.4	3 007 355.0	13.7	14.3	15.4	67 328.8	201 986.5	448 859.0
Nigeria	2 509	1 698	2 167	0.28	195 874 740	9.9	19 391 599.3	10.3	11.0	12.1	783 499.0	2 154 622.1	4 309 244.3
Pakistan	2 451	1 755	2 249	0.30	212 215 030	16.1	34 166 619.8	16.6	17.4	18.8	1 061 075.2	2 758 795.4	5 729 805.8
Rwanda	2 184	1 733	2 220	0.31	12 301 939	27.0	3 321 523.5	27.5	28.7	30.5	61 509.7	209 133.0	430 567.9
Sao Tome and Principe	2 628	1 748	2 242	0.22	211 028	3.9	8 230.1	4.0	4.5	5.2	211.0	1 266.2	2 743.4
Senegal	2 550	1 755	2 247	0.25	15 854 360	8.2	1 300 057.5	8.4	9.2	10.3	31 708.7	158 543.6	332 941.6
Sierra Leone	2 433	1 730	2 217	0.37	7 650 154	22.0	1 683 033.9	22.5	23.3	24.6	38 250.8	99 452.0	198 904.0
Somalia	2 048	1 707	2 188	0.34	15 008 154	35.0	5 252 853.9	35.8	36.7	38.6	120 065.2	255 138.6	540 293.5
South Sudan	2 200	1 724	2 206	0.30	10 975 920	24.7	2 711 052.2	25.3	26.4	28.1	65 855.5	186 590.6	373 181.3
Syrian Arab Republic	2 934	1 802	2 332	0.26	16 906 283	3.8	642 438.8	4.0	4.3	4.9	33 812.6	84 531.4	185 969.1
Tajikistan	2 092	1 780	2 287	0.29	9 100 837	33.5	3 048 780.4	34.4	35.5	37.5	81 907.5	182 016.7	364 033.5
Togo	2 506	1 743	2 235	0.28	7 889 094	11.9	938 802.2	12.3	13.0	14.2	31 556.4	86 780.0	181 449.2
Uganda	2 044	1 690	2 160	0.33	42 723 139	33.3	14 226 805.3	34.0	35.0	36.9	299 062.0	726 293.4	1 538 033.0

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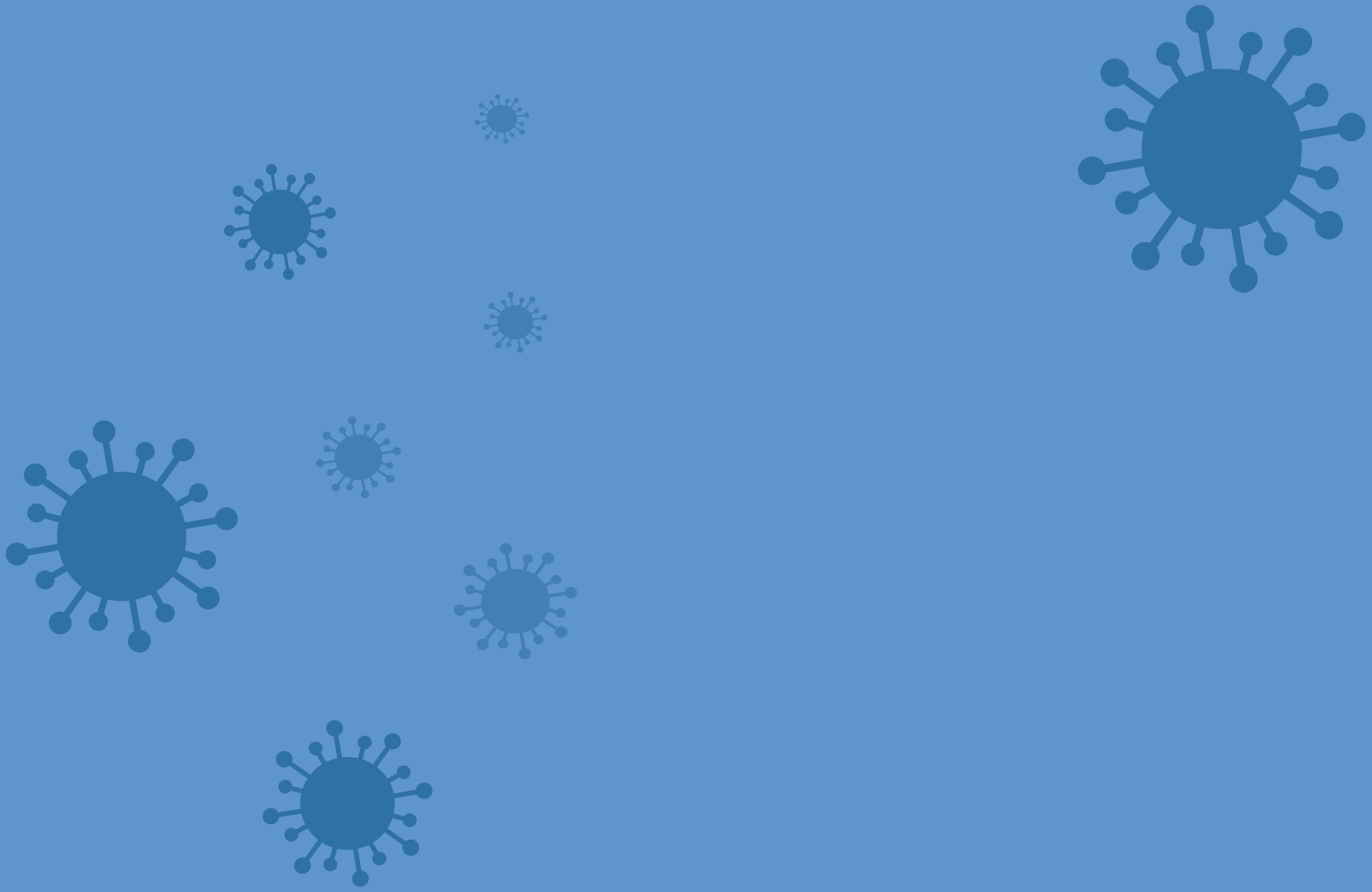
United Republic of Tanzania	2 282	1 666	2 125	0.38	56 318 348	25.0	14 079 587.0	25.6	26.4	27.8	337 910.1	788 456.9	1 576 913.7
Uzbekistan	2 776	1 849	2 383	0.23	32 955 400	4.7	1 548 903.8	4.9	5.4	6.2	65 910.8	230 687.8	494 331.0
Yemen	1 993	1 707	2 185	0.28	28 498 687	33.5	9 547 060.1	34.3	35.6	37.8	227 989.5	598 472.4	1 225 443.5
Zimbabwe	1 892	1 756	2 253	0.32	14 439 018	46.7	6 743 021.4	47.5	48.8	50.8	115 512.1	303 219.4	591 999.7

Notes: MDER and ADER refer to the minimum dietary energy requirement and the average dietary energy requirement, respectively. CV is the coefficient of variation accounting for inequality in the food supply availability.

Source: Authors' own elaboration.



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