

**Economist Intelligence Unit**

The  
Economist

# Global food security index 2012

An assessment of food affordability,  
availability and quality

A report from the Economist Intelligence Unit

Sponsored by

**DU PONT**



# Contents

Preface	2
Acknowledgements	3
Executive summary	4
Key findings	8
Overall Global Food Security Index rankings table	9
Rankings by income classification	10
Affordability and financial access	11
Availability	15
Quality and safety	19
Appendix: Methodology	22
Indicator selection	22
Food price adjustment factor	23
Country selection	24
Weighting	25
Data modelling	25
Scattergraphs: Correlation between overall rankings and dependent variables	26
Scoring criteria and definitions	30



# Preface

The *Global Food Security Index 2012: An assessment of food affordability, availability and quality* is an Economist Intelligence Unit publication, commissioned by DuPont. This findings and methodology paper discusses the major results of the index and the accompanying global benchmarking model. Lucy Hurst, associate director of custom research for the Americas, was the research director for this project. Nadia Hussaini and Jamie Morgan, analysts, were the project managers. Leo Abruzzese, global forecasting director and executive editor for the Americas, served as senior advisor. William Shallcross constructed the Excel benchmarking tool and Mike Kenny was responsible for layout and design. We would like to thank the many researchers who lent their expertise to this project. A full list of acknowledgements follows. ■

The findings, interpretation, and conclusions expressed herein are those of the author(s) and do not necessarily reflect the views of the sponsor.

The sponsor does not guarantee the accuracy of the data included in this work. The boundaries, colours, denominations and other information shown on any map in this work or related materials do not imply any judgement on the part of the sponsor concerning the legal status of any territory or the endorsement or acceptance of such boundaries. ■



# Acknowledgements

The following economists, researchers, food specialists and country analysts contributed to the report. We thank them for their participation.

*Economist Intelligence Unit specialists and contributors*

Diane Alarcon, Georgia Deoudes, Tom Felix Joehnk, Kate Jordan, Susanna Kim, Victoria Lai, Polina Minkovski, Robert Powell.

*Peer panel members*

The following experts on food security and agricultural policy contributed significantly to shaping the index methodology and vetting the indicators. Their diverse backgrounds and extensive experience ensured that a wide variety of views were considered. The panel met as a group in February in Washington to review an initial indicator list and provided ongoing support, as needed, throughout the project. They also advised on the selection of weights for the index.

Ademola Braimoh (World Bank), Margaret Enis (US Agency for International Development), Craig Gundersen (National Soybean Research Laboratory, University of Illinois at Urbana-Champaign), Eileen Kennedy (Friedman School of Nutrition Science and Policy, Tufts University), Samarendu Mohanty (International Rice Research Institute), Prabhu Pingali (Gates Foundation), Pedro Sanchez (Earth Institute, Columbia University), David Spielman (International Food Policy Research Institute), Robert Thompson (Chicago Council on Global Affairs), Patrick Westhoff (Food and Agricultural Policy Research Institute, University of Missouri-Columbia). ■

# Executive summary

Global food prices rose twice as fast as inflation in the last decade<sup>1</sup>, impoverishing millions at a time when poverty relief captured the world's attention. Huge price swings for wheat, maize, soybeans and rice—staple crops for much of the world—made matters worse, disrupting markets and harming both producers and consumers. The food riots that swept more than two dozen countries in 2008 and 2011 were the most visible effect of these trends, but they also point to a deeper and more lasting concern: chronic food insecurity.

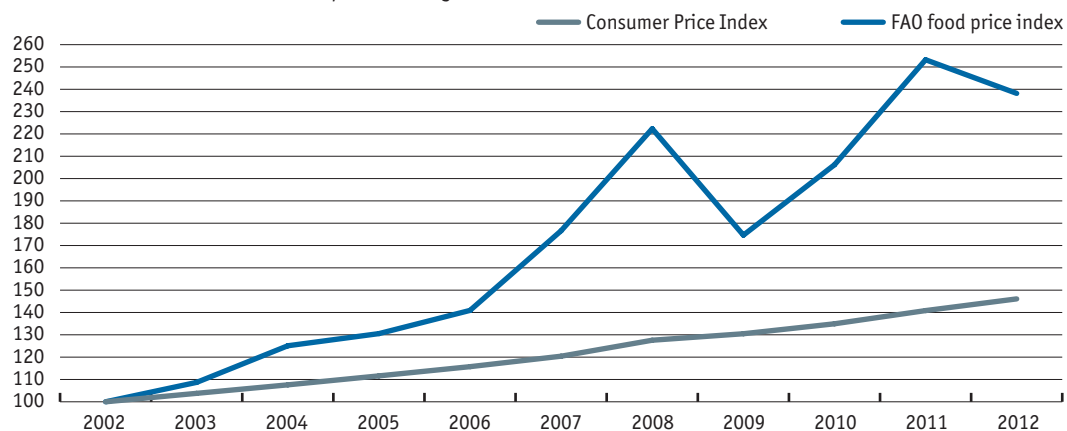
The world, on balance, is richer and better fed

than it was 50 years ago, but those gains are under threat. The global population is growing, and is expected to reach 9bn by 2050. Consumers in emerging markets are wealthier, and are spending more of their income on meats and processed foods—driving up demand and straining supplies. High prices for oil and other agricultural inputs are making production more expensive. Extreme weather increasingly threatens harvests, and agricultural productivity gains are waning as investment falters. Competing demands for crops adds to the pressure. All of this suggests that high

44 m people were pushed into poverty due to food price spikes in 2008, according to the World Bank.

## Rise of global food prices vs inflation

2002=100, deviation from 100 reflects percent change



Source: Economist Intelligence Unit and Food and Agriculture Organization.

<sup>1</sup> Economist Intelligence Unit calculations based on data from the EIU and the Food and Agriculture Organisation (FAO). Food prices rose by 238% over the past ten years, while inflation rose by 146%.

prices—and price volatility—will threaten global food security for at least the next decade.<sup>2</sup>

The World Bank estimates that global food price spikes in 2008 pushed 44m people below the poverty line, most of them in poor countries.<sup>3</sup> But the US Department of Agriculture says almost 15% of US households were food insecure in 2011, up from 11% before the recent price jumps.<sup>4</sup> Although greater food insecurity is a result, in part, of the global economic downturn, many of the longer-term pressures are not. The Food and Agriculture Organisation (FAO) says that production needs to increase by 50-70% to meet global demand by 2050.<sup>5</sup>

Sceptics say the world produces enough food to feed everyone; that may be true, but supplies often cannot get to where they need to go because of physical, political, economic and market constraints. Food insecurity is costly, and not just because people go to bed hungry; too little food raises healthcare costs and reduces workforce productivity.<sup>6</sup> ActionAid, a non-governmental organisation (NGO), estimates that food insecurity costs developing economies around US\$450bn in lost GDP each year.<sup>7</sup> Food insecurity also threatens political stability. Studies show that lack of food is correlated with a substantial deterioration of democratic institutions in low-income countries, as well as a rise in communal violence, riots, human rights abuses and civil conflict.<sup>8</sup>

2 Interview with Kostas Stamoulis of the Food and Agriculture Organization. Mr Stamoulis is the Director of the Agricultural Economic Development Division, and Secretary of the Committee on World Food Security.

3 "Food Price Hike Drives 44 Million People into Poverty", World Bank, February 15th 2011.

4 "Food Security in the United States: Key Statistics and Graphics", US Department of Agriculture (USDA), Economic Research Service, web publication, 2012.

5 "Food production will have to increase by 70 percent - FAO convenes high-level expert forum", FAO Media Centre, September 23rd 2009; "Food Production Must Double by 2050 to Meet Demand From World's Growing Population", UN General Assembly Panel Discussion, October 9th 2009.

6 D Shepard, E Setren and D Cooper, "Hunger in America: Suffering We All Pay For", Center for American Progress, Washington DC, October 2011; *Global Monitoring Report 2012*, IMF and World Bank, Washington DC, 2012, pg 6; *The State of Food Insecurity in the World 2011*, FAO, Rome, 2011, pg 19.

7 *Who's Really Fighting Hunger?*, Action Aid: Johannesburg, South Africa, September 14th 2010, via "The Cost of inaction", Mission 2014: Feeding the World, website, accessed May 23rd 2012.

8 R Arezki and M Brückner, "Food Prices and Political Instability", IMF Working Paper, March 2011; H Brinkman and C Hendrix, "Food Insecurity and Conflict: Applying the WDR Framework", World Development Report 2011 Background Paper, August 2nd 2010.

## Working toward a solution

To deepen the dialogue on food insecurity—and to measure the risks in a consistent, rigorous framework—the Economist Intelligence Unit has created the Global Food Security Index (GFSI). Sponsored by DuPont, the index assesses food security across three internationally designated dimensions<sup>9</sup>: affordability, availability and utilisation—the last of which we call "quality and safety". The index builds upon existing research on food security, including the FAO's annual State of Food Insecurity in the World report, the Global Hunger Index of the International Food Policy Research Institute (IFPRI), and the Maplecroft Food Security Risk Index, among others. Our GFSI complements these tools by analysing the inputs, or the drivers, of food security as a way of fostering dialogue about practical solutions and policy reforms. Importantly, the index considers the nutritional quality and safety of food—elements missing from similar indices—alongside traditional supply and availability issues. Finally, the index will feature a unique ongoing adjustment for changes in food prices and other macroeconomic factors, allowing it to serve as an early warning of potential price shocks that might compromise a country's food security, or worsen already poor conditions.

## Building the index

The GFSI uses the following definition of food security: "When people at all times have physical, social and economic access to sufficient and nutritious food that meets their dietary needs for a healthy and active life". This definition was developed by our research team, but is adapted from a formulation established at the World Food Summit in 1996. Each of the three categories in the GFSI—affordability and financial access, availability, and food quality and safety—is further divided into a series of indicators that evaluate programmes, policies or practices that influence food security.

We worked closely with a team of experts to

9 *Rome Declaration on World Food Security*, FAO Corporate Document Repository, Rome, November 1996. World Health Organisation (WHO), "Food security", WHO website.



identify the key determinants of food security and to select 25 appropriate indicators. The index uses data from a wide range of trusted international organisations, including the UN, the IMF, the FAO, the World Health Organisation (WHO), the World Bank and many others. In critical areas with limited or no data—for example, the presence of food-oriented social safety nets, access to financing for farmers, public expenditure on agricultural research and development, and protein quality in the average diet—we called on our global team of economists and country experts to construct qualitative indicators to fill the gaps. We convened a panel of food and development experts to provide input on indicator selection, structure and weighting. The research team selected countries based on data availability, geographic diversity and economic importance. The end product is a comprehensive assessment of food security across 105 countries.

### Topline results: Western nations are the most food secure

Wealthy nations, with little surprise, perform best in the index: the US, Denmark and France hold the top three spots, followed closely by a number of northern European and Australasian countries. High incomes, low spending on food relative to other outlays, and significant investment in agricultural research and development (R&D) put these countries at the top of the rankings. The index reveals, however, that people in the most food-secure nations do not have diets that are particularly rich in micronutrients. Wealthy nations do especially poorly in iron content from vegetables relative to their less well off counterparts. Sub-Saharan African countries are the most food insecure. Burundi, Chad and the Democratic Republic of Congo (DRC) take the bottom three spots. Each of these countries has done little to enable food security; they do not even have enough food available to meet the daily caloric needs of everyone in the country. In the DRC, the national food supply amounts to 1,605 calories per person per day—43% below the

recommended level for adults.

The index reveals more surprising findings, as well. Several policy indicators—access to financing for farmers, the presence of food safety net programmes, protein quality and diet diversification—are highly correlated with overall food security, suggesting that government action in these areas could substantially improve food security over time. The rankings of landlocked countries compared with coastline economies suggest that being landlocked in itself may not lead to greater food insecurity, despite the challenges such countries face in getting goods in and out of ports. South Korea and Japan have diets that are richest in micronutrients, and Botswana spends more on agricultural R&D as a share of agricultural output than almost any other country in the index.

### How this index can be used

The index is embedded in an Excel model with a range of analytical tools intended to allow cross-regional comparisons, as well as deeper dives into a specific country. Users can, for example, restrict their analysis to include only low-income or middle-income countries (see the tables that follow) or just those in a particular region. Any two countries may be compared directly, and individual indicators can be examined in detail. The index also allows final scores and category scores to be correlated with external factors that may influence food security. For example, food security, as expressed in the index, correlates strongly with countries that have a high degree of economic opportunity for women. The correlation function was also used to validate the degree to which the index is aligned with the negative consequences of food security. The overall scores were correlated with four output variables: the prevalence of undernourishment, stunted children, underweight children, and intensity of food deprivation. Each variable showed a negative correlation with the overall scores of 0.70 or greater.

The index can be used to analyse food security challenges in a variety of ways. The rankings

function gives a quick snapshot of global food security, and those countries most at risk. The regional filter allows comparisons within geographies or among economically similar countries, often a useful approach in encouraging reform. Country profiles use a “traffic-light” approach to display findings, showing clearly where countries do well and where they struggle, and suggesting where interventions are most needed. At a basic level, the index and the tool are a repository of more than 3,500 data points that bear on food security. Finally, the food price adjustment factor, which will be rolled out after the index is launched, will allow the food security scores to be modified following changes in global food prices. This adjustment will allow us to shock the model when, for example, food prices rise sharply, but also see how more gradual changes in food prices slowly improve, or erode, food security over time.

An index, even a carefully constructed one, is only a tool. By analysing conditions at the national level, it necessarily misses much local context. It cannot fully capture important cultural and political dimensions, and risks simplifying complex issues. That said, by reducing major food security themes to their core elements, it allows a bottom-up approach to understanding the risks to food security. By centralising existing data and filling data gaps, it aims to further research on food security. Most importantly, the index is meant to spur dialogue about the drivers of food insecurity and to suggest where countries and other stakeholders should focus their efforts to have the greatest impact. ■

**See the index website for more information on how to use the data and findings to inform your work: [www.foodsecurityindex.eiu.com](http://www.foodsecurityindex.eiu.com).**





## Key findings

- **The US, Denmark, Norway and France are the most food-secure countries in the world.** A combination of ample food supplies, high incomes, low spending on food relative to other outlays, and significant investment in agricultural research and development (R&D) put these countries at the top of the 105-nation index.
- **The food supply in advanced countries averages 1,200 calories more per person, per day, than in low-income economies.** The average individual needs 2,300 calories per day to live a healthy and active life.<sup>10</sup> Among wealthy nations, there is enough food for each person to eat 1,100 calories above that benchmark; in low-income countries, national food supplies fall, on average, 100 calories short of it.
- **Several of the sub-Saharan African countries that finished in the bottom third of the index, including Mozambique, Ethiopia, Rwanda and Niger, will be among the world's faster growing economies during the next two years.** Although still poor in absolute terms, rising incomes suggest that these countries may be in a position to address food insecurity more forcefully in coming years.
- **Several policy and nutrition related indicators, including access to financing for farmers, the presence of food safety net programmes, protein quality and diet diversification, are highly correlated with overall food security.** Governments may be better able to influence improvements in these areas than in more structural indicators, such as per-capita income.
- **China experienced the least volatility of agricultural production during the last 20 years, and three North African countries—Morocco, Tunisia and Algeria —among the most.** Countries with wide variances in annual farm output were considered less food secure and scored less well in the index.
- **The most food secure nations score less well for micronutrient availability.** Of the top ten countries in the index overall, only France ranks in the top ten for micronutrient availability. For many advanced economies, it is among their weakest scores. Germany, for example, ranks 10th overall but 43rd for micronutrients. The low ranks are primarily owing to limited availability of vegetal iron in national food supplies, as measured in the FAO Food Balance Sheets.
- **Landlocked countries fared nearly as well as those with a coastline.** The 22 landlocked countries in the index on average scored only seven points lower than those that are not landlocked. This suggests that although small countries without seaports may be particularly vulnerable to food shocks, being landlocked in itself does not translate into a significantly greater degree of food insecurity. ■

<sup>10</sup> FAO, as of June 2012.

## Overall GFSI rankings table

Weighted total of all category scores (0-100 where 100=most favourable)

Rank		Score /100	Rank		Score /100	Rank		Score /100
1	United States	89.5	36	Turkey	63.7	71	Uganda	41.9
2	Denmark	88.1	37	Serbia	63.2	72	Uzbekistan	40.8
3	Norway	88.0	=38	Romania	62.5	73	Algeria	40.5
4	France	86.8	=38	China	62.5	74	Cameroon	38.6
5	Netherlands	86.7	40	South Africa	61.7	75	Pakistan	38.5
6	Austria	85.6	41	Venezuela	61.6	76	Cote d'Ivoire	38.0
7	Switzerland	83.7	42	Panama	59.7	77	Kenya	37.6
8	Canada	83.4	43	Belarus	58.5	78	Myanmar	37.2
9	Finland	83.1	44	Ukraine	58.4	79	Nepal	35.2
10	Germany	83.0	45	Thailand	57.9	80	Nigeria	34.8
11	New Zealand	82.7	46	Bulgaria	57.6	81	Bangladesh	34.6
12	Belgium	82.2	47	Botswana	56.5	82	Benin	34.1
13	Spain	81.2	48	Peru	53.6	83	Yemen	33.3
14	Australia	81.1	49	Paraguay	52.8	84	Tajikistan	32.3
15	Portugal	80.8	50	Tunisia	52.7	85	Guinea	31.3
16	Japan	80.7	51	Colombia	52.3	86	Angola	30.5
17	Sweden	80.2	52	Egypt	51.6	87	Mali	30.4
18	Greece	79.7	53	Kazakhstan	51.1	88	Burkina Faso	30.2
19	Italy	79.1	54	Jordan	50.6	89	Cambodia	30.0
20	United Kingdom	79.0	55	Vietnam	50.4	90	Rwanda	29.8
21	South Korea	77.8	56	El Salvador	50.3	=91	Niger	29.2
22	Israel	77.7	=57	Ecuador	50.0	=91	Mozambique	29.2
23	Czech Republic	73.5	=57	Honduras	50.0	93	Senegal	28.8
24	Poland	72.3	59	Morocco	49.3	94	Sierra Leone	28.7
25	Hungary	70.7	60	Guatemala	48.2	95	Zambia	28.5
26	Chile	68.9	61	Dominican Republic	48.1	96	Sudan	27.6
27	Slovakia	68.8	62	Sri Lanka	47.4	97	Togo	27.5
28	Saudi Arabia	68.7	63	Philippines	47.1	98	Malawi	27.3
29	Russia	68.3	64	Indonesia	46.8	99	Tanzania	26.8
30	Mexico	67.7	65	Bolivia	45.2	100	Ethiopia	26.4
31	Brazil	67.6	66	India	45.0	101	Madagascar	26.3
32	Argentina	64.0	67	Azerbaijan	44.4	102	Haiti	24.5
=33	Malaysia	63.9	68	Ghana	43.1	103	Burundi	22.9
=33	Uruguay	63.9	69	Nicaragua	42.7	104	Chad	20.2
35	Costa Rica	63.8	70	Syria	42.0	105	Congo (Dem. Rep.)	18.4

# Rankings by income classification

(Income groups are World Bank classifications, 2012 data)

Rank		Score /100	Rank		Score /100	Rank		Score /100	Rank		Score /100
<b>High income</b> (US\$12,276 per capita or more)			<b>Upper middle income</b> (US\$3,976-12,275 per capita)			<b>Lower middle income</b> (US\$1,006-3,975 per capita)			<b>Low income</b> (US\$1,005 per capita or less)		
1	United States	89.5	1	Chile	68.9	1	Ukraine	58.4	1	Uganda	41.9
2	Denmark	88.1	2	Russia	68.3	2	Paraguay	52.8	2	Kenya	37.6
3	Norway	88.0	3	Mexico	67.7	3	Egypt	51.6	3	Myanmar	37.2
4	France	86.8	4	Brazil	67.6	4	Vietnam	50.4	4	Nepal	35.2
5	Netherlands	86.7	5	Argentina	64.0	5	El Salvador	50.3	5	Bangladesh	34.6
6	Austria	85.6	=6	Malaysia	63.9	6	Honduras	50.0	6	Benin	34.1
7	Switzerland	83.7	=6	Uruguay	63.9	7	Morocco	49.3	7	Tajikistan	32.3
8	Canada	83.4	8	Costa Rica	63.8	8	Guatemala	48.2	8	Guinea	31.3
9	Finland	83.1	9	Turkey	63.7	9	Sri Lanka	47.4	9	Mali	30.4
10	Germany	83.0	10	Serbia	63.2	10	Philippines	47.1	10	Burkina Faso	30.2
11	New Zealand	82.7	=11	Romania	62.5	11	Indonesia	46.8	11	Cambodia	30.0
12	Belgium	82.2	=11	China	62.5	12	Bolivia	45.2	12	Rwanda	29.8
13	Spain	81.2	13	South Africa	61.7	13	India	45.0	=13	Niger	29.2
14	Australia	81.1	14	Venezuela	61.6	14	Ghana	43.1	=13	Mozambique	29.2
15	Portugal	80.8	15	Panama	59.7	15	Nicaragua	42.7	15	Sierra Leone	28.7
16	Japan	80.7	16	Belarus	58.5	16	Syria	42.0	16	Togo	27.5
17	Sweden	80.2	17	Thailand	57.9	17	Uzbekistan	40.8	17	Malawi	27.3
18	Greece	79.7	18	Bulgaria	57.6	18	Cameroon	38.6	18	Tanzania	26.8
19	Italy	79.1	19	Botswana	56.5	19	Pakistan	38.5	19	Ethiopia	26.4
20	United Kingdom	79.0	20	Peru	53.6	20	Cote d'Ivoire	38.0	20	Madagascar	26.3
21	South Korea	77.8	21	Tunisia	52.7	21	Nigeria	34.8	21	Haiti	24.5
22	Israel	77.7	22	Colombia	52.3	22	Yemen	33.3	22	Burundi	22.9
23	Czech Republic	73.5	23	Kazakhstan	51.1	23	Angola	30.5	23	Chad	20.2
24	Poland	72.3	24	Jordan	50.6	24	Senegal	28.8	24	Congo (Dem. Rep.)	18.4
25	Hungary	70.7	25	Ecuador	50.0	25	Zambia	28.5			
26	Slovakia	68.8	26	Dominican Republic	48.1	26	Sudan	27.6			
27	Saudi Arabia	68.7	27	Azerbaijan	44.4						
			28	Algeria	40.5						

## Affordability and financial access

This category measures the ability of consumers to purchase food, their vulnerability to price shocks, and the presence of programmes and policies to support them when shocks occur.

Affordability and financial access is measured across six indicators:

- Food consumption as a proportion of total household expenditure
- Proportion of population living under or close to the global poverty line
- GDP per capita (at purchasing power parity, or PPP, exchange rates)
- Agricultural import tariffs
- Presence of food safety net programmes
- Access to financing for farmers

High food prices are an important cause of food insecurity—but so, too, are low prices, and wide swings in prices may be most damaging of all. Each, in its own way, disrupts markets and price signals, making consumption and production less secure. During the 1980s and 1990s, global food prices reached record lows.<sup>11</sup> Some experts even said food prices were set for long-term decline.<sup>12</sup> Since then, a combination of factors—including an

expanding global population, more expensive food preferences in emerging markets, higher cost of agricultural inputs and lower returns on agricultural productivity—have all pushed prices up. Food economists expect prices to remain high—and volatile—for the foreseeable future.<sup>13</sup> “We will experience higher prices in the next 15–20 years—there is no doubt about it”, says Kostas Stamoulis, director of the agriculture and economics division at the Food and Agriculture Organisation (FAO) and secretary of the Committee on World Food Security. “The question is, what will governments do about it? There is no such thing as the perfect price of food.”

High prices make food less affordable for consumers, particularly in developing countries. Those closest to the **global poverty line** and those for whom **food consumption makes up a significant portion of household expenditure** are the most vulnerable to higher prices; often, they are already eating the cheapest foods, and they have little disposable income. In Cambodia, rice prices doubled between May 2007 and May 2008, plunging many into poverty, particularly the rural poor. Although Cambodia is a net exporter of rice, like many countries with a sizable population near the global poverty line, many consumers are net buyers, even if they farm for a living.<sup>14</sup> According to the Global Food Security Index (GFSI), populations

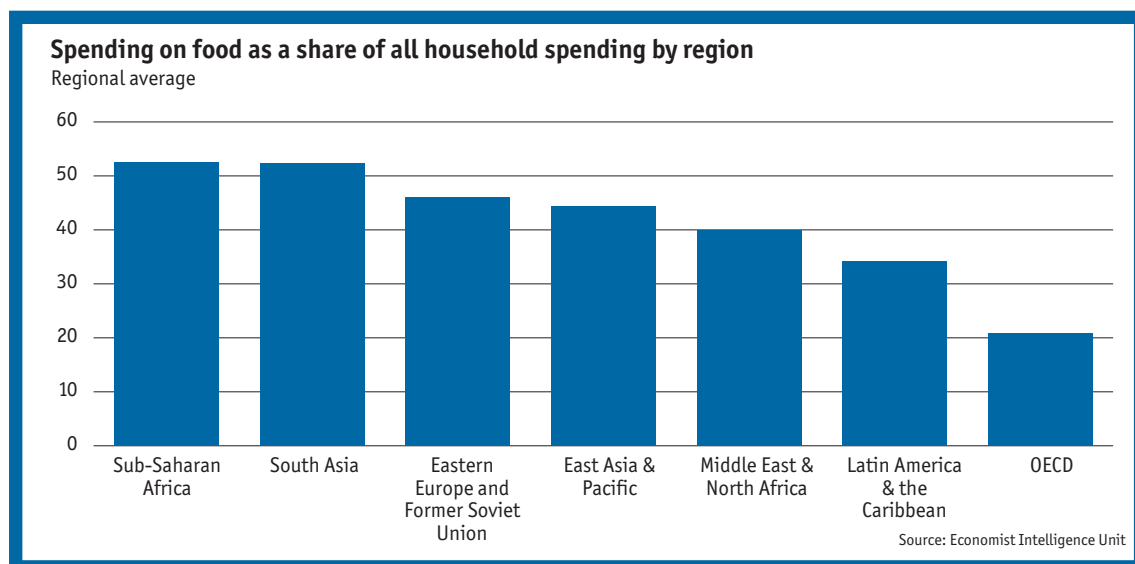
11 *The State of Food Insecurity in the World 2011*, FAO, Rome, 2011, pg 11.

12 *The State of Agricultural Commodity Markets 2004*, 92-5-105133-X (ISBN), FAO, Rome, 2004; “Agriculture commodity prices continue long-term decline”, FAO Newsroom, FAO, Rome/Geneva, February 15, 2005; Interview with Carlos Cafiero of the FAO. Mr Cafiero is a Senior Statistician with the Statistics Division.

13 *The State of Food Insecurity in the World 2011*, FAO, Rome, 2011, pg 11.

14 “Rising Food Prices Discussion Paper”, UNICEF, 2008.

Food economists expect prices to remain high—and volatile—for the foreseeable future, according to the FAO.



in sub-Saharan Africa and South Asia are most vulnerable to high prices. Of the 28 sub-Saharan African countries covered in the index, food consumption accounts for 50% or more of household spending in 20 of them. In South Asia, food costs exceed 45% of spending in four of the five countries covered. Consumers in Democratic Republic of Congo (DRC), Cambodia, and Nepal devote the greatest share of household spending to food—about 70% of household spending. In the Switzerland, New Zealand, and the US, by comparison, only around 7-14% of spending goes to food. Most citizens in these countries can easily divert a share of non-food spending to food, if high prices force them to do so.

Nonetheless, high food prices can also be problematic for advanced economies. A study conducted this year by Craig Gundersen and James P Ziliak found that one in seven elderly people in the US is food insecure—approximately 8.3m people. Although the US ranks second-best in the index for **food consumption as a share of household spending**, the recent economic downturn placed greater strains on a number of households that were not previously at risk.<sup>15</sup>

Low food prices can also cause food insecurity,

<sup>15</sup> C Gundersen and J Ziliak, "Senior Hunger in America 2012: An Annual Report", University of Kentucky Center for Poverty Research, May 2012 via "Great Recession Reflux Amounts to More Hunger Among Seniors", University of Illinois, Department of Agricultural, Consumer and Environmental Sciences: In the News, May 15th 2012.

especially in low-income, agrarian economies. Indeed, economists have been debating for some time whether high or low prices are worse. Recent studies have found that cheap food may put a larger portion of rural poor at risk of food insecurity than was previously believed.<sup>16</sup> Low prices depress smallholder farmers' incomes and disrupt their ability to purchase food. Low prices are also a disincentive to produce, which can hurt crop output in subsequent years.<sup>17</sup> A study conducted by M Ataman Aksoy and Aylin Isik-Dikmelik found that in rural areas, net buyers—those who buy more food than they sell—are often just as negatively affected by low food prices as net sellers. In the nine countries they examined, much of the economic activity in rural areas was tied in some way to farming. Low incomes for farmers meant low incomes for all.<sup>18</sup>

Despite the risks posed by high and low food prices, volatility—sharp swings in the price level—is one of the most significant concerns for short-

<sup>16</sup> M Ravallion, "Do Price Increases for Staple Foods Help or Hurt the Rural Poor?", Policy, Planning and Research Working Paper WPS 167, World Bank, Washington DC, 2011; D Byerlee, R Myers and T Jayne, "Managing Food Price Risks and Instability in an Environment of Market Liberalization", Agriculture and Rural Development Department, World Bank, Washington DC 2005; M A Aksoy and A Isik-Dikmelik, "Are Low Food Prices Pro-Poor? Net Buyers and Sellers in Low-Income Countries", Policy Research Working Paper 4642, World Bank, June 2008.

<sup>17</sup> Interviews with Mr Stamoulis and Mr Cafiero.

<sup>18</sup> M A Aksoy and A Isik-Dikmelik, "Are Low Food Prices Pro-Poor? Net Buyers and Sellers in Low-Income Countries", Policy Research Working Paper 4642, World Bank, June 2008.

Price volatility makes it difficult for small farmers to invest in more efficient agricultural tools.

term food security.<sup>19</sup> According to the World Bank, the 2008 price increase in many food commodities sent 44m people into poverty that were not there previously.<sup>20</sup> Says Mr Stamoulis: “We should not forget that the food crisis of 2008 was a spike in food prices—that is, everything went up very quickly. People were caught by surprise, and there was no time to adjust their production to take advantage of the higher prices, or to adjust their consumption away from expensive foods.”<sup>21</sup> Sudden price changes can often cause poor consumers or suppliers to sell important assets at low prices to maintain food security in the short term. In the longer term, those actions keep families in poverty, and can also inhibit developing countries from making gains in agricultural productivity. Ongoing price volatility reduces incentives for smallholders to invest in more efficient agricultural tools, as they cannot count on a return on their investment.<sup>22</sup>

Policymakers can help farmers mitigate price-related risks by ensuring access to finance. In particular, financing for smallholders can help them invest in productivity-enhancing equipment so they can quickly adjust to low food prices by increasing production.<sup>23</sup> In the index, this is captured through **access to financing for farmers**. Sub-Saharan African countries perform particularly poorly in this area, with all of the countries scoring a 2 or lower on a 4 point scale (where 4 equals the greatest level of farmer financing).

**Food safety nets** are another important risk-coping mechanism. School feeding programmes can keep children from leaving classrooms during a food crisis, and cash transfers may support families during a sudden price increase.<sup>24</sup> Scholars at the International Food Policy Research Institute (IFPRI) and the World Bank also suggest that safety

nets can expand economic growth.<sup>25</sup> A range of programmes are in place globally, and academics continue to debate the efficacy of each type and when they are appropriate. The wide range of models makes it difficult to compare food safety net regimes across countries; nonetheless, most experts agree that they are a critical component of any food insecurity solution. As a result, the Economist Intelligence Unit has constructed a series of standardised benchmarks against which government commitment and non-governmental organisation (NGO) presence can be compared globally.<sup>26</sup> Food safety net regimes were examined for the breadth of services available, the geographic reach of the programmes, and the depth of financing. Comprehensive national programmes are considered the most favourable. An overly strong reliance on donor organisations is considered a weakness, as it indicates that the programmes are subject to external funding. High-income countries scored best on this indicator, as well as several middle-income countries that have invested in national hunger alleviation programmes, such as Brazil.

School feeding initiatives are one particularly popular model for hunger alleviation. In Europe, education and feeding programmes for the poor have existed since the 19th century.<sup>27</sup> Norway, ranked 4th in the affordability category, is one of the European pioneers of school feeding programmes. The well-known “Oslo breakfast”<sup>28</sup> has been provided informally at schools in Norway since 1897. It gained its formal name 30 years later.<sup>29</sup>

Countries in Latin America and East Asia pioneered many of the modern models for safety

19 *The State of Food Insecurity in the World 2011*, FAO, Rome, 2011.

20 “Food price hike drives 44 million people into poverty”, Press Release No. 2011/333/PREM, World Bank, Washington DC, February 15th 2011.

21 Interview with Mr Stamoulis.

22 *The State of Food Insecurity in the World 2011*, FAO, Rome, 2011.

23 Interview with Mr Stamoulis.

24 *The State of Food Insecurity in the World 2011*, FAO, Rome, 2011.

25 H Alderman and J Hoddinott, “Growth-Promoting Social Safety Nets, 2020 Focus Brief on the World’s Poor and Hungry People”, International Food Policy Research Institute (IFPRI), Washington DC, October 2007.

26 “Action Plan on Food Price Volatility and Agriculture”, Ministerial Declaration, Meeting of G20 Agriculture Ministers, Paris, June 2011; S Fan, “Moving from Rhetoric to Action: Priorities to Curtail Price Volatility & Protect the Poor”, IFPRI, Paris, June 23rd, 2011; Interviews conducted by EIU with food security experts.

27 “The National School Lunch Program: Background and Development”, USDA, February 21st 2012.

28 The Oslo breakfast consists of so-called protective foods, such as milk, eggs, citrus fruits and leafy or yellow vegetables, which contain sufficient amounts of vitamins, high quality proteins, and minerals to defend against nutritional deficiency diseases. See *Report of the Conference of FAO-First Session*, FAO Corporate Document Repository, Quebec City: 1945.

29 “The National School Lunch Program: Background and Development”, USDA, February 21st 2012.



net programmes. Mexico's government introduced conditional cash transfers through its PROGRESA programme in the late 1990s.<sup>30</sup> Providing cash to beneficiaries, rather than direct food handouts, empowered the recipients and incentivised certain behaviours, such as regular school attendance and healthcare visits;<sup>31</sup> conditional cash transfer programmes have since proliferated across Latin America, and in parts of Asia and Africa.<sup>32</sup> Seven of the top ten upper-middle income countries for the food safety nets indicator are from Latin America.

Overall, the index shows that food is most affordable in the US and several advanced countries—Switzerland, the Netherlands, and Norway also share the top ranks. Food expenditure

in these countries comprises a low share of total outlays, and strong government programmes support households that are unable to meet their daily food needs.

Costly food and large, vulnerable populations put Nigeria, the Democratic Republic of Congo (DRC), and Chad at the bottom of the index for affordability. The DRC and Chad also lack food safety net programmes to support their at-risk communities. In Chad the World Food Programme runs several large-scale food programmes, yet because a significant share of donor funding goes to conflict affected areas bordering Sudan, programmes in the rest of the country are under-resourced.<sup>33</sup> ■

30 The program has since been superseded by the program Oportunidades.

31 J Berman, "Policy-Oriented Research Impact Assessment (PORIA) Case Study on the International Food Policy Research Institute (IFPRI) and the Mexican PROGRESA Anti-Poverty and Human Resource Investment Conditional Cash Transfer Program", IFPRI, Washington DC, 2007.

32 Interviews conducted by the EIU with food security experts.

33 2010 Annual Evaluation Report, World Food Programme (WFP), Rome, May 2011.

## Availability

This category measures the sufficiency of the national food supply, the risk of supply disruption, national capacity to disseminate food, and research efforts to expand agricultural output.

Availability is measured across five indicators:

- Sufficiency of supply
- Public expenditure on agricultural research and development (R&D)
- Agricultural infrastructure
- Volatility of agricultural production
- Political stability risk

It is often said that the world produces enough food to feed every mouth in it.<sup>34</sup> The Green Revolution of the 1970s ushered in the productivity gains that made this possible. Technology, for example, enabled seeds to absorb more water and fertiliser, expanding crop yields. Those gains, however, are slowing. For the first time since the Green Revolution, global yield growth is increasing at a slower rate than the population.<sup>35</sup> In some places, fertiliser use has reached saturation, and water availability is now much lower than it once was. The combination of slowing returns on technology and the growing global population have made sufficiency of future food supplies uncertain. According to the UN, global food

<sup>34</sup> See the following for just two examples: R Patel, "Can the World Feed 10 Billion People?", *Foreign Policy*, May 4th, 2011; "2012 World Hunger and Poverty Facts and Statistics", World Hunger Education Service.

<sup>35</sup> "How much is enough?", *The Economist*, February 24th 2011.

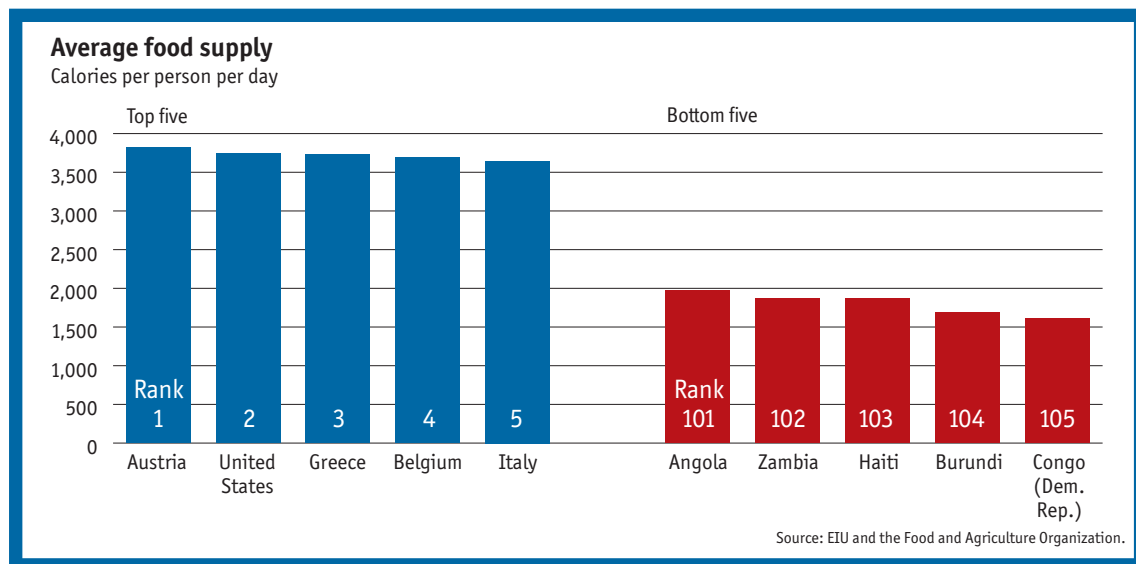
production will need to rise by 50% by 2030 to meet demand.<sup>36</sup>

At its most basic level, food availability is a measure of the supply of food relative to the size of the population. This is captured in the **sufficiency of supply** indicator of the Global Food Security Index (GFSI). Rather than explore specific sources of supply—domestic production versus imports, for example—the Economist Intelligence Unit asked a more basic question: do people have enough to eat? The Food and Agriculture Organisation (FAO) provides reliable estimates of supply available for human consumption—that is, all food available after production, exports and imports—and this was the foundation for our sufficiency of supply assessment. According to the FAO, the average adult needs 2,300 calories per day to lead a healthy and active life.<sup>37</sup> In the US, which ranks first overall in the index, the national food supply is equivalent to 3,748 calories per person per day. The US is outranked only by Austria, where available food is equivalent to 3,819 calories per person per day. Sub-Saharan Africa is the only region where average food supply is below the daily adult requirement.

<sup>36</sup> "UN: 50 percent more food needed by 2030", *Associated Press*, MSNBC, June 3rd 2008.

<sup>37</sup> There are several different daily caloric benchmarks; the most widely used internationally is the FAO benchmark. It is calculated based on an average of normative calorie requirements the FAO calculates for individual countries. Until recently the benchmark was 2,100 calories per day. 2,300 calories reflects the FAO recommendation as of June 2012. Correspondence with Carlo Cafiero, senior statistician with the Statistics Division at FAO.

The national food supply in the US is equivalent to 3,748 calories per person per day.



Food aid from international donors is another source of supply, although the index makes a distinction between emergency or humanitarian aid—which is considered valuable and necessary—and **chronic food aid**, which we treat as evidence of fundamental weakness and policy failures. Chronic dependence on food aid also makes a country subject to donor budgets, and therefore less food secure. According to the IMF, programmatic aid flows are set to slow over the 2011-13 period<sup>38</sup>, making reliance on food aid even more problematic in the short term. The countries most dependent on food aid are among the poorest in Latin America, sub-Saharan Africa and South Asia. Bangladesh is one of the largest recipients of food aid, receiving 180,000 tonnes in 2010.

Extreme weather in Russia, Pakistan and Australia in recent years illustrates the threat that natural phenomena can pose to food supplies. The index measures these risks through **volatility of agricultural production**. The standard deviation in annual growth rates was calculated to measure the stability of crop production year on year (that is, the average difference between the growth rate in a given year and the average growth rate over the period analysed). China experienced the least volatility of agricultural production during the last

20 years, and three North African countries—Algeria, Morocco and Tunisia—among the greatest. Low production volatility in China is in part a result of geographic size, and in part owing to the fact that grain production is heavily incentivised. The Chinese government, for example, sets a minimum purchasing price higher than market rates to encourage grain growth. Recently, the government began moving away from this practice by paying direct subsidies to farmers.

One mechanism for managing shocks like extreme weather is investment in agricultural technology. Technology can also help farmers increase crop yields, reduce vulnerability to climate change, and improve nutritional outcomes.<sup>39</sup> It is difficult to generalise about yield gaps because conditions are so country-specific, but research at a field in the UK's Rothamsted Research station illustrates the extent to which more productive inputs can increase yields. The Broadbank field at the research station is cultivated using three different levels of technology. One section is tilled using state-of-the-art inputs—high quality seeds, fertilisers, plant protection products and husbandry. The second uses technology popular at the start of the Green Revolution. The third is tilled without any fertilizer, pesticides or other additive technology. The yield difference between the

China experienced less volatility in agricultural production over the past 20 years than any other country in the index.

<sup>38</sup> Disbursements of programmatic aid are expected to decline by 0.2% per year, according to donor plans for the forecast period. *Global Monitoring Report 2012*, IMF and World Bank, Washington DC, 2012, pg 9.

<sup>39</sup> Expert panel discussions, Chicago Council event, "Advancing Food and Nutrition Security at the 2012 G8 Summit," May 18th 2012.

## Women and food security

Experts agree that women are a critical part of expanding agricultural output, particularly in sub-Saharan Africa. Indeed, the Global Food Security Index (GFSI) shows a 0.93 correlation with the Economist Intelligence Unit's Women's Economic Opportunity Index, a measure of the global environment for female economic participation. The Food and Agriculture Organisation (FAO) estimates that if women had access to the same productive resources as men—better seeds, fertilisers and fungicides—they could increase their yield by 20–30%. As women make up 43% of the world's farmers, this would increase total agricultural output in developing countries by 2.5% to 4%, and reduce hunger globally by 12% to 17%, according to the FAO.

highest and lowest-technology segment was between 80% and 90%.<sup>40</sup>

In the GFSI, public-sector efforts to improve agricultural technology are measured through **public expenditure on agricultural R&D as a percentage of agricultural GDP**.<sup>41</sup> The indicator we chose was the best available across 105 countries. Carlo Cafiero, a senior statistician in the Statistics Division at the FAO, explains the importance of agricultural R&D, even in times of plenty. "Usually the results from investment in research and technology within agriculture come with a considerable time delay. So now, we are facing considerable problems because in the '80s and '90s the investment in public agriculture was particularly low; prices were low, so there was little incentive for research. And now... we cannot benefit from the increase in production that could have occurred if there had been more investment in the '80s and '90s."<sup>42</sup>

High-income countries perform best on R&D indicators, particularly Denmark, Norway, South Korea and France, where expenditure on agricultural research is equal to more than 4% of agricultural output. Some high scores, such as Botswana's, may reflect lower agricultural output rather than greater expenditure on agricultural R&D, and should be considered in context.<sup>43</sup> Sub-Saharan Africa performs well as a region on this

40 J Parker, "The 9 billion people question", *The Economist*, February 24th 2011.

41 Ideally, we would have measured private as well as public research and development (R&D) spending, but private data were not available for the large number of countries covered in the index.

42 Interview with Mr Cafiero.

43 N M Beintema and G J Stads, "African Agricultural R&D in the New Millennium: Progress for Some, Challenges for Many", Food Policy Report, IFPRI, Washington, DC, February 2011, pg 7.

indicator. A recent study shows that productivity returns on agricultural R&D are highest in the poorest countries—many of which are concentrated in sub-Saharan Africa.<sup>44</sup>

Even with expanding productivity, farmers also need access to markets to be able to sell their crops. Food experts often note that smallholders could contribute significantly to the global food supply if they had access to larger markets.<sup>45</sup> The **agricultural infrastructure** indicator measures access to markets through roads and ports, as well as assessing crop storage.

Within the agricultural infrastructure indicator, port infrastructure—or access to ports for landlocked countries—is considered. This is particularly relevant to food security, as recent research has shown that small landlocked countries are more vulnerable to food price shocks.<sup>46</sup> Several World Bank studies have also found that landlocked countries can experience greater unpredictability in transport time and be subject to significant rent-seeking activities, both of which could make food availability costlier and more challenging.<sup>47</sup> Landlocked countries were therefore scored based on their ability to access ports through rivers and other means, taking into account delays and other obstacles to transporting goods to those ports.

44 C Thirtle, L Lin and J Piesse, "The Impact of Research Led Agricultural Productivity Growth in Africa, Asia, and Latin America", *World Development*, Vol. 31, No. 12, December 2003, pgs 1,959–1,979.

45 Expert panel discussions, Chicago Council event, "Advancing Food and Nutrition Security at the 2012 G8 Summit", May 18th 2012.

46 *The State of Food Insecurity in the World 2011*, FAO, Rome, 2011.

47 J F Arvis, G Raballand and J F Marteau, "The cost of being landlocked: logistics costs and supply chain reliability", Policy Research Working Paper, World Bank, January 2007; N Christ and M Ferrantino, "Land Transport for Export: The Effects of Cost, Time, and Uncertainty in Sub-Saharan Africa", Office of Economics Working Paper, US International Trade Commission, Washington DC, February 8th 2011; "Landlocked Countries: Higher Transport Costs, Delays, Less Trade", World Bank, Website, June 16th 2012.

However, even considering such obstacles, landlocked countries on the whole were not significantly less food secure than those with ports. The 22 landlocked countries evaluated in the index scored, on average, just seven points lower than countries with a coastline. Kostas Stamoulis, director of the agriculture and economics division at the FAO and secretary of the Committee on World Food Security, explains: "It is a matter of mobilisation of resources and development. There is no reason why landlocked countries should do significantly worse than countries that are not landlocked".<sup>48</sup>

Overall, Denmark, Norway and France score the best in the availability category. Notably, none of them rank in the top ten for sufficiency of food supply. Instead, they do well in spending on agricultural research, agricultural infrastructure and political stability risk, suggesting that investment in agriculture and good governance are important drivers of availability. The Democratic Republic of Congo, Chad, and Haiti finish at the bottom, with low scores on every indicator except production volatility. ■

<sup>48</sup> Interview with Mr Stamoulis.

## Quality and safety

This category measures what is sometimes called “utilisation” in food security parlance. It assesses the variety and nutritional quality of average diets, as well as the safety of food.

Food quality and safety is measured across five indicators:

- Diet diversification
- Government commitment to increasing nutritional standards
- Micronutrient availability
- Protein quality
- Food safety

Poor nutrition is a concern for wealthy and poor countries alike. Nutrition, not included in earlier definitions of food security, is now widely recognised as important, particularly in the 1,000 days between the start of a woman’s pregnancy and her child’s second birthday.<sup>49</sup> Bibi Giyose, a senior advisor for food and nutrition security at the New Partnership for Africa’s Development (NEPAD), explains: “The first two years are critical to determining how a child will be able to function in society. After two years, the damage is done, and you are putting out fires. It is very hard to reverse the damage of malnutrition”. Research has shown that poor nutrition at a young age, even temporarily as a result of higher food prices, can harm a child’s cognitive development.

<sup>49</sup> Series on Maternal and Child Undernutrition, *The Lancet*, January 16th 2008.

Malnourished children are more likely to drop out of school, and World Bank research shows they have a 10% lower lifetime earning potential<sup>50</sup>. Indeed, malnutrition costs some poor countries national income equivalent to 2-3% of GDP each year.<sup>51</sup>

Poor nations are not the only ones suffering. Malnutrition is a financial burden for healthcare systems in many advanced economies. In the UK, researchers estimate that malnutrition and associated diseases raise domestic healthcare costs by £7.3bn (US\$11.7bn) annually.<sup>52</sup> In the US, hunger inflates healthcare costs by an estimated US\$130.5bn a year.<sup>53</sup> Obesity is also becoming recognised as a form of malnutrition.<sup>54</sup> At the 2009 rate of obesity growth in the US, 103m people are expected to be obese in 2018, with associated healthcare costs of US\$344bn.<sup>55</sup>

<sup>50</sup> “Repositioning Nutrition As Central to Development”, International Bank for Reconstruction and Development (IBRD), World Bank, Washington DC, 2006.

<sup>51</sup> “Repositioning Nutrition As Central to Development”, IBRD, World Bank, Washington DC, 2006.

<sup>52</sup> M Elia (chairman & editor), R Stratton, C Russell, C Green and F Pan, “The cost of disease-related malnutrition in the UK and economic considerations for the use of oral nutritional supplements (ONS) in adults”, British Association for Parenteral and Enteral Nutrition (BAPEN), 2006; “Malnutrition costs the UK more than £7.3 billion of actual expenditure each year—double the projected £3.5 billion cost of obesity”, BAPEN, December 14th 2005.

<sup>53</sup> D Shepard, E Setren and D Cooper, “Hunger in America: Suffering We All Pay For”, Center for American Progress: Washington DC, October 2011.

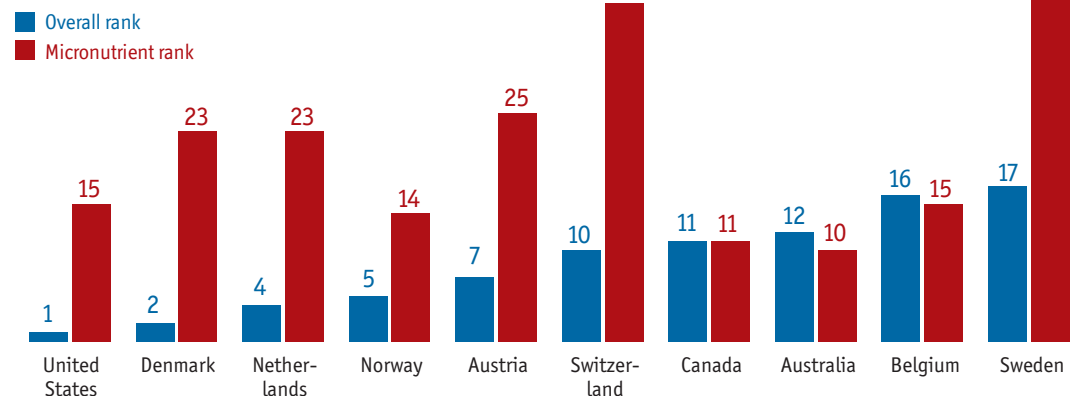
<sup>54</sup> World Hunger, 2012 World Hunger and Poverty Facts and Statistics; *The Economist*, “The nutrition puzzle” Feb 18th 2012.

<sup>55</sup> A collaborative report from United Health Foundation, the American Public Health Association and Partnership for Prevention Based on research by Kenneth E Thorpe, PhD of Emory University, *The Future Costs of Obesity: National and State Estimates of the Impact of Obesity on Direct Health Care Expenses*, November 2009.



### Micronutrient availability vs overall rank

(Lower number indicates better result)



Source: Economist Intelligence Unit

Vitamin A and iron deficiencies are among the most common micronutrient gaps:<sup>56</sup> their availability in national food supplies is assessed under **micronutrient availability**. While micronutrient deficiencies are a significant problem in poor countries, wealthier nations struggle as well. None of the ten richest nations, as measured by GDP per capita, finish in the top ten for micronutrient availability, with the exception of Australia. Nearly all high-income countries have ample levels of vitamin A in their diets, but they are significantly lacking in iron from vegetables and vegetable products. Developing countries have higher iron availability from vegetal sources, which is all non-animal products. Policies that address nutrition deficiencies are generally effective. Analysis of individual cases consistently shows at least a 1:2 cost-benefit ratio, including breastfeeding promotion, vitamin A supplements, and salt iodisation.<sup>57</sup> Vitamin A supplements are particularly cheap, at 15 US cents per person, and are widely used. Iron supplements cost US\$10-50 per capita per year.<sup>58</sup>

<sup>56</sup> WHO, "Micronutrient deficiencies", WHO website. EIU interviews with nutrition experts.

<sup>57</sup> *Global Monitoring Report 2012*, IMF and World Bank, Washington DC, 2012.

<sup>58</sup> *Global Monitoring Report 2012*, IMF and World Bank, Washington DC, 2012.

**Protein quality**, another indicator in this category, correlates very highly with overall food security. To provide a comprehensive assessment of protein intake—one that includes protein absorbed from foods, such as legumes, whole grains, meat and dairy—the Economist Intelligence Unit uses a unique quantitative assessment of protein quality in diets. It is calculated by assessing the presence of nine essential amino acids in the average national diet. This allows the index to account for protein gained from non-animal sources, which is important in many countries where meat-eating is not widespread. Three Mediterranean countries—Israel, Greece and Portugal—fare best on this indicator. Latin American countries also do well, particularly upper middle income countries.

Diet diversification is often promoted as one solution to micronutrient deficiencies and lack of protein. Ms Giyose explains: "Supplements—such as vitamin A—have been... shown to be the most efficient way of preventing malnutrition. However, food-based solutions and diet diversity are more sustainable over the long-term, as they enhance the breadth of production in a society".

Conversely, poor **diet diversification** often indicates a lack of sufficient nutrients. The problem is most acute in South Asia, according to the index rankings. In Bangladesh, for example, rice makes up 60% of food consumption, and nearly 50% of

children were moderately or severely underweight in 2005.<sup>59</sup> In Nepal, also one of the lowest ranked in this category, consumption is diversified more broadly across wheat, rice and maize, yet carbohydrates still make up 74% of overall caloric intake. Research has shown that successful interventions among the rural poor include a combination of crop diversification, use of indigenous food plants and promoting nutritional awareness in schools.<sup>60</sup>

Diet diversity presents a different set of issues in emerging and advanced economies. Residents of wealthy countries, and increasingly of emerging ones, consume large quantities of processed foods that do not fill most nutritional needs. That economic development leads to a “nutrition transition”—a shift in consumption patterns, work and leisure habits that often results in high-fat and sugar-rich diets and less exercise—has been known for some time.<sup>61</sup> In some regions, the problem is accelerating. In many Arab countries, diets are increasingly stratified between the wealthy and the poor, and obesity is on the rise.<sup>62</sup> Diets are still the most diverse in North America and Western Europe, with the Netherlands, Switzerland and the US topping the index.

Poor nutritional quality can be addressed through better information and frequent

monitoring of **nutritional standards** and **food safety**. We consulted with the World Health Organisation (WHO) to identify appropriate metrics for nutritional standards, while the organization is independently in the process of developing a more comprehensive measure of “nutritional governance”. For food safety, we created a new indicator that considers the presence of regulated food markets, the existence of a government entity to regulate such markets and accessibility of potable water. In sub-Saharan Africa, for example, the presence of aflatoxins—a carcinogenic toxin produced by mould—in maize and peanuts has made food safety a particular issue. Sub-Saharan Africa does by far the poorest of any region in food safety, scoring 33 points less than the next region above it.

Overall, high micronutrient availability and good protein quality put Israel at the top of the quality and safety category. France finished second, performing even better than Israel in micronutrient availability, with a high degree of iron availability through animal foods. The US ranks third, with high diet diversification and strong protein quality. Togo, Ethiopia and the Democratic Republic of Congo rank at the bottom; all three lack even basic national nutritional guidelines. ■

59 G L Khor, “Food based approaches to combat the double burden among the poor: Challenges in the Asian context”, *Asia Pacific Journal of Clinical Nutrition*, Vol. 17 (suppl 1), 2008, pgs 111-115.

60 “Malawi: Diet diversification answer to food insecurity”, IRIN, April 4th 2006; G L Khor, “Food based approaches to combat the double burden among the poor: Challenges in the Asian context”, *Asia Pacific Journal of Clinical Nutrition*, Vol. 17 (suppl 1), 2008, pgs 111-115.

61 A Drenowski and BM Popkin, “The nutrition transition: new trends in the global diet”, *Nutrition Reviews*, Vol. 55, No. 2, 1997, pgs 31-43; “Global and regional food consumption patterns and trends”, sub-section of *Diet, nutrition and the prevention of chronic diseases: Report of the joint WHO/FAO expert consultation*, WHO Technical Report Series, No. 916.

62 *Arab Human Development Report 2009*, UN Development Programme, New York, 2009, pg 12.

# Appendix: Methodology

The Global Food Security Index (GFSI) is a comprehensive assessment of the drivers of food security. The index analyses the issue across three internationally designated dimensions:<sup>1</sup> affordability, availability and utilisation—the last of which the Economist Intelligence Unit calls “quality and safety”. It is a dynamic, qualitative and quantitative benchmarking model, which adjusts for the monthly impact of global food prices.

## Indicator selection

We worked closely with a team of food security experts to identify the key determinants of food security and to select appropriate categories and indicators. We convened this panel of food security specialists in February 2012, to help select and prioritise food security indicators through a transparent and robust methodology. The panel reviewed the model framework, selection of indicators, weighting and overall construction of the index.

Three category scores are calculated from the weighted mean of underlying indicators and scaled from 0–100, where 100=most favourable. These categories are: affordability, availability, and quality and safety. The overall score for the GFSI (from 0–100) is calculated from a simple weighted average of the category and indicator scores.

<sup>1</sup> *Rome Declaration on World Food Security*, FAO Corporate Document Repository, Rome, November 1996; WHO, “Food security”, WHO website.

The categories and indicators are:

### 1. Affordability

- 1.1 Food consumption as a share of household expenditure
- 1.2 Proportion of population under the global poverty line
- 1.3 Gross domestic product per capita
- 1.4 Agricultural import tariffs
- 1.5 Presence of food safety net programmes
- 1.6 Access to financing for farmers

### 2. Availability

- 2.1 Sufficiency of supply
  - 2.1.1 Average food supply in kcal/capita/day
    - 2.1.2.1 Dependency on chronic food aid
- 2.2 Public expenditure on agricultural research and development
- 2.3 Agricultural infrastructure
  - 2.3.1 Existence of adequate crop storage facilities
  - 2.3.2 Road infrastructure
  - 2.3.3 Port infrastructure
- 2.4 Volatility of agricultural production
- 2.5 Political stability risk

### 3. Quality and safety

- 3.1 Diet diversification
- 3.2 Nutritional standards
  - 3.2.1 National dietary guidelines
  - 3.2.2 National nutrition plan or strategy
  - 3.2.3 Nutrition monitoring and surveillance

- 3.3 Micronutrient availability
  - 3.3.1 Dietary availability of vitamin A
  - 3.3.2 Dietary availability of animal iron
  - 3.3.3 Dietary availability of vegetal iron
- 3.4 Protein quality
- 3.5 Food safety
  - 3.5.1 Agency to ensure the safety and health of food
  - 3.5.2 Percent of population with access to potable water
  - 3.5.3 Presence of formal grocery sector

Data for the quantitative indicators are drawn from national and international statistical sources. Where datasets had missing values, we constructed estimates. Some qualitative indicators have been created by the EIU specifically for this index, based on information from development banks and government websites; others have been drawn from a range of surveys and data sources and adjusted by us.

The main sources used in the GFSI are the Economist Intelligence Unit's proprietary database; the World Bank Group; the IMF; the Food and Agriculture Organisation (FAO), the UN Development Programme (UNDP), the World Health Organisation (WHO); the World Trade Organisation (WTO); the World Food Programme (WFP); Agricultural Science and Technology Indicators (ASTI); the International Food Research Policy Institute (IFPRI); and national statistical offices.

### Food price adjustment factor

Food prices play an integral role in food security by affecting affordability. High food prices have the greatest impact in developing countries, where the poor typically spend a large share of their income on food, and where a price spike can significantly reduce food consumption. While food producers may benefit from price increases, and thus higher

incomes, this is typically a medium- to-long-run phenomenon and is not considered for the purpose of our index.

To measure the effect of food prices on affordability, we will apply a food price adjustment factor to each country's affordability score in the GFSI. This factor will be based on changes in global food prices, as measured by the FAO global food price index. To capture other elements of affordability, we will adjust the change in the FAO index by each country's change in income per head—as forecast by the Economist Intelligence Unit.

We will then multiply this adjusted FAO food price change by what we call the local "food price pass-through rate". We define this rate as the ratio of the change in local food prices to the change in global food prices between 2000 and 2011. If local food prices for Country X rose by 20% of the FAO index change during the historical period, we will assume, going forward, a 20% pass-through of global prices. The size of the pass-through factor will be capped at 100% of the FAO global change, so that in no case would any country's price factor be multiplied by more than one.

It is our intention to adjust each country's starting score in the GFSI—as reflected in the scores in the table on page 10—beginning in late 2012. We will adjust the score quarterly, using the modified change in the monthly FAO food price index, as modified by us. Over time, countries scores will improve if food prices fall, and deteriorate if prices rise. The country-specific adjustments we will make to the FAO index—to income growth and the historical price pass-through factor—will result in different levels of adjustment, with vulnerable countries hurt the most by rising prices and wealthy countries hurt the least.

## Country selection

The 105 countries in the index were selected based on regional diversity, economic importance, and size of population. They are:

East Asia & Pacific	Europe & Central Asia	Latin America & Caribbean	Middle East & North Africa	North America	Sub-Saharan Africa	South Asia
Australia	Austria	Argentina	Algeria	Canada	Angola	Bangladesh
Cambodia	Azerbaijan	Bolivia	Egypt	United States	Benin	India
China	Belarus	Brazil	Israel		Botswana	Nepal
Indonesia	Belgium	Chile	Jordan		Burkina Faso	Pakistan
Japan	Bulgaria	Colombia	Morocco		Burundi	Sri Lanka
Malaysia	Czech Republic	Costa Rica	Saudi Arabia		Cameroon	
Myanmar	Denmark	Dominican Republic	Syria		Chad	
New Zealand	Finland	Ecuador	Tunisia		Congo (Dem. Rep.)	
Philippines	France	El Salvador	Yemen		Cote d'Ivoire	
South Korea	Germany	Guatemala			Ethiopia	
Thailand	Greece	Haiti			Ghana	
Vietnam	Hungary	Honduras			Guinea	
	Italy	Mexico			Kenya	
	Kazakhstan	Nicaragua			Madagascar	
	Netherlands	Panama			Malawi	
	Norway	Paraguay			Mali	
	Poland	Peru			Mozambique	
	Portugal	Uruguay			Niger	
	Romania	Venezuela			Nigeria	
	Russia				Rwanda	
	Serbia				Senegal	
	Slovakia				Sierra Leone	
	Spain				South Africa	
	Sweden				Sudan	
	Switzerland				Tanzania	
	Tajikistan				Togo	
	Turkey				Uganda	
	Ukraine				Zambia	
	United Kingdom					
	Uzbekistan					

## Weighting

The weighting assigned to each category and indicator can be changed to reflect different assumptions about their relative importance. Two sets of weights are provided in the index. The first option, called neutral weights, assumes equal importance of all indicators and evenly distributes weights. The second option, called peer panel weights, averages the suggested weights from five members of an expert panel. The expert weights are the default weights in the model.

## Data modelling

Indicator scores are normalised and then aggregated across categories to enable a comparison of broader concepts across countries. Normalisation rebases the raw indicator data to a common unit so that it can be aggregated. The indicators where a higher value indicates a more favourable environment for food security—such as gross domestic product per capita or average food supply—have been normalised on the basis of:

$$x = (x - \text{Min}(x)) / (\text{Max}(x) - \text{Min}(x))$$

where  $\text{Min}(x)$  and  $\text{Max}(x)$  are, respectively, the lowest and highest values in the 105 economies for any given indicator. The normalised value is then transformed from a 0-1 value to a 0-100 score to make it directly comparable with other indicators. This in effect means that the country with the highest raw data value will score 100, while the lowest will score 0.

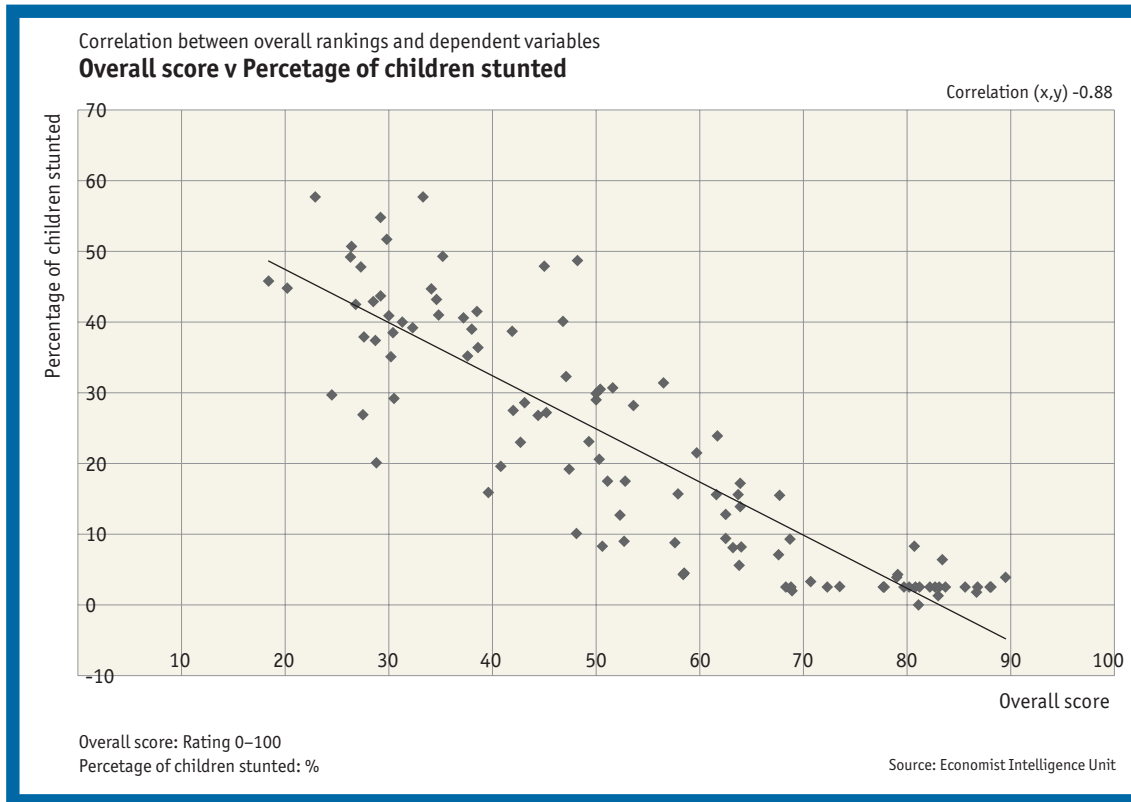
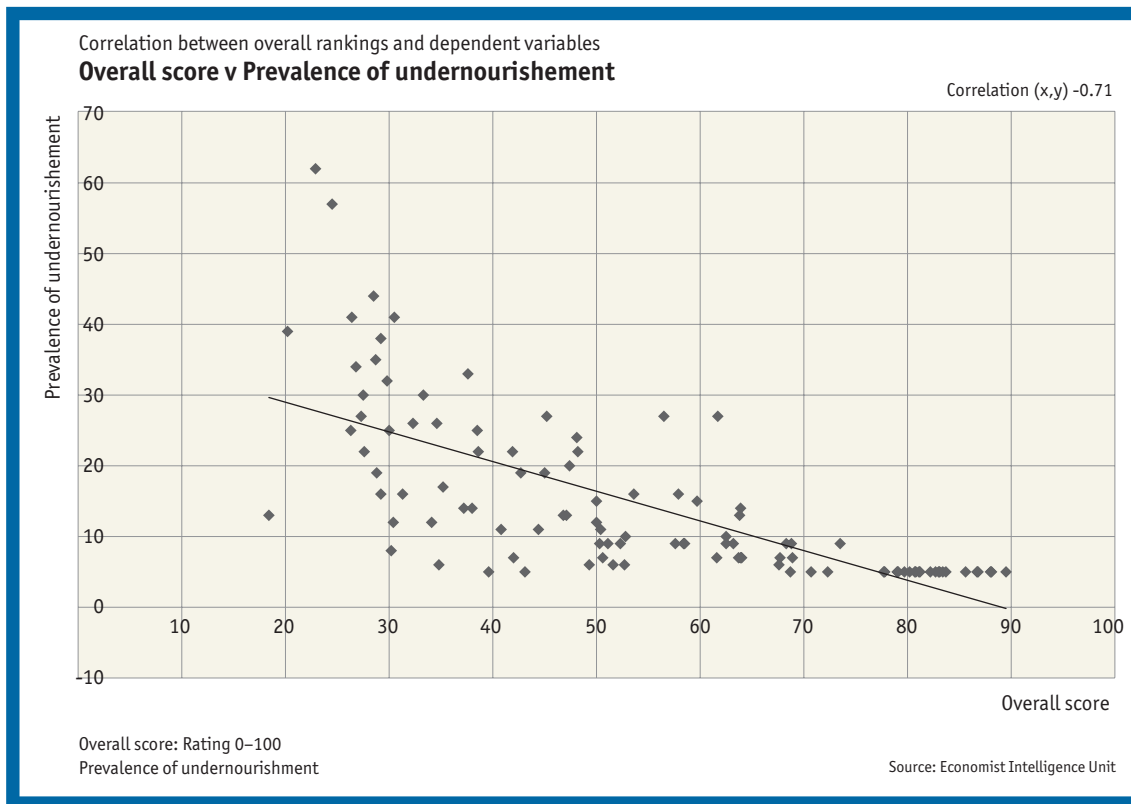
For the indicators where a high value indicates an unfavourable environment for food security—such as volatility of agricultural production or political stability risk—the normalisation function takes the form of:

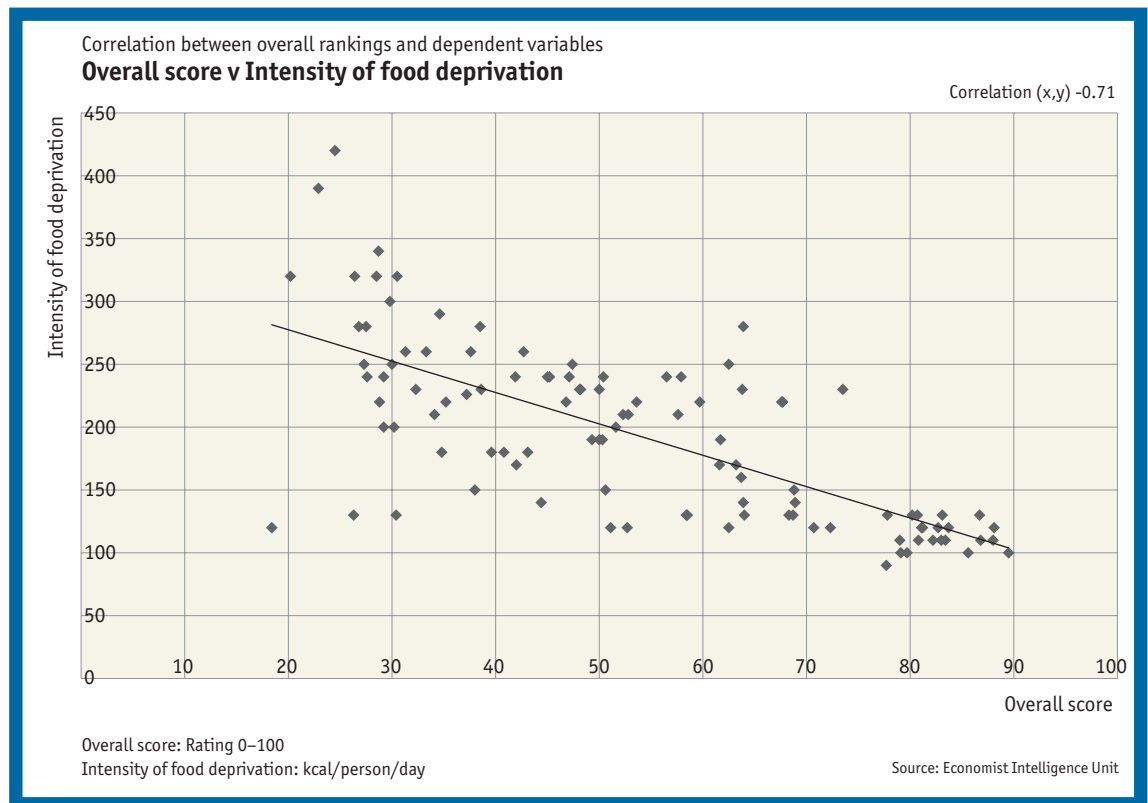
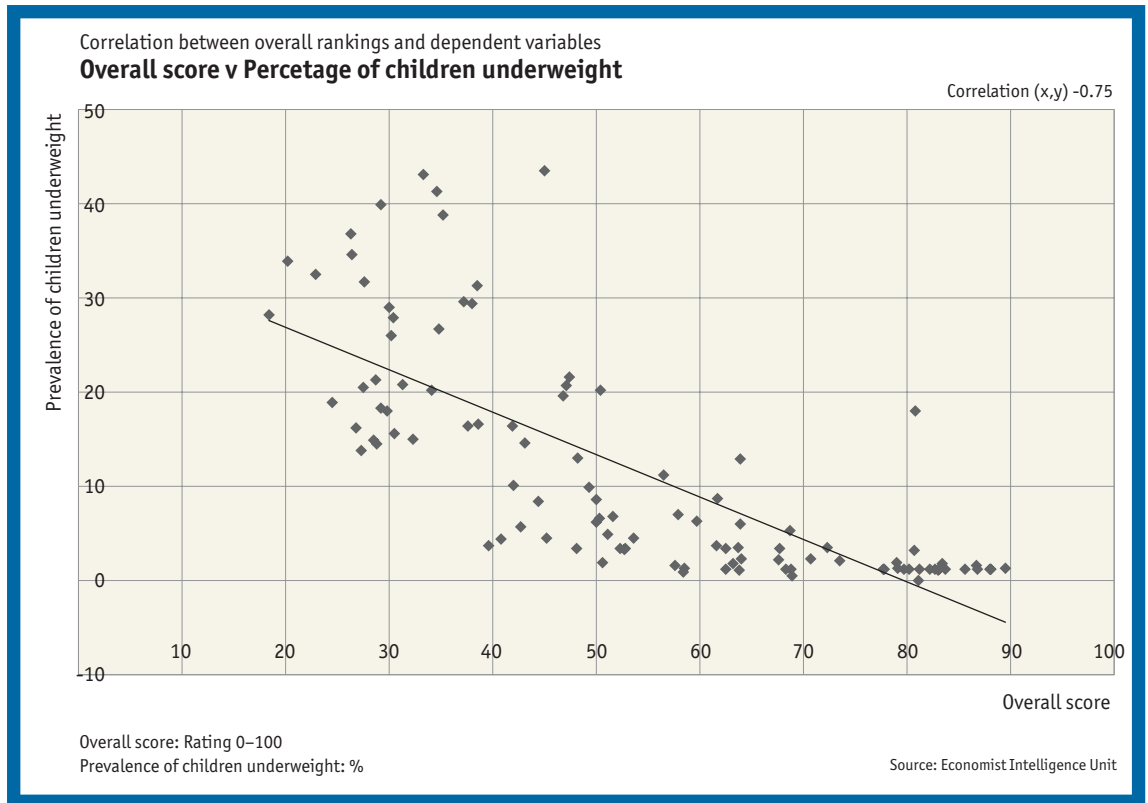
$$x = (x - \text{Max}(x)) / (\text{Max}(x) - \text{Min}(x))$$

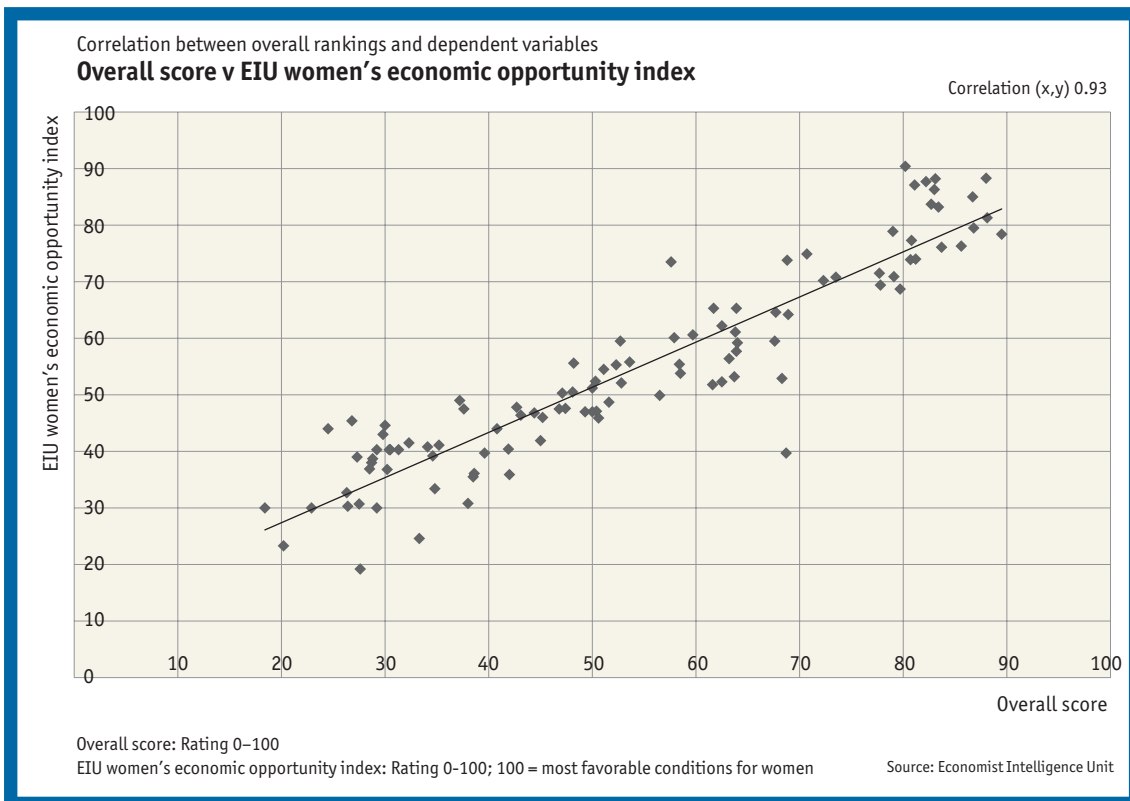
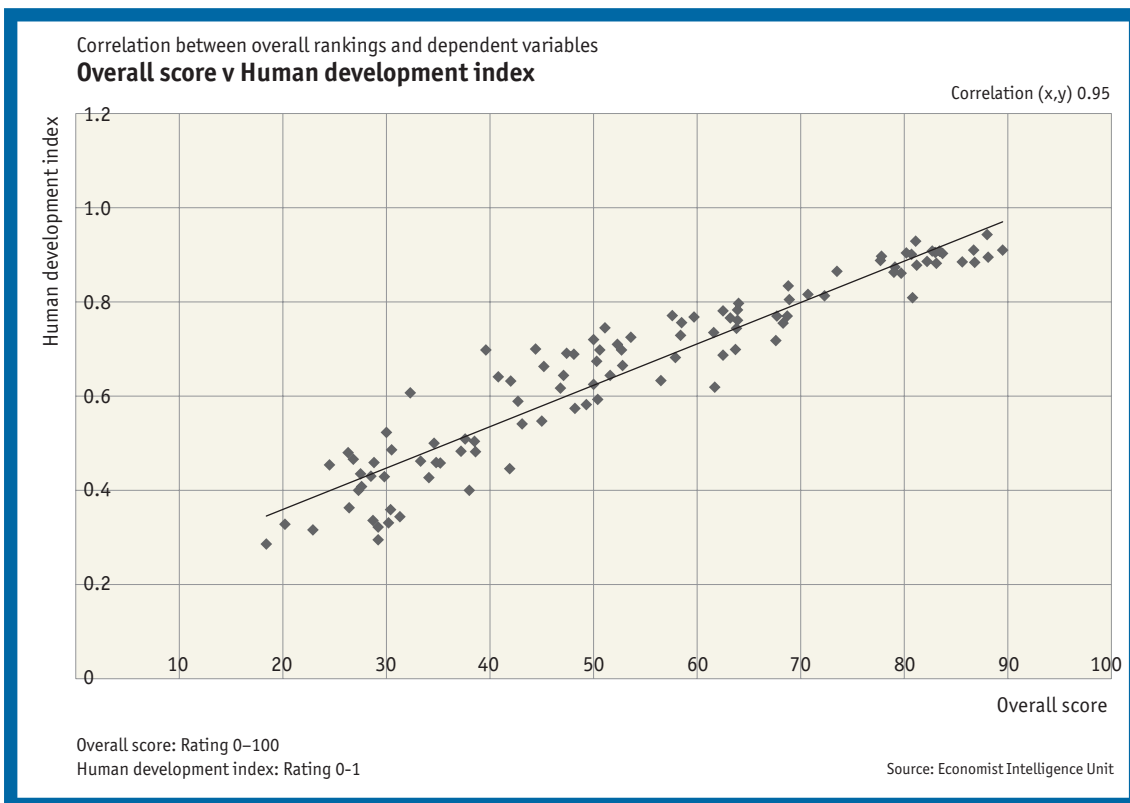
where  $\text{Min}(x)$  and  $\text{Max}(x)$  are, respectively, the lowest and highest values in the 105 economies for any given indicator. The normalised value is then transformed into a positive number on a scale of 0-100 to make it directly comparable with other indicators.

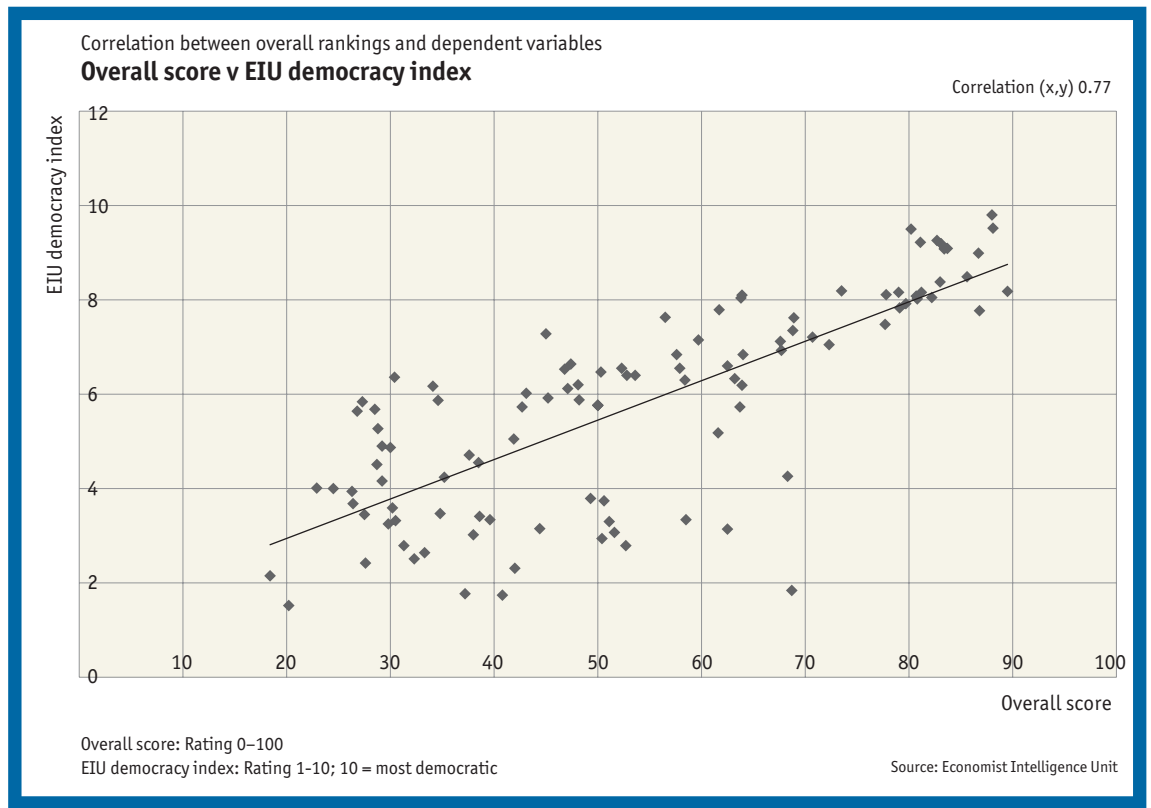


## Scattergraphs: Correlation between overall rankings and dependent variables









## Scoring criteria and definitions

Where the quantitative or survey data have missing values, the Economist Intelligence Unit has estimated the scores.

Indicator	Source	Year	Indicator definitions and construction
<b>1) Affordability</b>			
Food consumption as a proportion of total household expenditure	FAO	Latest available year between 2002 and 2010	This indicator measures the share of household expenditure that is spent on food at a national average.
Proportion of population living under or close to the global poverty line	World Bank	Latest available year between 2001 and 2011	This indicator measures the percentage of the population living on under US\$2/day in purchasing power parity (PPP) terms.
Gross domestic product per capita (at PPP exchange rates)	EIU; World Bank; IMF	2011	This indicator measures the average individual income and, hence, the ability to afford food.
Agricultural import tariffs	WTO	2010	This indicator measures the average applied most favoured nation (MFN) tariffs on agricultural imports.
Presence of food safety net programmes	Qualitative scoring by EIU analysts	2011	<p>This indicator measures public initiatives to protect the poor from food-related shocks. This indicator considers food safety net programmes, including in-kind food transfers, conditional cash transfers (that is, food vouchers), and the existence of school feeding programmes by the government, non-governmental organisations (NGOs), or the multilateral sector. It is measured on a 0-4 scale based on the prevalence and depth of food safety net programmes.</p> <p>0=Minimal evidence of food safety net programmes or programmes are run only by NGOs or multilaterals. Emergency food aid programmes funded by multilaterals or NGOs are not considered.</p> <p>1=Moderate presence of food safety net programmes, but mainly run by NGOs or multilaterals. Depth and/or prevalence are inadequate.</p> <p>2=Moderate prevalence and depth of food safety net programmes run by governments, NGOs or multilaterals.</p> <p>3=National coverage, with very broad, but not deep, coverage of food safety net programmes.</p> <p>4=National government-run provision of food safety net programmes. Presence of NGOs or multilaterals is not critical to national coverage.</p>
Access to financing for farmers	Qualitative scoring by EIU analysts	2011	<p>This indicator measures the availability of financing for farmers. This indicator is scored on a 0-4 scale based on the depth and range of farmer financing.</p> <p>0=Developing economy with no access to government or multilateral farmer financing programmes.</p> <p>1=Developing economy with limited multilateral or government farmer financing programmes.</p> <p>2=Emerging market with some multilateral or government financing.</p> <p>3=Emerging market with well developed multilateral farmer financing programmes OR developed economy with broad, but not deep, farmer financing.</p> <p>4=Advanced economy with access to deep farmer financing.</p>

Indicator	Source	Year	Indicator definitions and construction
<b>2) Availability</b>			
Sufficiency of supply	FAO and WFP	2006-10	This is a composite indicator that measures food availability through food supply in kcal/capita/day and levels of food aid.
Average food supply	FAO	2007	This indicator measures the estimated per capita amount of food available for human consumption in kcal/capita/day.
Dependency on chronic food aid	WFP	2006-10	This indicator measures whether a country is a recipient of chronic food aid. For the purpose of this index, chronic aid recipients are defined as those countries that have received non-emergency food aid over a five-year time span. It is measured on a 0-2 scale. 0=Receives chronic food aid on an increasing basis over the last 5 years. 1=Receives chronic food aid on a decreasing basis over the last 5 years. 2=Receives little to no food aid or only on an emergency basis.
Public expenditure on agricultural research & development (R&D)	ASTI; EIU estimates based on OECD, World Bank, ASTI, and EIU data	Latest available year between 2000 and 2010	This indicator is a proxy for agricultural innovation and technology that increases market efficiency and access. It is measured as a percentage of agricultural GDP and is scored on a nine-point scale. 1= 0-0.5% 2= 0.51-1% 3= 1.01-1.5% 4= 1.51-2% 5= 2.01-2.51% 6= 2.51-3% 7= 3.01-3.5% 8= 3.51-4% 9= 4.01-4.50%
Agricultural infrastructure	EIU Risk Briefing; World Bank, National agricultural ministries	2011-12	This is a composite indicator that measures the ability to store and transport crops to market. Sub-indicators include: <ul style="list-style-type: none"> <li>• existence of adequate crop storage facilities;</li> <li>• extent and quality of road infrastructure; and</li> <li>• quality of ports' infrastructure.</li> </ul>
Existence of adequate crop storage facilities	Qualitative scoring by EIU analysts based on documents from the World Bank and national agricultural ministries	2012	This binary indicator assesses the presence of sufficient crop storage facilities based on size of agricultural sector and population. It is measured on a 0-1 scale. 0=No 1=Yes
Road infrastructure	EIU Risk Briefing	2011	This qualitative indicator measures the extent and quality of road infrastructure and is measured on a 0-4 scale, where 4=best.
Port infrastructure	EIU Risk Briefing	2011	This qualitative indicator measures the quality of ports' infrastructure and is measured on a 0-4 scale, where 4=best.

Indicator	Source	Year	Indicator definitions and construction
Volatility of agricultural production	FAO	1990-2010	This indicator measures the standard deviation of the annual growth of agricultural production over 20 years.
Political stability risk	EIU Risk Briefing	2011	This indicator measures whether political instability has affected access to food (that is, has it cut off food transportation, reduction in food aid from other countries, and other factors). It is measured on a 0-100 scale, where 100=highest risk.

### 3) Quality and Safety

Diet diversification	FAO	2005-07	This indicator measures the share of non-starchy foods (all but cereals, roots and tubers) in total dietary energy consumption. A larger share of non-starchy foods signifies a greater diversity of food groups in the diet.
Government commitment to increasing nutritional standards	Qualitative scoring by EIU analysts based on WHO, FAO, and national health ministry documents	2012	This is a composite indicator that measures nutrition governance. It is comprised of a set of binary sub-indicators as follows: <ul style="list-style-type: none"> <li>• existence of national dietary guidelines;</li> <li>• existence of national nutrition plan or strategy; and</li> <li>• existence of regular nutrition monitoring and surveillance.</li> </ul>
National dietary guidelines	Qualitative scoring by EIU analysts based on WHO, FAO and national health ministry documents	2012	This is a binary indicator that measures whether the government has published guidelines for a balanced and nutritious diet. 0=No 1=Yes
Nutrition plan or strategy	Qualitative scoring by EIU analysts based on WHO, FAO and national health ministry documents	2012	This is a binary indicator that measures whether the government has published a national strategy to improve nutrition. 0=No 1=Yes
Nutrition monitoring and surveillance	EIU analyst scoring based on WHO, FAO and national health ministry documents	2012	This is a binary indicator that measures whether the government monitors the nutritional status of the general population. Examples of monitoring and surveillance include the collection of data on undernourishment, nutrition-related deficiencies, and other indicators. 0=No 1=Yes
Micronutrient availability	FAO	2005-07	This is a composite indicator that measures the availability of iron and vitamin A in the food supply. Sub-indicators include: <ul style="list-style-type: none"> <li>• dietary availability of vitamin A;</li> <li>• dietary availability of animal iron; and</li> <li>• dietary availability of vegetal iron.</li> </ul>



Indicator	Source	Year	Indicator definitions and construction
Dietary availability of vitamin A	FAO	2005-07	<p>According to the FAO, the dietary availability of vitamin A is calculated by converting the amount of food available for human consumption (as estimated by the FAO Food Balance Sheets) into the equivalent of Vitamin A. This indicator is expressed in micrograms of retinol activity equivalent/capita/day on a 0-2 scale.</p> <p>0= less than 300 mcg RAE/person/day.            1= 300-600 mcg RAE/person/day.            2= more than 600 mcg RAE/person/day.</p>
Dietary availability of animal iron	FAO	2005-07	<p>According to the FAO, the dietary availability of iron is calculated by converting the amount of food available for human consumption (as estimated by the FAO Food Balance Sheets) into the equivalent of iron. Animal iron is obtained from products such as meat, milk, fish, animal fats and eggs. This indicator is expressed in mg/capita/day.</p>
Dietary availability of vegetal iron	FAO	2005-07	<p>According to the FAO, the dietary availability of iron is calculated by converting the amount of food available for human consumption (as estimated by the FAO Food Balance Sheets) into the equivalent of iron. Vegetable iron is obtained from products such as cereals, pulses, roots and tubers, vegetable oils, fruits and vegetables. This indicator is expressed in mg/capita/day.</p>
Protein quality	EIU calculation based on data from FAO, WHO, and US Department of Agriculture (USDA) Nutrient Database	2005-07	<p>This indicator measures the grams of quality protein through the Protein Digestibility Corrected Amino Acid Score (PDCAAS). The PDCAAS methodology assesses the presence of nine essential amino acids in the average national diet. The inputs of this calculation include: the amino acid profile, protein digestibility value, and the average grams consumed of each food item which contributes.</p>
Food safety	Scoring by EIU analysts based on government websites, WHO data and EIU Industry Briefing	2008-12	<p>This is a composite indicator that measures the enabling environment for food safety. Sub-indicators include:</p> <ul style="list-style-type: none"> <li>• existence of agency to ensure health/safety of food;</li> <li>• access to potable water; and</li> <li>• presence of a formal grocery sector.</li> </ul>
Existence of agency to ensure health/safety of food	Qualitative scoring by EIU analysts based on government websites	2012	<p>This is a binary indicator that measures the existence of a regulatory or administrative agency to ensure the health and safety of food.</p> <p>0=No            1=Yes</p>
Access to potable water	WHO	2008	<p>This indicator measures the percent of population with access to an improved water source, which is measured on a 0-4 scale.</p> <p>0=0-59%            1=60-69%            2=70-79%            3=80-89%            4=90-100%</p>

Indicator	Source	Year	Indicator definitions and construction
Presence of formal grocery sector	EIU Industry Briefing	2012	This indicator measures the presence of formal grocery sector measured on a 0-2 scale. 0=Minimal presence. 1=Moderate presence. 2=Widespread presence.

#### 4) Output variables

Prevalence of undernourishment	FAO	2006-08	This indicator measures the proportion of the population who do not receive the minimum number of calories required for an average person, as defined by the FAO/WHO Expert Consultation in 2001.
Percentage of stunted children	WHO	Latest available year between 1972 and 2010	The percentage of children under five years who have a height-for-age below minus two standard deviations of the National Center for Health Statistics (NCHS)/WHO reference median.
Percentage of underweight children	WHO	Latest available year between 1972 and 2011	The percentage of children under five years who have a weight-for-age below minus two standard deviations of the NCHS/WHO reference median.
Intensity of food deprivation	FAO	2006-08	Intensity of food deprivation is a measure of how much people, on average, fall below the dietary energy requirement. It is measured as the difference between the minimum dietary energy and the average dietary energy intake of the undernourished population.
Human Development Index	UNDP	2011	The Human Development Index is a composite index that measures development by combining indicators on life expectancy, educational attainment and income.
Women's Economic Opportunity Index	EIU	2011	The Women's Economic Opportunity Index measures specific attributes of the environment for women employees and entrepreneurs in 128 economies. The index includes 29 indicators in the following categories: labour policy and practice; access to finance; education and training; women's legal and social status; and the general business environment.
Democracy Index	EIU	2011	The Democracy Index provides a snapshot of the state of democracy in 165 states and two territories. The index includes indicators in the following five categories: electoral process and pluralism; functioning of government; political participation; political culture; and civil liberties.

Whilst every effort has been taken to verify the accuracy of this information, neither The Economist Intelligence Unit Ltd. nor the sponsor of this report can accept any responsibility or liability for reliance by any person on this white paper or any of the information, opinions or conclusions set out in the white paper.

**London**

26 Red Lion Square  
London  
WC1R 4HQ  
United Kingdom  
Tel: (44.20) 7576 8000  
Fax: (44.20) 7576 8476  
E-mail: london@eiu.com

**New York**

750 Third Avenue  
5th Floor  
New York, NY 10017  
United States  
Tel: (1.212) 554 0600  
Fax: (1.212) 586 0248  
E-mail: newyork@eiu.com

**Hong Kong**

6001, Central Plaza  
18 Harbour Road  
Wanchai  
Hong Kong  
Tel: (852) 2585 3888  
Fax: (852) 2802 7638  
E-mail: hongkong@eiu.com

**Geneva**

Boulevard des  
Tranchées 16  
1206 Geneva  
Switzerland  
Tel: (41) 22 566 2470  
Fax: (41) 22 346 93 47  
E-mail: geneva@eiu.com