Training on SDG 2.c.1 Indicator of Food Price Anomalies

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PURPOSE AND OBJECTIVES

Training purpose

To understand the Indicator of food price anomalies and the methodology to estimate it

Training objectives

- Understand basic concepts of price volatility
- Have a firm grasp of how to calculate the indicator
- Comprehend the use and limitations of the indicator
- Equip with the capacity to calculate the indicator

SDG INDICATORS UNDER FAO CUSTODIANSHIP

2 ZERO HUNGER

2.1.1 Hunger

2.1.2 Severity of food insecurity

2.3.1 Productivity of small-scale food producers

2.3.2 Income of small-scale food producer

2.4.1 Agricultural sustainability

2.5.1 Conservation of genetic resources for food and agriculture

2.5.2 Risk status of livestock breeds

2.a.1 Public Investment in agriculture

2.c.1 Food price volatility

5 GENDER EQUALITY

5.a.1 Women's ownership of agricultural land

5.a.2 Women's equal rights to land ownership

6 CLEAN WATER AND SANITATION

6.4.1 Water use efficiency

6.4.2 Water stress

14 LIFE BELOW WATER

14.4.1 Fish stocks sustainability

14.6.1 Illegal, unreported unregulated fishing

14.7.1 Value added of sustainable fisheries

14.b.1 Access rights for small-scale fisheries

15 LIFE ON LAND

15.1.1 Forest area

15.2.1 Sustainable forest management

15.4.2 Mountain Green Cover

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

12.3.1 Global food losses

SDG GOAL, TARGET & INDICATOR

SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture

SDG Target 2.c

Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help **limit extreme food price volatility**.

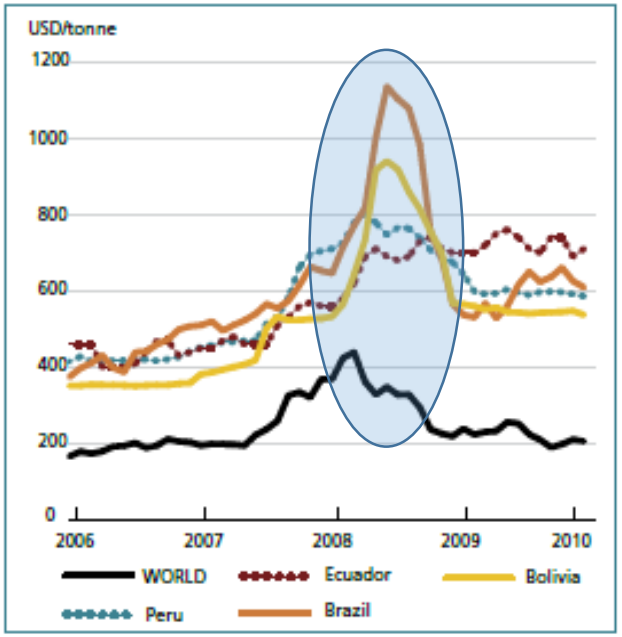
SDG Indicator 2.c.1: **Indicator of Food Price Anomalies (IFPA)**

The IFPA is an indirect indicator of Target 2.c, as it is a measure of food price volatility, detecting **abnormal growth** of prices in food markets.

SDG GOAL, TARGET & INDICATOR (2)

Price volatility and relevance of stable markets in achieving Goal 2

FIGURE 5: NOMINAL WORLD MARKET WHEAT GRAIN PRICES AND DOMESTIC WHOLESALE WHEAT FLOUR PRICES, JANUARY 2006 TO DECEMBER 2009



Source: FAO (2013b) and country chapters.

- The connection between food prices and food security was brought into sharp focus during the food price crisis of 2007/2008.
- Extreme price movements of agricultural commodities pose a threat to agricultural markets and to food security.
- In many countries, market prices are sometimes the only source of information available to assess the severity of a local shock to either access or availability of food.

SDG GOAL, TARGET & INDICATOR (3)

The Indicator of Food Price Anomalies (IFPA) may help to put in place policies that limit extreme price volatility.

- **Improving market information**: Information on prices allow markets to function more efficiently and monitoring food prices is crucial for evidence-based policy decisions
- **Stockholding**: accumulated stocks might reduce volatility, as long as they are accumulated in periods of excess supply and released in times of excess demand
- **Trade policies and buffer stocks:** governmental interventions to stabilize prices, including the use of a combination of import/export levies, as well as food reserve stockpiles
- **Coping mechanism**: targeted safety-net mechanisms in an effort to reduce the negative consequences of price volatility, while in the long term, investment in agriculture can prevent price volatility

(Policy options to address price volatility and high prices - FAO)

PRICE VOLATILITY

Price volatility is the variability of price series around its central value – i.e. the tendency for individual price observations to vary significantly from their mean value.

- **Price volatility** differs from the **price level**, which in agricultural markets, varies because production supply and consumption demand are variable.
- The **extent** to which given production and consumption shocks translate into price volatility depends on supply and demand **elasticity.**
- It is generally supposed that the most important source of price variability in agriculture is **weather shocks to agriculture yields** (*Gilbert and Morgan, 2010*).
- Price volatility generates **uncertainty**, which increases risks for producers, traders, consumers and governments and may lead to sub-optimal decisions compared with those achieved under more stable price conditions.

PRICE VOLATILITY (2)

Actors vulnerable to extreme price swings in agricultural markets

Consumers

When prices surge unexpectedly, vulnerable consumers may have to **lower their food intake**, take children out of school, save on healthcare services or **sell productive assets**, such as land and livestock.

Producers

High volatility brings with it considerable downside price risks, which affect **planting decisions** and **undermine agriculture investment** where it is needed most.

FINALIZING THE INTRODUCTION

SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture

SDG Target 2.c

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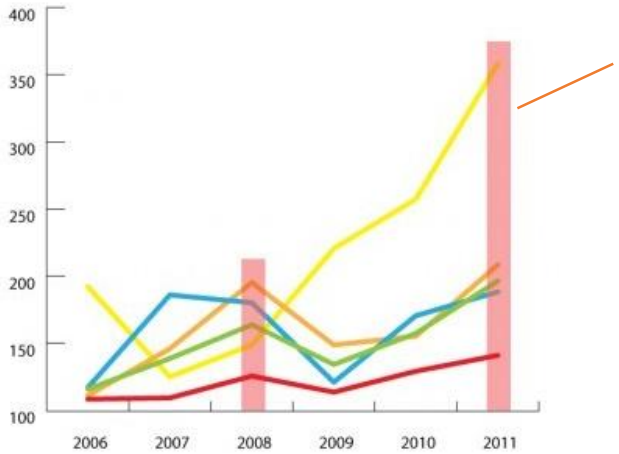
SDG Indicator 2.c.1: Indicator of Food Price Anomalies (IFPA)

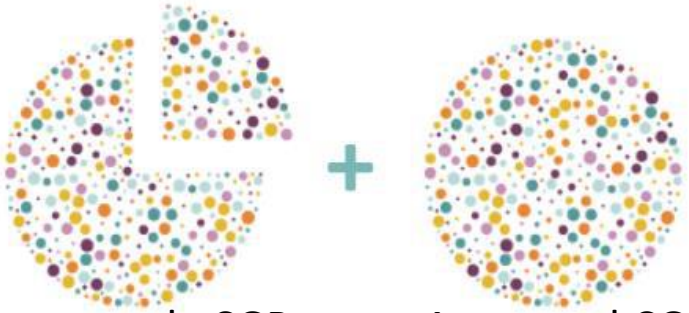
The IFPA is an indirect indicator of Target 2.c, as it is a measure of food price volatility, detecting **abnormal growth** of prices in food markets.

INTRODUCTION TO IFPA



Is the rate of change in prices normal for the period of time being observed?

- The IFPA provides an answer to this question, as it detects **abnormal price growth** by measuring the normalized differences of compound growth rates of prices from their historic mean.
- The IFPA uses a weighted sum of quarterly and annual **compound growth rates** (CGR). By using both CGRs, the indicator captures price variations (seasonality and shocks) **within the year** and **across years**.

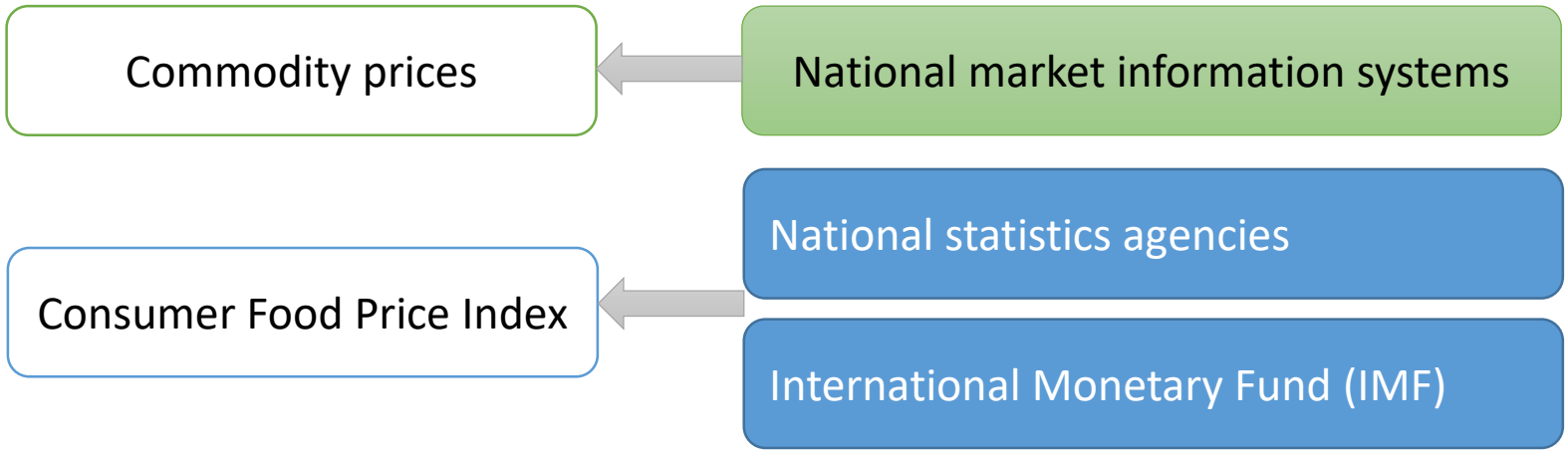


A quarterly CGR An annual CGR

INTRODUCTION TO IFPA (2)

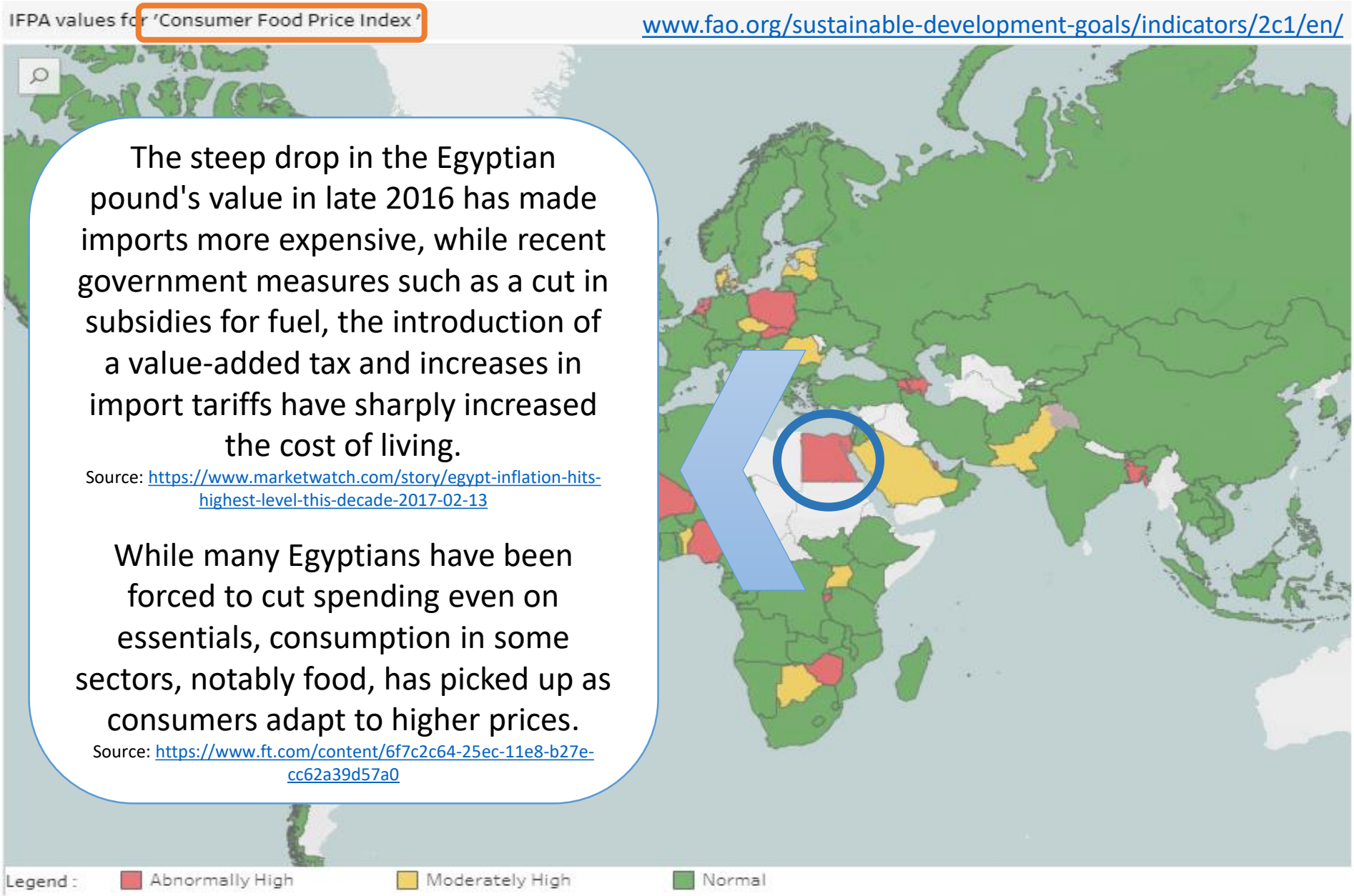
The IFPA can be measured with Food CPI and commodity prices.

- Data sources



- The main challenge in implementing the indicator is **data availability** and **data quality**. The indicator is very sensitive to both issues and in particular data gaps. A time series of **at least 5-year monthly data points** are required to calculate the indicator.
- In terms of data availability countries have made significant investments in collecting and disseminating commodity price data at a national level. However, **accessing** this information at a global level still at times remains challenging.

USE OF INDICATOR



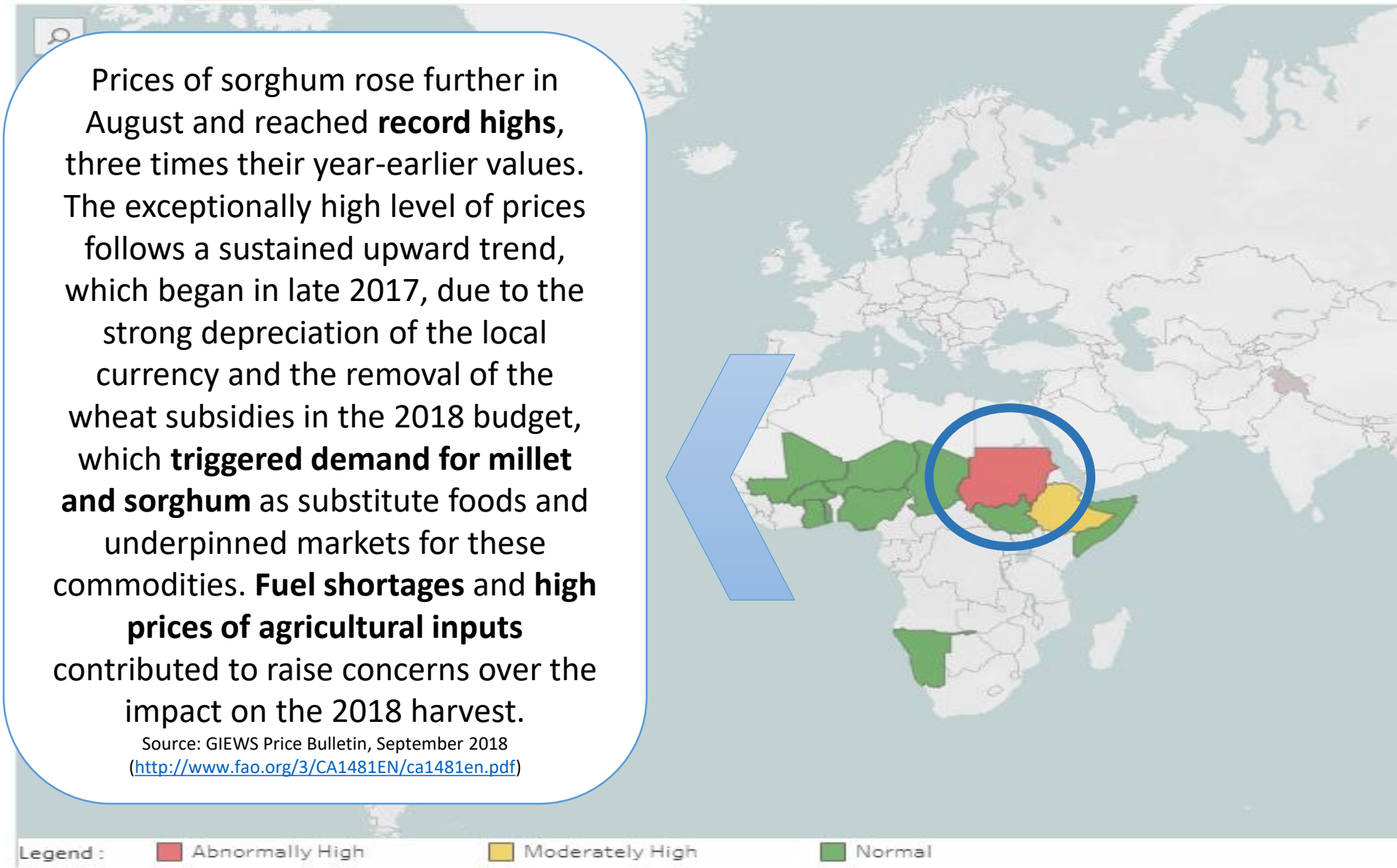
USE OF INDICATOR (2)

IFPA values for 'Sorghum'

www.fao.org/sustainable-development-goals/indicators/2c1/en/

Prices of sorghum rose further in August and reached **record highs**, three times their year-earlier values. The exceptionally high level of prices follows a sustained upward trend, which began in late 2017, due to the strong depreciation of the local currency and the removal of the wheat subsidies in the 2018 budget, which **triggered demand for millet and sorghum** as substitute foods and underpinned markets for these commodities. **Fuel shortages** and **high prices of agricultural inputs** contributed to raise concerns over the impact on the 2018 harvest.

Source: GIEWS Price Bulletin, September 2018 (http://www.fao.org/3/CA1481EN/ca1481en.pdf)



COMPOUND GROWTH RATE

The IFPA relies on a **compound growth rate** approach.

A compound growth rate is a **geometric mean** which assumes that a random variable grows at a steady rate, compounded over a specific period of time.

$$CGR_t = \left(\frac{P_{t_B}}{P_{t_A}}\right)^{\frac{1}{n}} - 1 \qquad \textit{Equation 1}$$

P_{t_A} = The price at the beginning of the period

P_{t_B} = The price at the end of the period

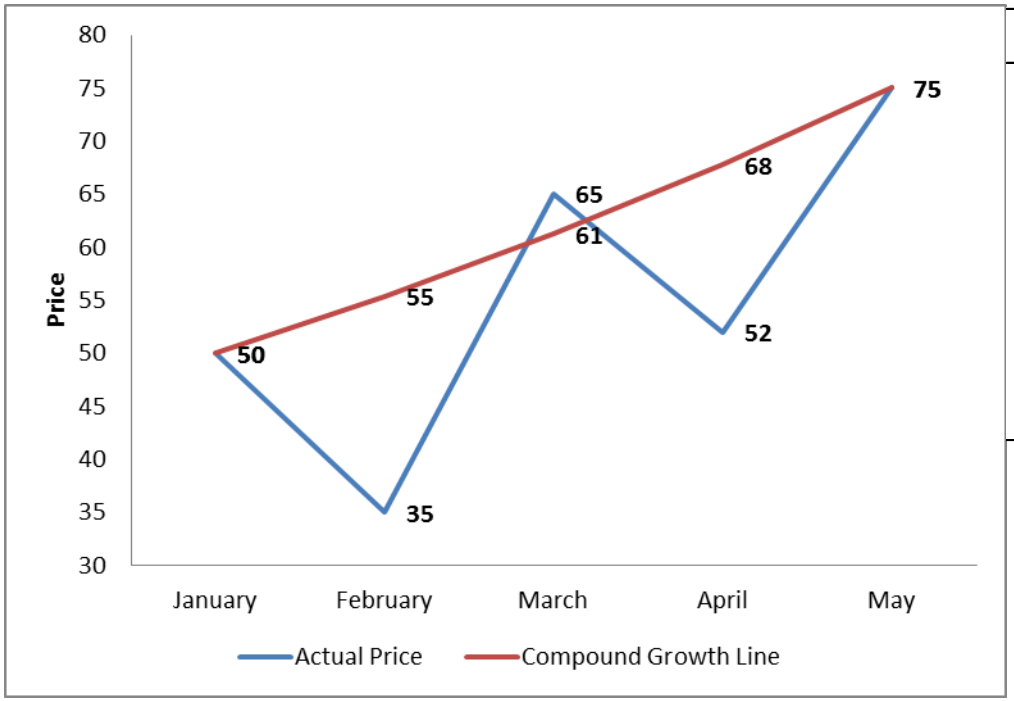
n = The time in months between periods A and B

The growth in any random variable from the beginning of the period t_A to the end of the period t_B, raised to the power of one over the length of the period of time being considered *n.*

The Compound Growth Rate is a geometric and **not an arithmetic mean**, as the latter is affected by the level of volatility in prices.

COMPOUND GROWTH RATE (2)

A compound growth rate is good to deal with **price volatility**.



January	February	March	April	May
50	35	65	52	75
	-30%	86%	-20%	44%
			Average	20%
50	55	61	68	75
	11%	11%	11%	11%
			Compound	11%

Compound growth rate

$$\left(\frac{75}{50}\right)^{\frac{1}{5-1}} - 1 * 100 = 10.6\%$$

Assuming a steady rate of growth, the compound growth rate **smooths** the **effect of volatility** of periodic price movements. This is of advantage especially when dealing with highly volatile price series, as it establishes a baseline from which to measure abnormal.

INDICATOR FORMULA

The **IFPA** for a particular year *y* in month *t* is the following weighted sum of quarterly and annual IFPA:

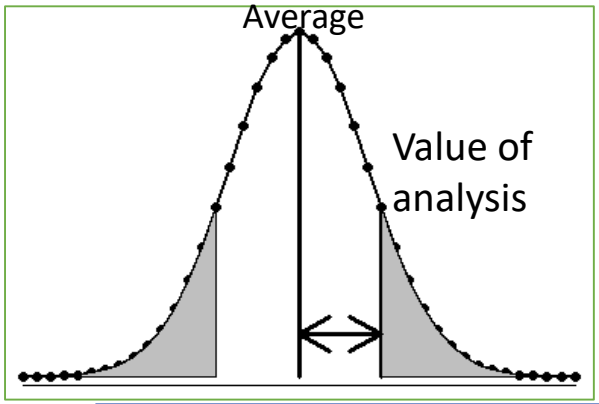
$$IFPA_t = \alpha\left(\frac{CQGR_{yt} - \overline{CQGR_t}}{\hat{\sigma}_{CQGR_t}}\right) + (1-\alpha)\left(\frac{CAGR_{yt} - \overline{CAGR_t}}{\hat{\sigma}_{CAGR_t}}\right)$$

$CQGR_{yt}$ and $CAGR_{yt}$ are the quarterly and annual compound growth rates in year y and month t respectively

$\overline{CQGR_t}$ and $\overline{CAGR_t}$ are weighted means of the quarterly and annual compound growth rates in month t

$\hat{\sigma}_{CQGR_t}$ and $\hat{\sigma}_{CAGR_t}$ are weighted standard devaitions of the quarterly and annual compound growth rates in month t

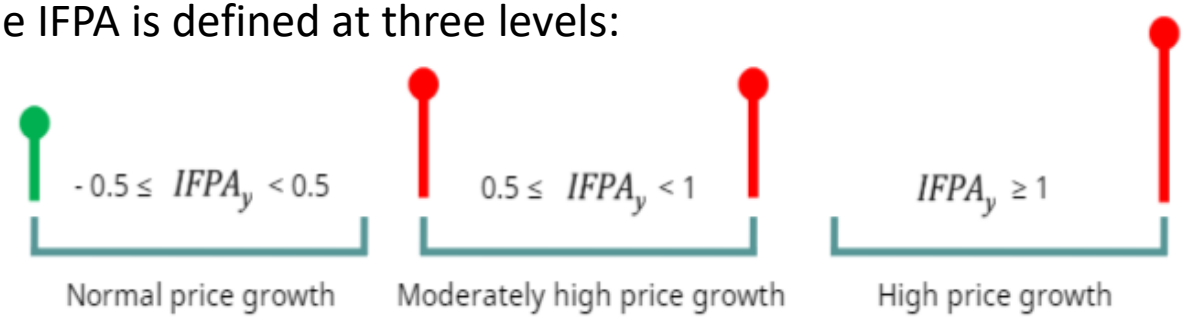
α establishes the relative importance of the quarterly compound growth rate anomalies to the year-on-year price variations. (http://www.fao.org/giews/food-prices/research/detail/en/c/235685/)



The IFPA of December 2016 contains information of the reference growth rates of September-December 2016 and December 2015-December 2016, compared to the price increases in these periods of other years.

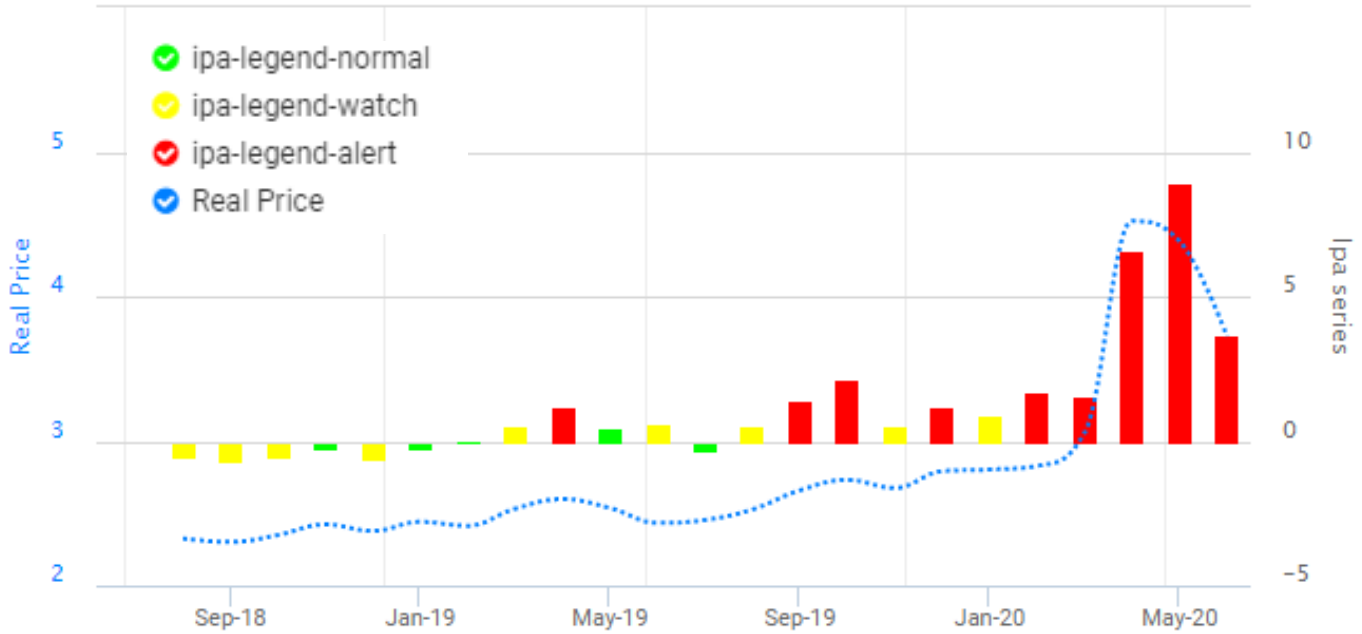
INDICATOR INTERPRETATION

The IFPA is defined at three levels:



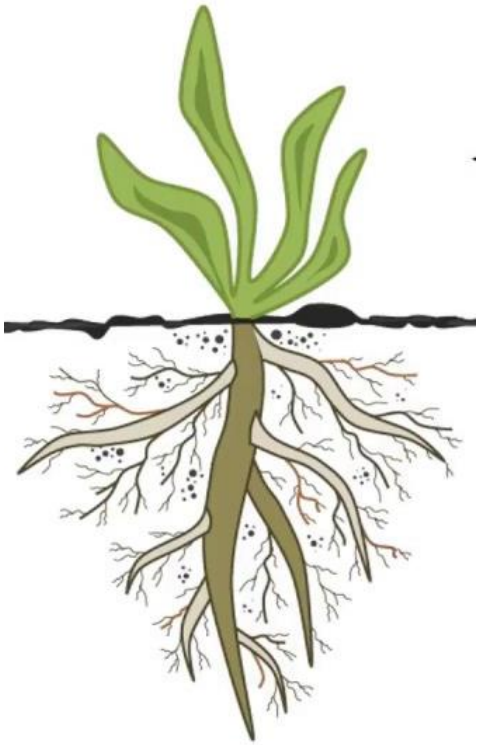
An example of IFPA in graph

Morocco, Retail, National Average, Wheat (soft)



Source: GIEWS FPMA Tool (https://fpma.apps.fao.org/giews/food-prices/tool)

LIMITATIONS



It is important to underline that the indicator is only **a guide to understand market dynamics**.

It cannot be relied on as the sole element to determine whether a food security alert should be given.

Results must be weighed with other available information on market fundamentals, macroeconomic context and external shocks that can explain these price movements.

This is especially important when evaluating whether the observed price shocks will persist or are transitory.

INDICATOR CALCULATION

0. Deflate nominal prices/food CPI by general **CPI** to net out the effects of inflation and compare prices in constant money terms over time.

Or food CPI

	A	B	C	D
1	Mongolia, Rice			
2	Date (MMM	Nominal price	CPI	Real price
3	Jan-06	667	0.562	1186.833
4	Feb-06	658	0.566	1162.544
5	Mar-06	660	0.567	1164.021
6	Apr-06	666	0.581	1146.299
7	May-06	671	0.587	1143.101
8	Jun-06	679	0.588	1154.762
9	Jul-06	695	0.588	1181.973
10	Aug-06	681	0.581	1172.117
11	Sep-06	681	0.583	1168.096
12	Oct-06	708	0.584	1212.329
13	Nov-06	708	0.586	1208.191
14	Dec-06	697	0.591	1179.357
15	Jan-07	690	0.592	1165.541
16	Feb-07	700	0.602	1162.791
17	Mar-07	714	0.608	1174.342

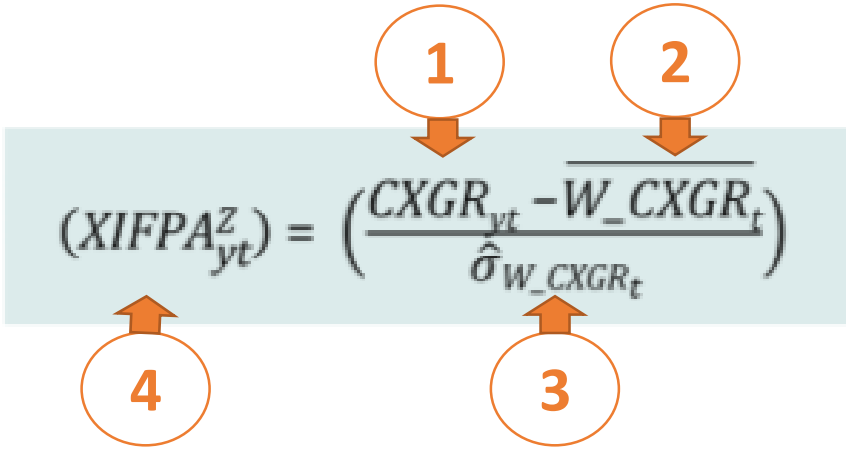
There are two versions of the price series, a **nominal** and the **real** term series, which has been deflated using the domestic consumer price index (CPI 2010= 100) as reported by the International Monetary Fund (IMF).

$$Real\ price = \frac{Nominal\ price}{CPI}$$

The series used in this example is Wholesale Prices for Rice in Mongolia from 2006 to 2017

INDICATOR CALCULATION (2)

Before start, please note the order of the calculation.



1. Calculate **Compound Quarterly** and **Annual Compound Growth Rates.**

Calculate the $CQGR_{yt}$

$$CQGR_{Dec2016} = \left(\frac{Pr_{Dec2016}}{Pr_{Sep2016}}\right)^{\frac{1}{3}} - 1$$

Calculate the $CAGR_{y}$

$$CAGR_{Dec2016} = \left(\frac{Pr_{Dec2016}}{Pr_{Dec2015}}\right)^{\frac{1}{12}} - 1$$

INDICATOR CALCULATION (3)

$$(XIFPA_{yt}^{z}) = \left(\frac{CXGR_{yt} - \overline{W\_CXGR_t}}{\hat{\sigma}_{W\_CXGR_t}}\right)$$

1a.Compound Quarterly Growth Rates

Date (MMM-YY)	Price in real terms	Month	Year	CQGR-Equation 1
Jan-16	1504.365			
Feb-16	1495.104			
Mar-16	1491.267			
Apr-16	1471.142	4	2016	-0.007416389
May-16	1458.732	5	2016	-0.008175784
Jun-16	1465.659	6	2016	-0.005756937
Jul-16	1457.229	7	2016	-0.003162292
Aug-16	1466.686	8	2016	0.001814218
Sep-16	1480.685	9	2016	0.003405646
Oct-16	1477.04	10	2016	0.004511186
Nov-16	1469.919	11	2016	0.000734244
Dec-16	1476.596	12	2016	-0.00092125
Jan-17	1469.231	1	2017	-0.001765359
Feb-17	1454.941	2	2017	-0.003408044
Mar-17	1433.495	3	2017	-0.00982599
Apr-17	1429.262	4	2017	-0.009151498
May-17	1420.908	5	2017	-0.00785881
Jun-17	1433.435	6	2017	-1.4143E-05
Jul-17	1436.568	7	2017	0.001700959
Aug-17	1420.79	8	2017	-2.76383E-05

Please note: The CQGR can only be calculated from the second quarter of 2016, as there are no price data of the last quarter of 2015, which would enable the calculation.

$$CQGR_{Dec2016} = \left(\frac{Pr_{Dec2016}}{Pr_{Sep2016}}\right)^{\frac{1}{3}} - 1$$

INDICATOR CALCULATION (4)

$$(XIFPA_{yt}^{z}) = \left(\frac{CXGR_{yt} - \overline{W\_CXGR_t}}{\hat{\sigma}_{W\_CXGR_t}}\right)$$

Both **average** and **standard deviation** are multiplied by a **weight** (*W*). The weights are **linear time weights** (i.e. built in such a way that the most recent past has a higher weight) and **employed only to the past values.**

2. Build the linear time weights

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2006		1	1	1	1	1	1	1	1	1	1	1
2007			2	2	2	2	2	2	2	2	2	2
2008				3	3	3	3	3	3	3	3	3
2009					4	4	4	4	4	4	4	4
2010						5	5	5	5	5	5	5
2011							6	6	6	6	6	6
2012								7	7	7	7	7
2013									8	8	8	8
2014										9	9	9
2015											10	10
2016												11
2017												
		1	3	6	10	15	21	28	36	45	55	66
	QN6	QN7	QN8	QN9	QN10	QN11	QN12	QN13	QN14	QN15	QN16	QN17
	0	1	2	3	4	5	6	7	8	9	10	11

INDICATOR CALCULATION (5)

$$(XIFPA^{Z}_{yt}) = \left(\frac{CXGR_{yt} - \overline{W\_CXGR_t}}{\hat{\sigma}_{W\_CXGR_t}}\right)$$

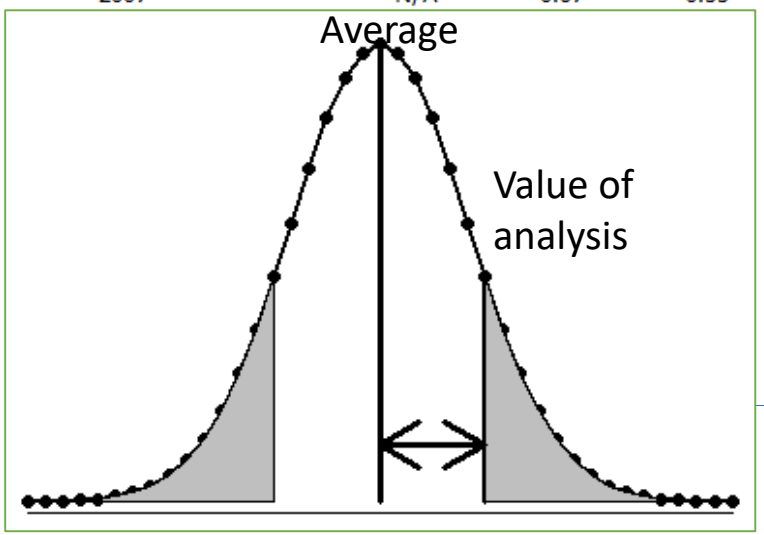
2a. Calculate the weights

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2006		1	1	1	1	1	1	1	1	1	1	1
2007			2	2	2	2	2	2	2	2	2	2
2008				3	3	3	3	3	3	3	3	3
2009					4	4	4	4	4	4	4	4
2010						5	5	5	5	5	5	5
2011							6	6	6	6	6	6
2012								7	7	7	7	7
2013									8	8	8	8
2014										9	9	9
2015											10	10
2016												11
2017												
		1	3	6	10	15	21	28	36	45	55	66

	QN6	QN7								QN15	QN16	QN17
	0	1								9	10	11

e.g. the weight of 2006 in calculating the quarterly IFPA of 2016 has a value of 0.0182, which is 1/55 (one over the sum of all weights from 2006 to 2016).

	QW2006	QW2007	QV								QW2016	QW2017
2006	N/A	1.00	0.33	0.17	0.10	0.07	0.05	0.04	0.0278	0.02	0.0182	0.0152
2007		N/A	0.67	0.33	0.20	0.13	0.10	0.07	0.0556	0.04	0.0364	0.0303
					0.30	0.20	0.14	0.11	0.0833	0.07	0.0545	0.0455
					0.40	0.27	0.19	0.14	0.1111	0.09	0.0727	0.0606
					N/A	0.33	0.24	0.18	0.1389	0.11	0.0909	0.0758
						N/A	0.29	0.21	0.1667	0.13	0.1091	0.0909
							N/A	0.25	0.1944	0.16	0.1273	0.1061
								N/A	0.2222	0.18	0.1455	0.1212
									N/A	0.20	0.1636	0.1364
										N/A	0.1818	0.1515
											N/A	0.1667
												N/A
					1	1	1	1	1	1	1	1



INDICATOR CALCULATION (6)

$$(XIFPA^{Z}_{yt}) = \left(\frac{CXGR_{yt} - \overline{W\_CXGR_t}}{\hat{\sigma}_{W\_CXGR_t}}\right)$$

2. Calculate weighted average

$$\overline{W\_CXGR_t} = \frac{1}{\sum_{y=1}^{Y} w_y} \sum_{y=1}^{Y} w_y CXGR_{yt}$$

$\overline{W\_CXGR_t}$ = The weighted average for month *t* of the X (quarterly or annual) CGR

w_y = The weight for year *y*

$CXGR_{yt}$ = The un-weighted compound growth rate in year *y* in month *t*

$\sum_{y=1}^{Y}$ = The summation operator over years Y

Quaterly Weighted Average-Equation 3

Month	Qwavg2006	Qwavg2007	Qwavg2008	Qwavg2009	Qwavg2010	Qwavg2011	Qwavg2012	Qwavg2013	Qwavg2014	Qwavg2015	Qwavg2016	Qwavg2017
1			-0.00868913	-0.01129364	-0.01520389	-0.01683281	-0.01855930	-0.01516485	-0.01343205	-0.01271055	-0.01162126	-0.00967978
2			-0.00845732	-0.01127628	-0.01371317	-0.01500440	-0.01591241	-0.01516448	-0.01425620	-0.01276947	-0.01162888	-0.01014696
3			-0.00094629	-0.00853907	0.00066523	-0.00675867	-0.00792788	-0.01152342	-0.01151698	-0.01047472	-0.00983663	-0.00863208
4		-0.01151627	-0.00414004	-0.01181045	0.01050413	0.00499343	0.00257414	-0.00389682	-0.00493155	-0.00498556	-0.00447768	-0.00496746
5		-0.00560640	-0.00873842	0.07505310	0.06141324	0.04793183	0.03208461	0.01881563	0.01435817	0.01042276	0.00922608	0.00632577
6		-0.00265858	-0.00658903	0.08050178	0.05211448	0.04537352	0.02835303	0.01839564	0.01587321	0.01195780	0.01162316	0.00872648
7		0.01026768	0.00108442	0.08487697	0.04791786	0.04704909	0.02920377	0.01969302	0.01861220	0.01426133	0.01378380	0.01095945
8		0.00839075	0.00377699	-0.00645076	-0.00154033	0.00991787	0.00456030	0.00219101	0.00818569	0.00634416	0.00634558	0.00559035
9		0.00383431	-0.00312188	-0.01593657	-0.00392345	0.00559339	0.00177095	-0.00036004	0.00959728	0.00811648	0.00793731	0.00718203
10		0.00848856	-0.00523803	-0.01139704	-0.00426051	0.00094863	-0.00069369	-0.00270156	0.00958536	0.00784171	0.00727773	0.00681664
11		0.01015547	-0.00513990	-0.00788477	-0.00772540	-0.00844411	-0.00720490	-0.00697854	0.00077370	0.00068633	0.00164973	0.00149715
12		0.00320321	-0.00608860	-0.00894901	-0.00735206	-0.01053550	-0.00838985	-0.00703751	-0.00465336	-0.00473169	-0.00370345	-0.00323975

=SUMPRODUCT(QTYDEC,QW_2017)/SUM(QW_2017)

The same procedure will apply to the annual weighted average.

INDICATOR CALCULATION (7)

$$(XIFPA^{Z}_{yt}) = \left(\frac{CXGR_{yt} - \overline{W\_CXGR_t}}{\hat{\sigma}_{W\_CXGR_t}}\right)$$

i.e. Calculate weighted average of January 2017 quarterly CGR

$$\overline{W\_CXGR_t} = \frac{1}{\sum_{y=1}^{Y} w_y} \sum_{y=1}^{Y} w_y CXGR_{yt}$$

$\overline{W\_CXGR_t}$ = The weighted average for month *t* of the X (quarterly or annual) CGR

w_y = The weight for year *y*

$CXGR_{yt}$ = The un-weighted compound growth rate in year *y* in month *t*

$\sum_{y=1}^{Y}$ = The summation operator over years Y

SUMPRODUCT(CQJRJAN,QW_2017)/SUM(QW_2017)

	CQGRJAN		QW2017		SUMPRODUCT
2006			0.015152		0.000000
2007	-0.013034		0.030303		-0.000395
2008	-0.013898		0.045455		-0.000632
2009	-0.021069		0.060606		-0.001277
2010	-0.020091		0.075758		-0.001522
2011	-0.022876	×	0.090909	=	-0.002080
2012	-0.004981		0.106061		-0.000528
2013	-0.007367		0.121212		-0.000893
2014	-0.009825		0.136364		-0.001340
2015	-0.006719		0.151515		-0.001018
2016	0.000028		0.166667		0.000005
2017	-0.001765				0.000000
					-0.009680

+

INDICATOR CALCULATION (8)

$$(XIFPA^{Z}_{yt}) = \left(\frac{CXGR_{yt} - \overline{W\_CXGR_t}}{\hat{\sigma}_{W\_CXGR_t}}\right)$$

3. Calculate the Weighted Standard Deviation

$$\hat{\sigma}_{W\_CXGR_t} = \sqrt{\frac{\sum_{y=1}^{\gamma} w_y (CXGR_{yt} - W\_CXGRt)^2}{\sum_{y=1}^{\gamma} w_y (\hat{\gamma} - 1)/\hat{\gamma}}}$$

$\hat{\sigma}_{W\_CXGR_t}$ = The weighted standard deviation for month t of the X (quarterly or annual) CGR

$\hat{\gamma}$ = The total number of weights

Quarterly Weighted Standard Deviation-Equation 4

Month	Qwsd2006	Qwsd2007	Qwsd2008	Qwsd2009	Qwsd2010	Qwsd2011	Qwsd2012	Qwsd2013	Qwsd2014	Qwsd2015	Qwsd2016	Qwsd2017
1			0.008689132	0.00620388	0.00714892	0.00621091	0.00594928	0.00813241	0.00789934	0.00717512	0.00689453	0.00774257
2			0.008457323	0.00622432	0.00570433	0.00495028	0.00439057	0.00400176	0.00393715	0.00470678	0.00494032	0.00567573
3			0.000946286	0.00931726	0.01468801	0.01651126	0.01382178	0.01358488	0.01185786	0.01075258	0.00977059	0.00931334
4			0.007376228	0.01042382	0.03246276	0.02710284	0.02283111	0.02294868	0.020137864	0.01787095	0.01610488	0.01467301
5			0.003132011	0.10264115	0.07740069	0.06479710	0.06027011	0.05713947	0.05066589	0.04572999	0.04119520	0.0380306
6			0.003930457	0.10669117	0.08765052	0.07010874	0.06511173	0.05863748	0.05143101	0.04639010	0.04170831	0.03848773
7			0.009183259	0.10277846	0.09146459	0.07232215	0.06739429	0.06023669	0.05262331	0.04760189	0.04280424	0.03943907
8			0.004613765	0.01284105	0.01166908	0.02033053	0.01922335	0.01700299	0.01907911	0.01737585	0.01561973	0.01429745
9			0.006956196	0.01626254	0.02072874	0.02224807	0.01957666	0.01718557	0.02493223	0.02234704	0.02009249	0.01833566
10			0.013726596	0.01129413	0.01303422	0.01319166	0.01128802	0.01034507	0.02618039	0.02352539	0.02118532	0.01927289
11			0.015295371	0.00995149	0.00727103	0.00585951	0.00530567	0.00455032	0.01600513	0.01420435	0.01294921	0.01176714
12			0.009291812	0.00668203	0.00537713	0.00658838	0.00660122	0.00617860	0.00719878	0.00639045	0.00618762	0.00572443

=SQRT(SUMPRODUCT(QW_2017*(QTYDEC-M14)^2)/(SUM(QW_2017)*(QN17_-1)/QN17_))

The same procedure will apply to the annual weighted standard deviation.

INDICATOR CALCULATION (9)

$$(XIFPA^{z}_{yt}) = \left(\frac{CXGR_{yt} - \overline{W\_CXGR_t}}{\hat{\sigma}_{W\_CXGR_t}}\right)$$

i.e. Calculate the Weighted Standard Deviation January 2017 quarterly CGR

$$\hat{\sigma}_{W\_CXGR_t} = \sqrt{\frac{\sum_{y=1}^{\gamma} w_y (CXGR_{yt} - W\_CXGRt)^2}{\sum_{y=1}^{\gamma} w_y (\hat{\gamma}-1)/\hat{\gamma}}}$$

SQRT(SUMPRODUCT(QW_2017*(CQGRJAN-WAvg)^2)/(SUM(QW_2017)*(NoW2017-1)/NoW2017))

	QW_2017	CQGRJAN	WAvg	Numerator	QW_2017	NoW2017	Denominator
2006	0.01515			0.0000014	0.01515	11	0.01377
2007	0.03030	-0.01303		0.0000003	0.03030		0.02755
2008	0.04545	-0.01390		0.0000008	0.04545		0.04132
2009	0.06061	-0.02107		0.0000079	0.06061		0.05510
2010	0.07576	-0.02009		0.0000082	0.07576		0.06887
2011	0.09091	-0.02288	-0.00968	0.0000158	0.09091		0.08264
2012	0.10606	-0.00498		0.0000023	0.10606		0.09642
2013	0.12121	-0.00737		0.0000006	0.12121		0.11019
2014	0.13636	-0.00982		0.0000000	0.13636		0.12397
2015	0.15152	-0.00672		0.0000013	0.15152		0.13774
2016	0.16667	0.00003		0.0000157	0.16667		0.15152
2017		-0.00177		0.0000000			0.00000
				0.00005			**0.90909**

$\times$ (CQGRJAN $-$ WAvg)^2 $=$ Numerator $\times \frac{10}{11} =$ Denominator

$= \sqrt{0.0006}$

$= 0.00774$

INDICATOR CALCULATION (10)

$$(XIFPA^{Z}_{yt}) = \left(\frac{CXGR_{yt} - \overline{W\_CXGR_t}}{\hat{\sigma}_{W\_CXGR_t}}\right)$$

4. Calculate and compile quarterly and annual IFPAs.

Quarterly Indicator for Food Prica Anomalies (QIFPA)-Equation 5

month	QIPA_2006	QIPA_2007	QIPA_2008	QIPA_2009	QIPA_2010	QIPA_2011	QIPA_2012	QIPA_2013	QIPA_2014	QIPA_2015	QIPA_2016	QIPA_2017
1			-0.599487077	-1.575726098	-0.683568281	-0.972915531	2.28226012	0.95882508	0.4567	0.8350	1.6896	1.02219651
2			-0.666630896	-0.978779995	-0.679078701	-0.641988604	0.68139615	1.021373704	1.8881	1.3328	1.7998	1.18732173
3			-16.04754123	2.469689916	-1.516318036	-0.24784517	-1.0405434	0.002131893	0.4395	0.3264	0.7397	-0.1281939
4			-2.079765672	5.351821315	-0.509263609	-0.312421482	-1.1337089	-0.202899364	-0.0134	0.1563	-0.1825	-0.2851519
5			53.50651978	-0.332221885	-0.522530896	-0.855983865	-0.8806342	-0.35104518	-0.3884	-0.1439	-0.4224	-0.3729781
6			44.31587313	-0.665174327	-0.230721879	-0.849704329	-0.6117115	-0.193578004	-0.3806	-0.0397	-0.4167	-0.2271015
7			18.24897943	-0.898999399	-0.028495452	-0.863616699	-0.5644839	-0.080743242	-0.4134	-0.0552	-0.3959	-0.2347543
8			-4.433577012	0.9560							-0.2901	-0.3929363
9			-3.684395592	1.8467							-0.2255	-0.5661476
10			-0.897383722	1.5796							-0.1306	-0.5380189
11			-0.358915644	0.04							-0.0707	-0.0454631
12			-0.615683424	0.59747							0.4496	0.7778191

The quarterly IFPA of December 2016 compares the reference growth rate of Sep-Dec 2016 with price movements during the last quarter of the past years.

Annual Indicator for Food Prica Anomalies (QIFPA)-Equation 5

month	AIPA_2007	AIPA_2008	AIPA_2009	AIPA_2010	AIPA_2011	AIPA_2012	AIPA_2013	AIPA_2014	AIPA_2015	AIPA_2016	AIPA_2017
1			7.52729228	-0.2218589	-0.09175854	-1.34240036	-1.32649845	1.022509305	-0.479983461	0.225491701	-0.3519456
2			5.33503926	-0.2415758	-0.12541179	-1.34933467	-1.10572633	1.015512817	-0.443939884	0.193248463	-0.38657
3			5.24743597	-0.5602532	-0.02297775	-1.23844377	-0.62769693	0.88656018	-0.401398855	0.229089839	-0.4305027
4			5.37738534	-0.77271722	0.0039964	-0.95187687	-0.51840601	0.792896215	-0.308446145	0.070715609	-0.2898015
5			-1.00262271	-0.49469591	-0.46286936	-1.27675006	-0.4082944	1.201605587	-0.152015571	-0.018302535	-0.2985316
6			-1.16859071	-0.16848748	-0.76331595	-1.09196784	-0.19404056	1.004925808	-0.064248033	-0.072727425	-0.2710437
7			-0.93627645	-0.14158419	-1.23361854	-1.02738996	-0.10297196	0.93749622	0.023902414	-0.237791957	-0.1816379
8			-0.62234698	-0.25063964	-1.93966635	-0.9739443	0.30344467	0.358971915	0.05306306	-0.155708178	-0.3753463
9			-0.47768658	-0.29430335	-2.28637792	-0.94764032	0.80324249	-0.173803705	0.061352954	-0.185027996	-0.4556547
10			-0.44647363	-0.18851562	-1.86075733	-0.97174265	1.06636024	-0.463934931	0.115841522	-0.213099617	-0.3687507
11			-0.41337322	-0.23991674	-1.57590256	-1.03828227	0.96081904	-0.391159366	0.162421698	-0.308377932	-0.3324575
12			-0.2824339	-0.52373812	-1.64961868	-1.09187051	0.97593063	-0.418722216	0.201865844	-0.269756024	-0.4179907

INDICATOR CALCULATION (11)

5. Build IFPAs

Once you have calculated the quarterly and the annual IFPAs,
the **IFPA** for a particular year *y* in month *t* is = **0.4 (QIFPA) + 0.6 (AIFPA).**

Indicator of Food Price Anomalies (IFPA) by month and year-Equation 6											
month	IPA_2007	IPA_2008	IPA_2009	IPA_2010	IPA_2011	IPA_2012	IPA_2013	IPA_2014	IPA_2015	IPA_2016	IPA_2017
1	0.000	-0.240	3.886	-0.407	-0.444	0.107	-0.412	0.796	0.046	0.81	0.20
2	0.000	-0.267	2.810	-0.417	-0.332	-0.537	-0.255	1.365	0.267	0.84	0.24
3	0.000	-6.419	4.136	-0.943	-0.113	-1.159	-0.376	0.708	-0.110	0.43	-0.31
4	0.000	-0.832	5.367	-0.667	-0.123	-1.025	-0.392	0.470	-0.123	-0.03	-0.29
5	0.000	21.403	-0.734	-0.506	-0.620	-1.118	-0.385	0.566	-0.149	-0.18	-0.33
6	0.000	17.726	-0.967	-0.193	-0.798	-0.900	-0.194	0.451	-0.054	-0.21	-0.25
7	0.000	7.300	-0.921	-0.096	-1.086	-0.842	-0.094	0.397	-0.008	-0.30	-0.20
8	0.000	-1.773	0.009	1.028	-1.533	-0.782	0.817	0.022	0.032	-0.21	-0.38
9	0.000	-1.474	0.452	0.374	-1.612	-0.743	1.525	-0.223	0.019	-0.20	-0.50
10	0.000	-0.359	0.364	0.366	-1.291	-0.868	2.778	-0.412	0.017	-0.18	-0.44
11	0.000	-0.144	-0.232	-0.263	-0.649	-0.555	3.643	-0.246	0.247	-0.21	-0.22
12	0.000	-0.246	0.070	-1.025	-0.534	-0.327	1.280	-0.273	0.475	0.02	0.06
Annual IFPA- Simple Average	0.00	2.89	1.19	-0.23	-0.76	-0.73	0.66	0.30	0.05	0.05	-0.20

fx =(0.4*M56+0.6*AB56)

Quarterly Indicator of Food Price Anomalies

Annual Indicator of Food Price Anomalies

▶ **IFPA is submitted from the fifth year due to the required length of the data – i.e. 2011 in the example**

FAO – IFPA CAPACITY DEVELOPMENT

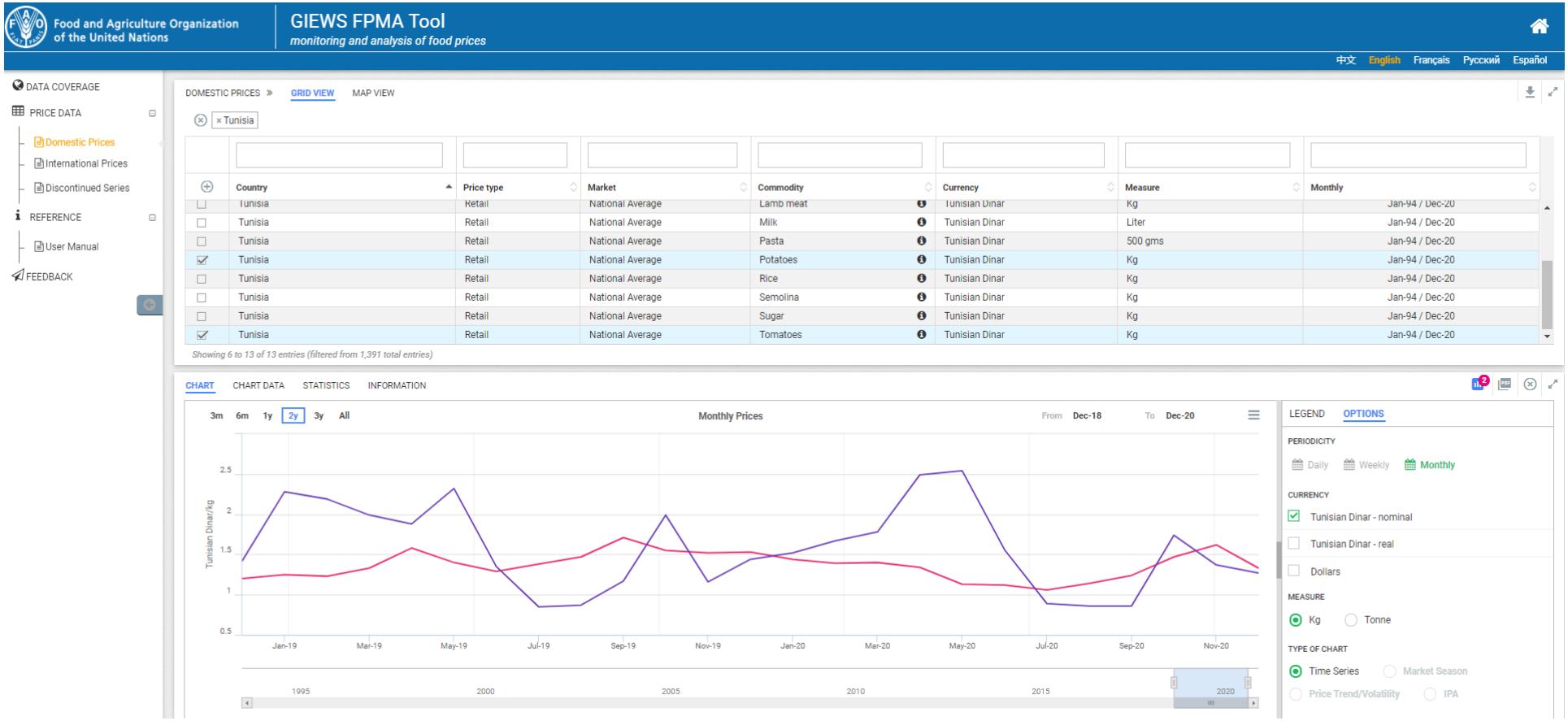
- Feeding into FAO's Global Information and Early Warning System (GIEWS) and its activities of Food Price Monitoring and Analysis (FPMA) the indicator of food price anomalies offers governments regular price information on a basket of goods.

- Results are disseminated and analysed through the FPMA website and **bulletin on a monthly basis** with the aim of providing early warning to countries where there is a potential impact on economic access to key food products as a result of abnormally high food prices. It helps countries ensure appropriate measures can be taken to soften the blow when consumer markets fluctuate.
  http://www.fao.org/giews/reports/fpma-bulletin/en/

http://www.fao.org/giews/food-prices/home/en/

FAO – IFPA Capacity Development (2)

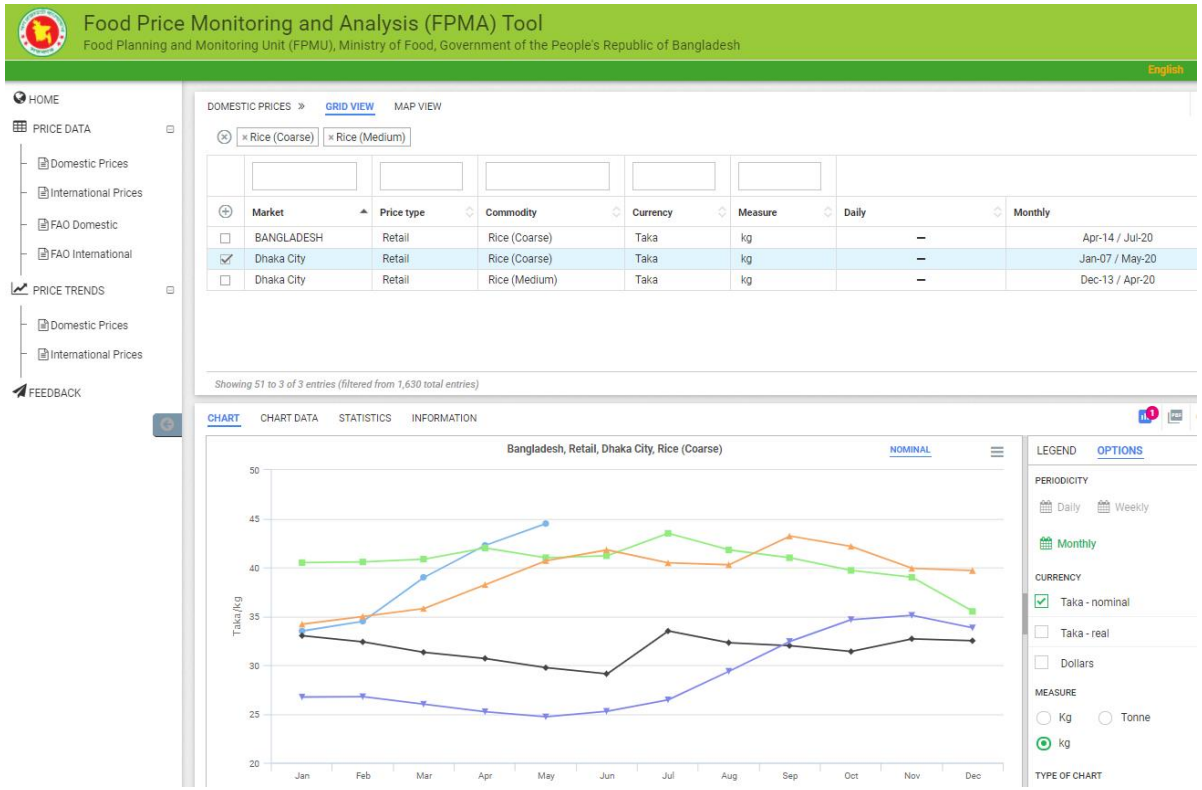
- FAO monthly analysis on IFPA relies on the information on price data gathered and disseminated via the FPMA Tool http://www.fao.org/giews/food-prices/tool/public/#/home



FAO – IFPA CAPACITY DEVELOPMENT (3)

- The FPMA Tool has been adapted for use at **country level**. The tool is linked to existing data collection systems and allows national and international stakeholders to easily monitor, analyze and disseminate price information for a wide range of commodities in markets of their choice with daily or monthly frequency. Currently the FPMA Tool is being deployed in a number of countries.

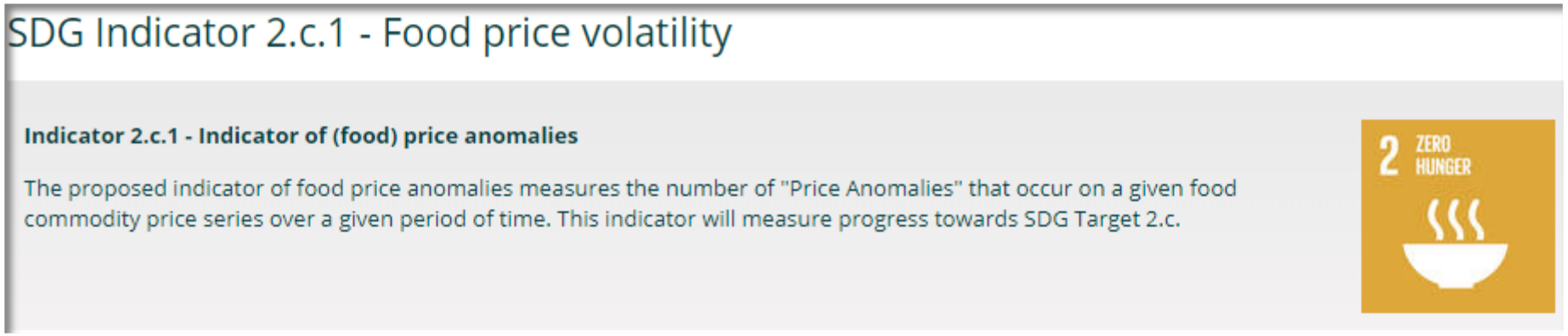
An example of a national price tool: Bangladesh



https://fpma.review.fao.org/giews-bgd/food-prices/tool/public/#/dataset/domestic

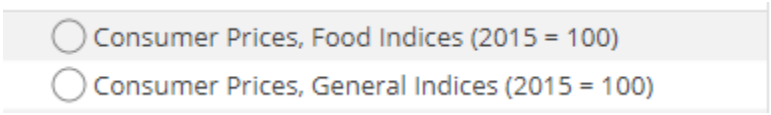
FAO – IFPA Capacity Development (4)

FAO has also a dedicated page on the annual results of IFPA
http://www.fao.org/sustainable-development-goals/indicators/2c1/en/



The indicator monitors key commodities for food security at a national level and at a regional/global level the overall price level of food. To accomplish this the indicator is calculated for a set of commodities (Maize, Rice, Wheat, Millet/Sorghum) and on the food price sub-index of the consumer price index as reported by the IMF and National sources.

- The analysis facilitates cross country and regional comparisons and monitoring as it is based on a nationally defined food basket
- For the commodity prices please visit FAOs Food Price Monitoring and Analysis (FPMA) Tool http://www.fao.org/giews/food-prices/tool/public/#/home
- For the Consumer Price Indices (Food/General) http://www.fao.org/faostat/en/#data/CP



FAO – IFPA CAPACITY DEVELOPMENT (5)

All the information on **SDGs** and **SDG 2.c.1** can be found at

- *Sustainable Development Goals*

http://www.fao.org/sustainable-development-goals/overview/mk/

- *SDG Indicator 2.c.1*

http://www.fao.org/sustainable-development-goals/indicators/2c1/en/

- In addition an ***e-learning course*** can be found at

https://elearning.fao.org/course/view.php?id=362

The course is a clear and easy-to-use guide to understand Indicator 2.c.1 (Indicator of food price anomalies) and the methodology to estimate it. It covers basic concepts related to market functioning, prices determination and price volatility and explains how to calculate the indicator and use the online Food Price Monitoring and Analysis (FPMA) tool to interpret indicator results, at national and international level.

This course is primarily intended for: staff of public institutions responsible for monitoring domestic food markets or involved in price data collection, dissemination and analysis within the reporting of SDG Indicator 2.c.1; as well as professionals working in public or private organizations interested in price monitoring and market stability.

You only need to register (free of charge) to get access to the course.

THANK YOU

FOR MORE INFORMATION, PLEASE CONTACT:

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