

Food security and agricultural markets: an analysis of the impacts of food price shocks on sub-Saharan countries

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Abstract

According to the Food and Agriculture Organization (FAO), the food price crises in 2007-2008 and 2011-2012 led to increases in the number of undernourished people worldwide. In this study, we address the issue of food insecurity by analyzing the main causes behind the food price shocks in the 2000s. Moreover, we also investigate whether the sub-Saharan countries are most vulnerable to these shocks, as often pointed out by specialized literature. To this end, we analyzed the correlation between the maize domestic prices—the most cultivated and consumed grain in this region—and the daily kilocalories consumption in African countries. Results show that the poorest nations, i.e. the ones with per capita income below \$ 1,400, suffer most from food prices crisis. Most African countries have advanced in addressing food insecurity issues. However, in some nations, the maize price shock in 2007–2008 was a throwback in this progress, causing daily kilocalorie consumption to fall by half in relation to levels of early-2000s.

Keywords: food insecurity, maize price; vulnerability; Africa.

1. Introduction

The fight against food insecurity has been a priority for the United Nations (UN) since its inception in 1945. This aim also inspired the United Nations Millennium Declaration, signed in September 2000. The first Millennium Development Goal (MDG) was to “Eradicate extreme poverty and hunger”, with the target being to halve hunger in a fifteen-year span.

At the end of this period, the UN launched the "Millennium Development Goals Report" which summarizes the results obtained. The MDGs have helped to lift more than 1 billion people out of extreme poverty since the 2000s, and to decrease the proportion of undernourished people by nearly half in developing countries. However, the fight against hunger has evolved unevenly among the regions of Africa, Asia and Latin America (United Nations, 2015).

In the past two decades, China alone accounted for two thirds of the total reduction in the number of undernourished people. In contrast, the pace of hunger reduction in the sub-Saharan countries was not enough to achieve the first MDG (United Nations, 2015). Currently, over 40% of the population of this region lives under conditions of extreme poverty.

Moreover, the fight against food insecurity has received a setback in the last ten years due to the: i) growing

scarcity of water and land; ii) recurring environmental disasters; iii) humanitarian crises stemming from ethnic and religious conflicts; ii) two food price shocks in 2007-2008 and 2011-2012. The food prices crisis is an important issue, after all, the poorest individuals are more vulnerable to price shocks able to deprive them of an adequate calorie intake. Therefore, the world's number of undernourished people has increased sharply in the 2007/2008 biennium (HLPE, 2011).

The food price shocks were especially traumatic for sub-Saharan Africa, given its dependency to maize, the region's main food source. Among all foodstuffs, maize has suffered the most intense price shock (Minot, 2014), in part due to increased demand for biofuels in the USA (Abramovay, 2009). The raising maize prices have affected millions of people across Africa, since, besides being a fundamental food in the diet of dozens of countries, maize is also used to feed the cattle and other types of animals. Therefore, there is an all-round increase in the cost of the animal protein sources.

Given this context of price volatility, two aims were outlined for this study: i) to discuss the main causes behind the food price crises in 2007-2008 and 2011-2012; ii) to examine how the maize price shocks have impacted the food security conditions in sub-Saharan countries. To this end, we used the databases of foodstuff prices and food security indicators provided by FAOSTAT¹'s. Our results show that the poorest African nations, i.e. the countries with per capita income below \$ 1,400, suffer most from food prices shocks.

The remainder of the study is structured as follows: Section 2 discusses the causes behind the food price shocks; Section 3 describes the methodology, i.e., the indicators extracted from the FAOSTAT platform; Section 4 presents the empirical results, and Section 5 concludes the study.

2. Price shocks and food security.

Two price shocks have affected the supply of many agricultural products in the current century. The price of the cereals, dairy products and vegetable oils doubled between 2005-2007. Not even the 2008 World Crisis was able to contain this ascending movement. Moreover, with the onset of the economic recovery in mid-2010, food prices reached a new peak between 2011-2012, which this time also included the animal protein sources. More recently, since 2014, the foodstuff prices have stabilized with the slowdown of the Chinese economy (HPLC, 2016).

Poor countries spend their income largely on food, so they are strongly impacted by price shocks. The Food and Agriculture Organization (FAO) estimated that the food prices crisis of 2007–2008 led to an increase in the number of undernourished people from 850 million to 1023 million (HPLC, 2011). The global hunger increasing has changed some conventions about food insecurity.

During the second half of the 20th century, the food supply grew faster than the demand due to substantial gains of productivity in agriculture. It was assumed (among developed countries) that the hunger is not due to the lack of food, but rather to the existence of extremely poor consumers who do not have enough income to afford an adequate calorie consumption. The recent price shocks have shaken this belief. As a result, there is a growing fear that the price shocks can reflect a potentially gap between the demand for food and

¹ Available at <http://www.fao.org/faostat/en/#home>

the agricultural output (World Bank, 2008).

According to this view, the main cause behind the price shocks is the increasing demand for food in Asia, particularly in China (Kearney, 2010). The income growth in Asian countries gave rise to a paradox. On the one hand, the increasing income in developing countries is a precondition for millions of people to achieve food security. However, the situation of the consumers living in other poor countries, who have not experienced the same income growth, tends to worsen due to the demand pressures and the increased food prices (World Bank, 2008).

The existence of a “new era of scarcity” characterized by a lasting imbalance between the supply and the demand for foodstuffs, is still a controversial issue. In fact, many scholars have rejected this idea. However, there is a much stronger consensus that several economic and environmental issues have hampered the food surplus growth rate. It is not possible anymore to expand the agricultural output by using extensively natural resources as water, land, biodiversity, and energy (HPLC, 2016).

Moreover, the trade barriers have also contributed to reducing the food supply in African countries. Several nations have tried to protect their markets from the international prices’ volatility, particularly in the case of maize. However, these measures put additional pressures on the domestic prices, which need to increase to equalize the demand for food with the domestic output. Hence, according to Minot (2014), the traditional food price stabilization efforts seems counterproductive. The price volatility is higher in countries with the most active intervention to stabilize maize prices.

3. Methodology.

We aim to study the correlation between the maize prices and the food security conditions prevailing in sub-Saharan countries. To achieve this goal, we initially follow the steps of Chauvin, Mulangu & Porto (2012). The authors chose the indicator termed per capita consumption of kilocalories (Kcal) per day to measure the nutritional status of 21 African countries over the last 50 years.

Furthermore, Belton & Taylor (2004) pointed out that the major grains cultivated in Africa are: maize (27.2 million tonnes yearly), sorghum (18.1 million tonnes yearly) and millet (13.1 million tonnes yearly). The sorghum and the millet are mostly produced and consumed on the African continent itself. Given this regional character, these cereals have not suffered major price fluctuations in the last two decades (Minot, 2014). However, in the case of maize, the bulk of the consumption occurs in developed countries, especially in the USA. Thus, the international prices shocks were transmitted to domestic markets, thereby affecting the food security of millions of people across Africa (Chauvin, Mulangu & Porto, 2012).

Considering these stylized facts, we examined the volatility of maize domestic prices in 20 sub-Saharan countries: Botswana, Cabo Verde, Cameroon, Congo, Cote d'Ivoire, Ethiopia, Gambia, Ghana, Guinea-Bissau, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Rwanda, Senegal, South Africa and Tanzania. For the same countries, we also collected information on the consumption of kilocalories per day and the per capita income. The historical series were provided by the FAOSTAT platform. The databases start in the year 2000 and end in 2013.

The FAOSTAT database of foodstuff prices has some limitations. Several African countries have missing

data for the entire period covered by the study². In the case of the 20 countries belonging to our sample, we identify some erroneous data entry that led to outliers. According to Schoeber, Boer & Schwarte (2018), the nonparametric Spearman's coefficient is a robust alternative to the Pearson's correlation coefficient in presence of outliers. Therefore, we use the Spearman's correlation coefficient to identify statistical relationships between the maize domestic price and the daily kilocalorie intake in each sub-Saharan nation.

4. Results

In this section, we investigate two stylized facts pointed out by specialized literature: i) international food price shocks were transmitted to domestic markets, thereby affecting several African countries; ii) the poorest countries in Africa are more vulnerable to food price crises. To address the first stylized fact, we examine the volatility of maize prices in 20 sub-Saharan nations (Table 1).

Table 1. Maize domestic prices 2000-2013 (US dollars/tonne)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Peak1*	Peak2**
Congo	262	232	282	304	495	655	823	1074	1338	1448	1675	1614	1642	475.%	593%
Ethiopia	119	79.	66	126	117	144	138	268	350	246	169	139	237	341%	76.4%
Niger	118	117	129	149	195	225	258	315	511.4	480	422	457	477	336%	290%
Cabo Verde	247	240	253	303	334	334	337	368	825	890	851	893	805	242%	271%
Mozambique	52.	91	126	105	121	151	139	145	279	231	162	226	254	204%	147%
Cameroon	175	177	186	238	276	284	306	363	472	373	315	407	418	166%	129%
Cote d'Ivoire	119	135	142	219	239	232	237	302	348	320	315	379		157%	181%
Senegal	130	156	205	239	174	185	242	298	377	324	290	328	354	140%	109%
Tanzania	119	119	123	150	165	158	214	144	265	282	298	276	163	121%	130%
Ghana	171	209	169	172	235	366	254	289	443	382	340	429		111%	104%
Malawi	111	156	279	128	144	185	198	135	327	332	228	193	218	109%	23.%
Kenya	190	169	141	157	193	201	213	232	353	309	217	281	401	108%	66.%
Rwanda	213	178	124	183	202	243	279	292	364	409	313	376	410	104%	111%
Nigeria	198	341	383	294	335	477	438	419	695	169	333	340	349	103%	-0.2%
Gambia	134	156	247	216	250	311	219	263	293	239				87.%	
Botswana	126	87	112	188	202	171	151	151	150	141	154	292	262	72%	236%
Guinea-Bissau	842	818	860	1028	1133	1165	1141	1329	1382					69%	
Madagascar	143	139	135	109	113	143	169	253	226	220	215	216		63%	55%
Mali	107	111	170	132	100	163	137	154	169	175	205	360	299	51.%	222%
Burundi	253	219.8	187.5	181.5	236.9	314.3	291.8	313.5	323	346.9	382.3	407.8	386.8	47.0%	85%
South Africa	78	103	129	123	129	205	201	154	137	210	240	207		33.3%	101%

² We exclude the following countries: Angola, Burkina Faso, Benin, Chad, Eritrea, Guinea, Mauritius, Namibia, Sierra Leone, Sudan, Zambia, Zimbabwe.

Source: FAOSTAT; * maize price change between 2008 and 2001;** maize price change between 2011 and 2001
Table 1 shows that the maize price shocks were a widespread phenomenon. In a six-year span (from 2001 up to 2007), the domestic prices doubled in at least 13 countries. The most dramatic cases were Congo, Ethiopia and Niger, where the increases exceeded 300%. Since the 2007-2008 peak, the prices fell sharply in only 3 countries (Ethiopia, Malawi and Nigeria) while in most nations, the maize prices remained high, or even continued to rise, as occurred in Congo, Côte d'Ivoire, Botswana and Mali. In sum, our results reinforce the first stylized fact presented above.

However, the evidences to support the second stylized fact were far less robust. As shown in Table 2, only 3 African nations—Niger, Rwanda and Guinea-Bissau—recorded significant negative correlations ($P < 0.05$) between the maize domestic price and the daily consumption of kilocalories.

Table 2. Correlation between the maize domestic prices and the daily consumption of kilocalories

Country	Spearman's Rho	P Value	Average income * (2000-2013)
Niger	-0.595	0.0319	793.67
Mozambique	0.3223	0.2611	800.55
Ethiopia	0.3612	0.2044	876.42
Malawi	-0.3789	0.1816	917.49
Rwanda	-0.7437	0.0023	1157.29
Guinea-Bissau	-0.8439	0.0042	1340.10
Madagascar	0.5245	0.0800	1405.03
Gambia	-0.4549	0.1022	1554.56
Mali	0.5245	0.0015	1749.97
Tanzania	0.4044	0.1515	1888.46
Senegal	0.4287	0.1261	2086.74
Kenya	0.1014	0.7301	2327.45
Ghana	0.4903	0.1056	2650.06
Cote d'Ivoire	-0.021	0.9484	2716.82
Cameroon	-0.4466	0.1260	2836.57
Nigeria	0.3718	0.1905	4276.84
Congo	-0.1584	0.5886	4825.46
Cape verde	0.4532	0.1036	5062.22
South Africa	0.3727	0.1894	11120.82
Botswana	-0.6121	0.0600	12442.67

Source: FAOSTAT; Hypothesis tests were performed on Stata 10; * Average income measured in US dollars.
We sort the African countries according to their average income over a thirteen-year span (2000-2013). The countries that recorded a significant negative correlation are among the poorest African nations, with average annual incomes of less than 1,400 dollars (Table 2).

The deterioration of the food security conditions in Niger, Rwanda and Guinea-Bissau³ reinforces the second stylized fact. As shown in Figures 1A and 1B, Niger and Rwanda experienced an increasing calorie intake during the first half of the 2000s. However, the maize price shocks not only aborted this progress but also halved the consumption of calories in comparison to the early-2000s levels.

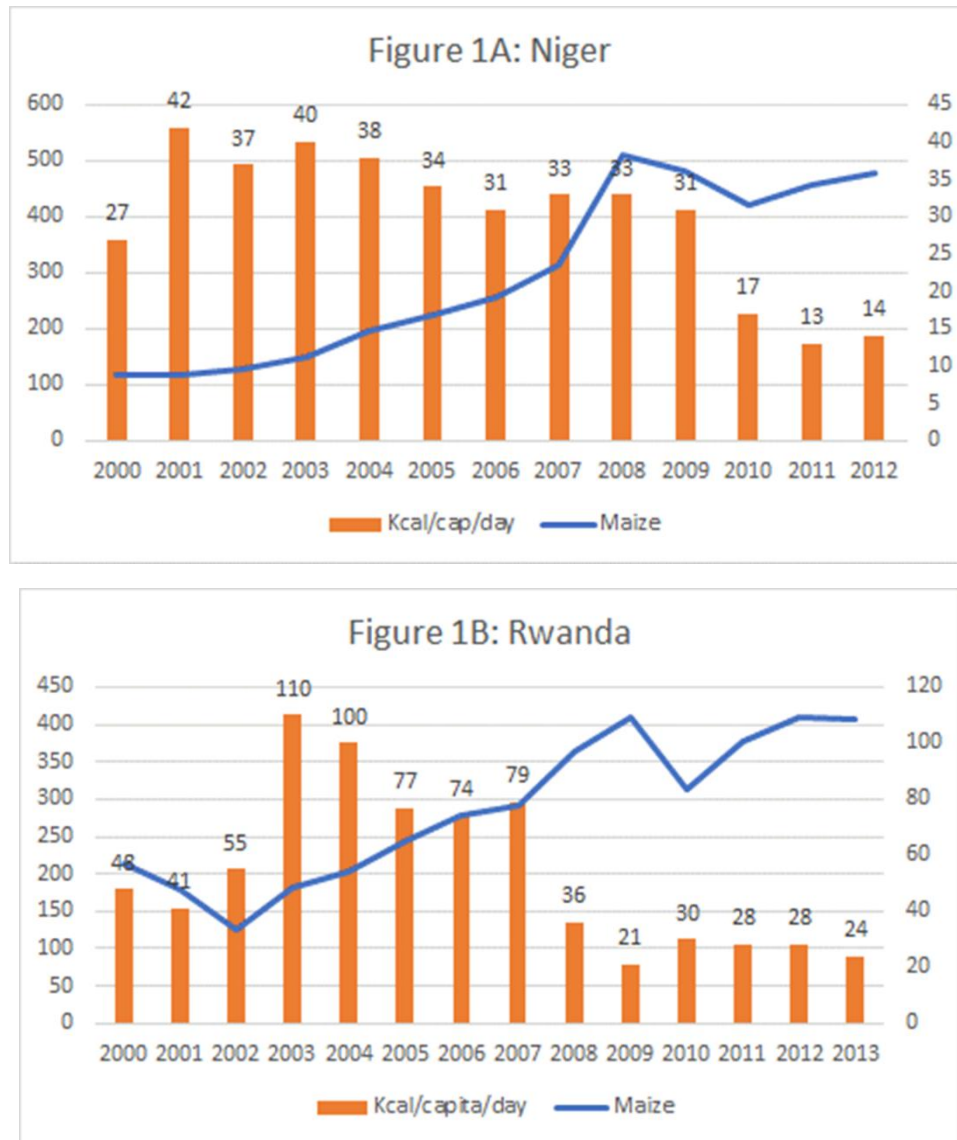


Figure 1. Maize domestic prices (US dollars/tonne – left axis) and daily consumption of kilocalories (right axis) in Niger (1A) and Rwanda (1B).

5. Conclusions.

This paper first discussed the main factors which have caused imbalances between food supply and demand in the 2000s. We contend that income growth in Asian countries, especially China, is the major cause behind the global rising demand for food and so the increases in the international food prices. On the other hand, from a supply perspective, several economic and environmental factors have hampered the growth of food production. The increasing limitations to the extensive exploitation of natural resources (water, land,

³ We do not include Guinea-Bissau in Figure 1 because the country has several missing data (see Table 1).

biodiversity, energy) present a huge challenge for modern agriculture. Moreover, trade barriers have also contributed to reducing the food supply in the poorest countries.

We also analyze whether the sub-Saharan countries are vulnerable to food price shocks, as often pointed out by specialized literature. A strong negative correlation was therefore expected between the maize domestic price - the most cultivated and consumed grain in Africa—and the consumption of kilocalories. However, this has not occurred; only 3 African nations—Niger, Rwanda and Guinea-Bissau—have recorded significant negative correlations for both variables. To some extent, the limitations inherent to the African databases seem to have compromised the robustness of the correlation coefficients calculated by the study.

On the other hand, it is also important to note that Niger, Rwanda and Guinea-Bissau are among the poorest countries in Africa. This finding reinforces the proposition that the poorest nations have suffered most from international food price shocks.

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