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Food Price Volatility over the Last Decade in Niger and Malawi: Extent, Sources and Impact on Child Malnutrition

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Abstract: Recently, considerable attention has rightly been paid to the nutritional impact of the sharp hikes in international food prices which took place in 2007-8 and, again, in 2010-11. While sacrosanct, this growing focus has somewhat obscured the effect of other factors which do affect malnutrition in the Sub-Saharan Africa context, i.e. the long term impact of agricultural policies, huge and persistent seasonal variation in domestic food prices, and the impact of famines which still regularly stalk the continent. This paper focuses on the relative weight of these factors in explaining child malnutrition (proxied by the number of child admissions to feeding centers) in Malawi and Niger, two prototypical countries in the region. The analysis shows that the drivers of domestic food staple prices and of the ensuing child malnutrition have to be found not only – or not primarily – in the changes of international food prices but mainly in the impact of agricultural policies on food production, the persistence of a strong food price seasonality, and recurrent and often poorly attended famines. Indeed, even during years of declines in international food prices, these factors often exert a huge upward pressures on domestic food prices and child malnutrition.

Keywords: Food prices, Famines, Seasonality, Food Policy, Child malnutrition, Niger, Malawi

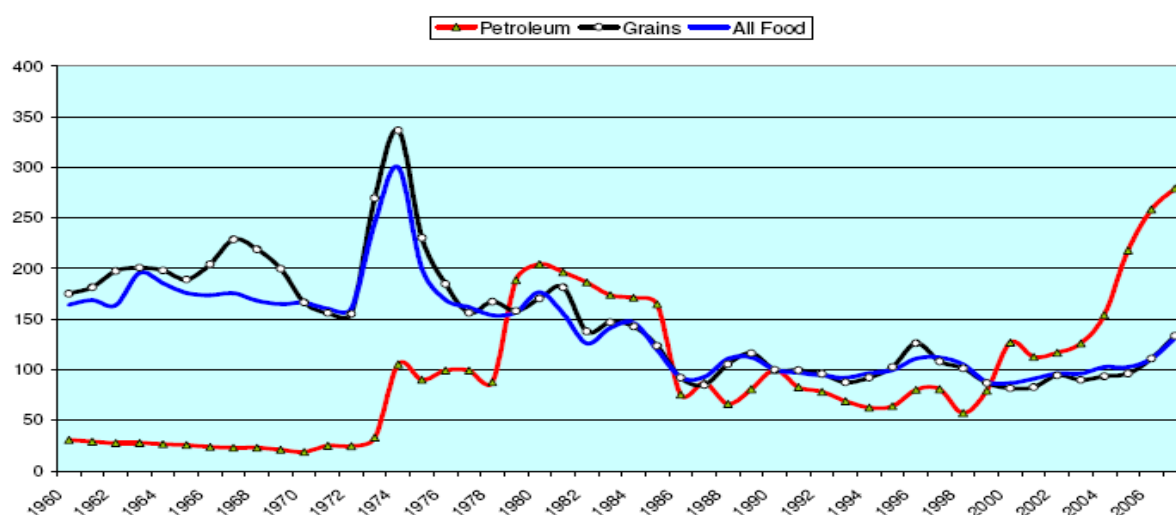
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1. Introduction

After peaking in 1974, the real international (US\$) food prices declined steadily till 1990 and then stagnated at a comparatively low level until mid 2007 (Figure 1), suggesting that with a growth of 1-1.5 per cent a year supply was growing faster than effective demand. However, between June 2007 and June 2008 international food prices rose sharply, while the decline observed between mid 2008 and mid 2010 did not offset its prior increase. In addition, the international food prices have surged again at a fast rate since mid 2010, and in January-May 2011 they had already exceeded the peak recorded in mid 2008 (Figure 2). The FAO estimates that these two surges in international food prices caused a marked increase in malnutrition in developing countries, as the rise in international prices was 'passed through' onto domestic prices. For instance, between 2005 and 2008 the number of undernourished people rose from 850 million to 963 million, and reached the historical peak of 1.02 billion people in 2009 (FAO, 2010), while the Development Committee of the World Bank-IMF (2011) estimates that the current food price spike has resulted in an estimated net increase of 44 million more people in poverty.

Figure 1 - Price indexes (1990 constant US\$ prices) for petroleum, grains and all food (1960-2008)



Source: World Bank Commodity Price Data

At the level of each single country, however, the transmission of changes in international food prices on domestic food prices is far from straightforward, and the extent of such transmission varies a lot according to its dependence on food imports, transport costs, pass-through margins, tradability of domestic foods, exchange rate variations and so on. In addition, the impact on malnutrition depends very much on the speed of such transmission, as a sharp short-term adjustment of domestic to world prices may impact the poor negatively, while a gradual transmission over the medium-long term might not harm their nutritional status.

Thus, whether, by how much, and at what speed surges in international food prices are passed on to domestic prices is a matter for empirical investigation. In this regard, it is worth recalling that in many SSA countries domestic food prices have often exhibited huge spikes and considerable volatility even during the long period of stability - or even decline - in international food prices depicted in Figure 1.

Figure 2 - Trends in FAO's Food Price Index (January 2007- May 2011)



Source: FAO's World Food Situation, 2011

For instance, in the case of the two countries analyzed in this paper – Niger and Malawi – the evidence that international food prices are a main driver of domestic prices is weak and the same applies to other African countries (Blein & Longo 2009, Diallo et al 2009, Benson et al. 2008).

To assess the extent of this price transmission, we carried out an econometric test of the impact of international food prices on domestic food prices over 2000-2010 in Malawi and Niger following the model proposed by Minot (2011). This model makes a series of rather stringent assumptions, i.e. homogeneous cereal products, competition among numerous small traders, perfect information, no trade taxes or other policy barriers to trade, and no transportation and transaction costs. In the above mentioned analysis, Minot carries out his estimation by means of the vector error correction model which assumes that the domestic food price is affected by the world price and vice versa. This assumption does not hold in the case of Malawi and Niger, two small countries whose prices do not affect world prices. For this reason equation (1) is estimated with the OLS method.

Given these assumptions, the price transmission occurs via short and long term lagged adjustments in the domestic price as described by the following econometric relation:

$$\Delta P_{i,t}^D = \alpha + \theta (P_{i,t-1}^D - \beta P_{i,t-1}^W) + \delta \Delta P_{i,t-1}^W + \rho \Delta P_{i,t-1}^D + \varepsilon_{i,t} \quad (1)$$

where $P_{i,t}^D$ is the natural logarithm of the domestic price of the commodity taken into consideration (maize for Malawi, millet for Niger) in country i ($i = \text{Malawi, Niger}$) converted into US dollars in month t , P_t^W is the natural logarithm of the international price of maize or

millet² in US dollars, Δ is the time difference operator ($\Delta P_t = P_t - P_{t-1}$), $\alpha, \theta, \beta, \delta$ and ρ are estimated parameters and ε_t the error term.

In equation (1) the first term in parenthesis represents the long term transmission of world prices on domestic prices (scaled by the parameter β). The subsequent two terms measure the short term impact of the lagged increments (Δ) of the natural logarithm of domestic and international prices. As β is unknown we estimate relation (1) after developing the parenthesis. A successful test of the hypothesis of the transmission of world prices on domestic prices requires that the estimated parameters β and δ are positive and statistically significant³. The regression results are presented hereafter in Table 1, panels A (Malawi) and B (Niger). The results in Panel A show that the long run elasticity of the Malawian price of maize in relation to its long run world price $\theta\beta$ is pretty low and barely significant. In turn, the short run elasticity of the domestic price relative to the world price (δ) is positive but not statistically significant. In contrast, the autoregressive term (ρ) is significant and shows that approximately 55 percent of the change in the Malawian maize price will be transmitted to the domestic price of the commodity in the subsequent year. Finally and interestingly, α (the trend component) is negative and significant.

Panel B on Niger shows that the long run relationship between world cereal prices is negative and highly significant, suggesting that an increase in the average world price of cereals reduces the domestic price of millet (a phenomenon which is difficult to explain, and which may point to a rapid increase in domestic output of millet on occasion of rises in international cereal prices), while the short run elasticity of the domestic millet price relative to the average world price of cereals (δ) is positive, sizeable and statistically significant. This suggests that there are important short term but not long term effects of international cereal prices on the domestic price of millet. However, the autoregressive term (ρ) is significant and slightly bigger than the prior term. It shows that approximately 57 percent of the change of the domestic price of millet in Niger will be carried over into next year. Finally and contrary to what observed in the case of Malawi, α is positive and significant.

Overall, with the exception of a possible short term effect on the domestic price of millet (and this may be due to the hypotheses made to proxy the international price of millet, see footnote 5) the results of Table 1 do not seem to support the view that, over 2000-2010, the price of maize in Malawi and of millet in Niger were mainly influenced by their world prices. The possible reasons of these results are the moderate dependence of these countries on imports of these staples and their greater dependence on local crop conditions, whether due to shocks, agricultural and food storage policies or seasonal variations (World Bank 2011a; Asian Development Bank 2011, Ellis & White 2010). For instance, Hauenstein Swan et al. (2009) provide evidence that the link between global price rises and malnutrition levels is not as clear as that one between seasonal price rises and malnutrition.

² For Niger, we could not use the international price of millet as such commodity is not globally traded. We used instead the simple average of the prices of wheat, rice, sorghum and maize – which assumes that in any case the domestic price of millet cannot deviate excessively from the international price of cereals.

³ To derive β (the long term elasticity of price transmission) we estimate $\theta\beta$, then obtain β as follows: $\beta = \frac{\theta\beta}{\theta}$.

Table 1 - Test of the transmission of international maize and millet prices on domestic price, OLS estimation on monthly data (January 2000- December 2010)

Panel A- Malawi

Dependent variable: $\Delta \ln$ maize price in Malawi (in US \$)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant (α)	-0.438	0.196	-2.234	0.0272
\ln maize price in Malawi -1 (in \$) (θ)	-0.091	0.025	-3.619	0.0004
\ln world (USA) maize price -1 ($\theta\beta$)	0.058	0.035	1.629	0.1056
$\Delta \ln$ world (USA) maize price -1 (δ)	0.198	0.162	1.221	0.2243
$\Delta \ln$ maize price in Malawi -1 (in \$) (ρ)	0.558	0.072	7.665	0.0000
Adjusted R-squared	0.332	Durbin-Watson stat		1.873
F-statistic	17.028	Prob (F-statistic)		0.000
N. obs	130			

Notes: the value of β is equal to $0.058/0.091 = 0.638$; it shows that around 60 percent of the international price will be transmitted onto the Malawian price in the long run. -1 = one month lag

Panel B- Niger

Dependent variable: $\Delta \ln$ millet price in Niger (in US \$)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant (α)	0.517	0.235	2.199	0.0297
\ln millet price in Niger -1 (in \$) (θ)	-0.169	0.049	-3.443	0.0008
\ln world cereal price -1 ($\theta\beta$)	-0.102	0.046	-2.231	0.0274
$\Delta \ln$ world cereal price -1 (δ)	0.542	0.155	3.493	0.0007
$\Delta \ln$ millet price in Niger -1 (in \$) (ρ)	0.566	0.109	5.193	0.0000
Adjusted R-squared	0.212	Durbin-Watson stat		1.8892
F-statistic	8.406	Prob (F-statistic)		0.0000
N. obs	130			

Note: the value of β is equal to $-0.102/-0.169 = 0.603$; it shows that around 60 percent of the international price will be transmitted onto the Niger price in the long run. -1 = one month lag.

Source: authors' calculation on FEWSNet and IMF data for the commodity world prices and the MWK/US\$ exchange rate; INFOEURO and FXTOP for the CFA/US\$ exchange rate; FEWSNet for the maize price in Malawi; and SIMA for the millet price in Niger.

Thus, while the relation between international and domestic food prices is not as direct as it is generally assumed, in some countries there is evidence that domestic food prices are influenced by: (i) the long term trend in domestic production and productivity per capita and the efficiency of domestic food markets, (ii) seasonal price fluctuations (stemming from intra-annual climatic variations and market imperfections), and (iii) large food crises and famines. Often, the silent increase in malnutrition and mortality due to these factors attracts less attention than the shocks caused on occasion of surges in international food prices. While increases in domestic food prices linked to food imports reduce the food purchasing power of the of the urban low and middle classes and may therefore raise poverty rates (and trigger food riots), their impact on malnutrition and mortality is unlikely to be necessarily more important than that due to the three types of price changes discussed in this paper. In

contrast, limited progress in these three areas is a main factor explaining the slow progress recorded in achieving the MDG on child malnutrition and child mortality⁴.

In view of the above, this paper focuses on these three sources of food price changes, each of which requires policy responses which differ among each other and from those needed on occasion of rises in international food prices. The analysis covers the last decade and concentrates on Niger and Malawi, two countries which experienced during this period a marked long run volatility of food prices, persistently large seasonal price fluctuations, and acute food price spikes on occasion of the food crises of 2005 and 2010 in Niger, and of 2002 and 2008/9 in Malawi. Purpose of this paper is therefore to analyze the importance of each of these three factors, and their relative contribution to overall domestic price volatility and changes in child malnutrition⁵ over the period considered.

2. Framework to analyze food price volatility and its impact on food security

In this paper we concentrate on household and individual food security, a concept which is more useful than that of national food security in explaining the levels and variations in malnutrition. In this approach, food security is reached when the value of the individual's and household's entitlements meet the cost of the household's energy requirements. One of the core component of this definition is the concept of 'entitlements' introduced by Sen (1981) as a set of alternative commodity bundles a person can command in a society, using its totality of rights and opportunities. Sen distinguishes 'trade entitlements' (what a person can buy with the commodities owned), 'production-based entitlements' (the right to own what a person produce with her resources), 'own-labour entitlements' (what a person can buy selling the labor power owned), and 'inheritance and transfer entitlements' (the right to own what it is willingly given by others, including state institutions). In addition, over the short term, food security depends also on the monetary value of the assets the household decides to sell to purchase food. Thus, the food entitlements bundle – and food security – of household group h ($h=1,..,k$) can be written as follows:

$$Qf_h = Qf_{sc_h} + Qj_h \frac{Pj}{Pf} + Qw_h \frac{Pw}{Pf} + \frac{Th}{Pf} + \frac{|AA|_h}{Pf} \quad (2)$$

where Qf_h , Qf_{sc_h} , Qj_h , and Qw_h are the total amount of food available to household group h , the amount of food produced for self-consumption, the amount of goods (such as animals, cash crops, firewood, etc.) sold and the amount of casual wage labour performed. In turn, Pf , Pj and Pw are the prices of food, the price of goods sold on the market and the wage rate, Th the nominal value of transfers received (including in the form of food aid, cash transfers on occasion of cash/food-for work, and cash obtained from begging), and $|AA|_h$ the income obtained from the sale of household assets. $\frac{Pj}{Pf}$ and $\frac{Pw}{Pf}$ are the 'terms of trade' between the prices of goods exchanged and that of food, and between the wage rate and the price of

⁴ Malnutrition is a key factor in the 3.5 million deaths among children of less than 5 years of age recorded every years.

⁵ In this paper we focus on child malnutrition as children are especially vulnerable to changes in food intake, as the incidence of child malnutrition helps capturing aspects of the distribution of wellbeing within the households not adequately reflected in other indicators, and as most nutritional data refer to this age group. In a sense, child malnutrition is the most important indicator of hunger in Africa.

food. The volume of market demand for food of household h is $(Qf_h - Qf_{sc_h})$, while total food demand is equal to $\sum_h (Qf_h - Qf_{sc_h})$.

Such 'micro' framework, includes all immediate determinants of the control over food, and can help understanding variations in Qf_h over (i) the long term, (ii) the seasonal cycle and (iii) on occasion of famines/food crisis. However, the right-hand-side (RHS) variables in (2) are most likely to change at different speeds over time, while their underlying determinants are obviously very different. Hereafter, we attempt to identify which RHS variables of (2) are more likely to influence control over food and the extent of malnutrition during the three different time dimensions illustrated above.

Determinants of long term food security

In this framework, the long term food security and malnutrition are affected by the following variables:

- Long term changes 'supply side conditions and policies', i.e.
 - Qf_{sc_h} is the amount of food production/capita for self-consumption of household h . As noted by Boserup (1965), this depends – *inter alia* – on the growth of the household size, land availability (which allows to expand the 'extensive land frontier' without increasing land yields) and its distribution, and agricultural policies aiming at expanding the 'intensive land frontier' (i.e. intensifying the use of land by increasing the application of complementary inputs such as high-yielding varieties, fertilizers and irrigation), by means of land reform (in countries with high land concentration), inputs support policies and subsidies, price support, and other policies. In several SSA countries, Qf_{sc_h} and land yields stagnated as public policy hardly focused on agricultural research, input subsidies, rural infrastructure and rural development. For example in the COMESA (Common Market for Eastern and Sothern Africa) countries, food supply has grown at 2.5 percent while the population increased at percent, resulting in a gradual erosion of Qf_{sc_h} for many households in this region (Karugia et al. 2009)⁶.
 - Changes in imports and exports, which after the adoption of the SAPs have become – for better or for worse – a more important determinant of the overall food supply than in the past⁷. Food imports and exports vary according to changes in domestic production, domestic and international prices, transport costs, foreign exchange availability and policy choices.
- Long term changes in 'demand side conditions and policies', i.e.

⁶ By 2008 only a fifth of the African countries had allocated more than 10 per cent of total public expenditure to agricultural development, as agreed in the Maputo Declaration on Food Security (2003), and many countries barely reached 4 per cent of GDP. In turn, the share of ODA allocated to agriculture has fallen from 18 percent in 1979 to just 3.5 percent in 2004, while in 2008 spending on agricultural R&D was 0.61 of the agricultural GDP, far below NEPAD's national investment target of at least one percent of GDP (for more details see Beintema & Stads 2011)

⁷ Dorosh et al. (2007) estimated that without the moderating impact of private imports, Zambia's maize price would have increases by over 160 percent and the maize consumption of poor household would have fallen by 25 percent below the actual level.

- An increase in market demand of food due to a rise in the incomes of non-food producers ($Q_{jh}P_j$), rises of (rural and urban) wages P_w , incomes in manufacturing and services, the discovery of primary commodities or an increase in their price, and an increase in social transfers T_h ;

- A decline in Q_{fsc_h} , the amount of food production/ capita for self-consumption, due to the rising commercialization of agriculture;

- Changes in the domestic price of food P_f which depends on the interaction of domestic

demand/supply conditions (which reflect also the policy measures adopted, see above), as well as in international food prices (and their impact on the domestic prices through growing/declining import dependence, for any given price transmission mechanism).

If not accompanied by a proportional increase in nominal cash income, rising P_f translates into lower purchasing power of the household and in a reduction (both in quantity and quality) of the bundles of goods and services that the household can control. The income elasticity of demand for major staples of poor households tends to be very high (Karugia et al., 2009). Moreover, several studies have shown that the consumption habits are very rigid and that the diet of the poor is already based on the cheapest staples (Kelly et al, 2008; Brown et al. 2009, Blein & Longo, 2009). This means that in response to an increase in the price of a particular staple food, poor households cannot easily find cheaper and nutritious substitutes and will end up reducing the resources allocated to key non-food items, such as health care and water and sanitation, a decision which also affect nutritional status over the long run.

Seasonal price volatility and food security

The literature describes recurrent and marked changes in food prices, poverty, body weight, malnutrition, and mortality during the annual 'hunger season' of about 4 months in the build up to the harvest period. Dostie et al. (2002), for instance, estimate that the number of people living below the national poverty-line in Madagascar increases each year from nine million to almost ten million during the hunger season. Similarly, child mortality doubles between May/June and the peak of the hunger season in December/January, with 26 percent of child deaths due to diarrhea and 22 percent to malnutrition (*ibid.*). Devereux (1992) provides evidence of how prevalence of malnutrition follows the price increases recorded during the hunger season in Ghana in 1988/89. The same has been shown for Niger by Mousseau and Mittal (2006).

This phenomenon is practically absent in the developed economies. In contrast, in most of SSA, small farmers sell part of their food output right after the harvest (when prices are at their lowest) to cover expenses for taxes and religious ceremonies and repay debts contracted during the lean season. After exhausting their food stocks, they start buying food (i.e. 6-8 months later, when food prices are their highest) with cash obtained by selling small animals, doing casual work, migrating, borrowing, or getting enrolled in food aid programs. Seen from this perspective, seasonal food security depends mainly – even in normal years – on:

- The strong seasonality of P_f , P_j and P_w . In particular, P_f rises while P_j and P_w drop.

Such strong fluctuations in P_f depends on inadequate storage facilities (at the family and collective level) which forces households to sell at a low price part of their produce after the harvest to avoid losing a significant proportion of the harvest (up to one third) to pests and decay. A second reason for selling part of the output immediately after the harvest is to repay debts contracted during the hunger season to buy food (at high prices), pay school and hospital fees, religious ceremonies, etc (Hauenstein et al. 2009). Lack of access to formal (non-usury) credit forces small farmers to sell at low prices to get the necessary cash they need for the above purposes. Improvements in storage capacity and the promotion of cereal banks would reduce crop sales after the harvest, smooth the food price seasonality, and reduce the small farmer's dependence on costly food purchases during the hunger season. In addition, a minimum of credit would permit the farmer to avoid buying food at high prices – de facto forfeiting part of her/his real income – and preserving therefore part of the harvest for sale during the period of higher prices.

The possibility to receive some form of seasonal transfer T_h (e.g. in the form of food/cash for work or remittances from seasonal migrants). In India, for instance the Employment Guarantee Scheme ensures 4 months of employment in public work schemes (or cash subsidy if no such programs are available within a radius of 20 Km from the residence of the household). While growing in number, such programs are few and far between in most SSA.

Extreme short term food price changes during food crises/famines

Poor SSA countries are often hit by sudden and acute price increases due to climatic factors, sharp changes in food imports/exports, rising market inefficiency and speculation. During these periods, food security and malnutrition can be affected by:

- Large year-to-year drops in food output for self-consumption Q_{fsc_h} , due to climatic shocks;
- An increase in P_f due to a constant food production for self consumption Q_{fsc_h} , accompanied by a decline in food imports or an increase in exports (caused, among others, by changes in exchange rates and cross-border prices);
- An increase in P_f due to a constant food production for self consumption Q_{fsc_h} , accompanied by hoarding by food traders who anticipate increases in future food prices;
- A rapid erosion in the prices of P_j (and possibly quantities produced Q_j) and in the wage rate and labor demand ($Q_{w_h}P_w$) relative to P_f ;
- A drop/ insufficient rise in public and private transfers $\frac{T_h}{P_f}$ due to inadequate policy responses,
- The limited resources obtained from the sale of assets $|AA|_h$ (land, livestock, tools, jewels) which aims at offsetting the decline in production, exchange and labor entitlements. 'Distress sales' of household assets during food crises generally provide a limited respite to households' short term nutritional problems, while they can affect their long term nutritional status whenever the assets divested are used to produce food or other goods.

The extent to which higher food prices translate into higher malnutrition rates in the short term depends on a series of factors. The majority of Sub Saharan farmers (and all of the non-

farmers) is net food buyers during 4-5 months a year (Ravallion 1989, Christiaensen & Demery (2006), Seshan and Umali-Deininger, 2007; Byerlee, Myers & Jayne 2006; Ivanic & Martin 2008, Hauenstein Swan et al. 2009). Under these conditions, a sudden rise in the price of staples, as observed during sudden food crises, translates immediately in a reduction of food consumption (Oxfam & Save the Children 2008)⁹. The impact is greatest among the poorest families who spend 60-75 percent of their income on food and are therefore less able than middle income families to substitute non-food for food consumption. Increases in food prices will not be so destructive as long as they are accompanied by a rise in the price of other crops, livestock and agricultural wages. However, the literature shows that rural and urban wages will generally increase at a slower pace than food prices or even fall (Rashid 2002; Walt 2008). Evidence from Ethiopia, for instance, suggests that a rise in other incomes could be nullified by the soaring cost of the main staple food (Hauenstein et al. 2009)¹⁰.

Interactions between long term, seasonal and crisis food security

While they show different dynamics and need different policy responses, these three types of changes in food prices influence each other and child malnutrition in the following ways:

- failure of improving long term food security via supply-side policies aiming at increasing land yields and food production per capita and at raising the incomes of all social groups lead to a situation of persistently fragile food security and high levels of chronic malnutrition which – together with a limited access to basic health services – exposes chronically malnourished children to a high risk of wasting and death during the hunger months and food crises;

- in turn, during the lean season households are frequently forced to gamble their future welfare to live today, which often has serious repercussions for the ability to increase food production over the medium term. When faced with seasonal food price increases, poor families almost universally react by restricting the quality and, later, the quantity of food consumed. Maintaining staple food consumption at the expense of micronutrients-dense foods, like eggs, meat or milk, can result in micronutrient deficiencies, a weakened immune system and, if prolonged, weight loss, causing malnutrition rates to rise. Seasonal hunger is a main cause of a high chronic incidence of child stunting and low weight, which do affect the long term learning capacity of children, their human capital formation and future productivity. In addition, in bad years seasonal hunger becomes the ‘father of famine’ as the seasonal price fluctuations are amplified not only by a given shock but also by lack of programmatic responses to deal with the seasonal food price fluctuations. It is this debilitating and neglected downward spiral of seasonal suffering that preceded the food crises of Malawi in 2001/02 and Niger in 2005 (see section 6).

- an inadequate public handling of food crises/famines affects in turn the households’ food security and ability to increase food production over the medium-long term. Indeed, as food

⁸ Notably, Aksoy & Isik-Dikmelik, (2008) suggest that the ‘marginal’ rural net food buyers (i.e. those who only enter the market to ‘top up’ their food supplies above their own subsistence stocks) are little affected by price changes. However, in the case of landlocked sub Saharan counties such as Niger and Malawi, the majority of the population is dependent on market purchases during 4-5 months a year to satisfy their food requirements.

⁹ For example, Oxfam and Save the Children 2008 predicted a reduction in food consumption of 17 percent between January and March 2008 if millet price rose from 200 to FCFA 300 per kg.

¹⁰ Despite considerable increase in their prices, in 2008 coffee, an oxen and a day agricultural wage respectively purchased in , in 2008 3, 23 and 24 percent less maize than in 2007 (Hauenstein et al. 2009).

insecurity intensifies because of poor public responses, more households adopt damaging and irreversible coping strategies such as selling or mortgaging assets and livestock, or borrowing at high interest rates using their land and future harvest as collaterals. In this case, the impact of surges in food prices does not always cause an immediate rise in malnutrition, but can have catastrophic consequences in later years, as coping mechanisms become more limited and family assets cannot be fully restored immediately and long term food production is hampered by lack of productive assets and credit.

All this suggests that the three types of food crises are closely interconnected and that piecemeal responses to each of them may generate only limited benefits. An integrated policy response to malnutrition and food security is thus in order. Of course, this is a tall order and lack of resources may limit the actions of governments in this regard. Yet, the formulation of an integrated policy response – even if implemented only gradually – is the only solution to the longstanding problem of food insecurity and child malnutrition still besetting important segments of the African society.

3. Background: structural features and food in-security in Niger and Malawi

Why focusing on Niger and Malawi?

Niger and Malawi are two small Least Developed Countries which – while differing in a number of respects (climate, soils, population density, religion, colonial tradition, and types of crops grown) – share several structural characteristics which make them representative of SSA countries facing major problems in the field of chronic, seasonal and acute food insecurity and malnutrition. Both are landlocked, neighbour larger and richer countries (Nigeria and Zambia/Zimbabwe), have a very low Gross Net Income per capita and level of human development, and recorded stagnation in GNI/capita during the last 20 years (Table 2). Both employ 80 percent of the workforce in low-input smallholder subsistence agriculture, suffer from growing scarcity of farmable land and loss of soil fertility, and depend for their food security on food aid and unstable regional markets dominated by a few large countries. Both have recently introduced a democratic rule¹¹ receive substantial inflows of foreign aid and have benefitted from the Heavily Indebted Poor Countries (HIPC) program.

In both countries, the average calories consumption per capita is around 2100 (ten percent lower than SSA's average), which means that an important proportion of the population has a food intake below the recommended norm and is food-short during the lean season every year, and that seasonal and year to year variations in food availability do affect the incidence of low birth weights and proportion of moderate and severe wasting among children (*ibid*). In turn, at between 40 and 50 percent, chronic malnutrition reaches some of the highest

¹¹ In Niger, after a series of military regimes which placed considerable attention to national food security, President Tandja came to power in 1999 following 'fair and free elections'. However, democracy did not ensure – as argued by Amartya Sen – the avoidance of famines. Indeed President Tandja of the MNSD Party (whose election was supported by the country's powerful millet wholesalers) consistently denied the gravity of the 2005 food crisis and responded to it late. As he later on tried to modify the Constitution so as to be elected for a third term, he was deposed in February 2010 by a benevolent military junta which – *inter alia* - responded quickly to the food crisis of 2010 and organized new elections which brought to power in April 2011 President Issoufou of the main opposition party. In Malawi the political scene was dominated for long (1964-1994) by Dr. Banda a self-appointed dictator who was defeated in 1994 by President Muluzi. Since then, Malawi has enjoyed a democratic regime which has placed food security at the centre of its policy agenda. Despite this, and despite the important role plaid by the government in the food market, the country did not escape two food crises in 2002 and 2008/9 (section 6).

levels in the world, while health status remains precarious, as suggested by the values of their LEB and U5MR.

**Table 2 - Structural features and food security in Niger and Malawi
(2009 or averages for last few years)**

	Niger	Malawi	SSA average
A. Structural characteristics			
Population (mn.)	15.3	15.3	840 (total)
Population density	10.5	126.9	34
Population growth rate (%)	4.1	3.2	2.8
Distance from nearest harbor	1040	1020	n.a.
GNI/capita (US\$)	340	280	1147
GDP/c 1990-09 growth rate	-0.2	0.5	1.8
Adult literacy (%)	29	73	63
Primary net enrolment rate	38	91	65
Secondary net enrolment rate	7-11	25	28-32
Ratio of income share top 20% to that of bottom 40%	3.1	2.5	4.2
% poor (GNI/day<1.25 US\$)	66	74	53
ODA as % of GNI	13	22	4
B. Agriculture			
% Rural population	83	81	57
Farmable land /capita	0.98	0.23	0.24
Fertilizer consumption (kg/ha)	0.43	41.7	11.62
% labor force in agriculture	82.9	79.1	58.4
% landless/land-short farmers	2-3	2	n.a.
C. food security			
Calories availability/c	2145	2107	2370
% of calories covered by main cereal staple	85 (millet-sorghum)	90 (maize)	
Av-Cereal Imports/Total Cons	0.13	0.14	0.27
% food aid in total consumpt.	2.8	3.7	3.0
D. Nutritional and health			
LBW	27	13	14
% wasted children			
- moderate and severe	34-41	15-21	22-27
- severe	11	3-4	7
% stunted children	46	53	42
Per/cap. health expenditure (\$)	16	17	80
Life expectancy	52	54	53
U5MR	160	110	129

Source: authors' compilation on the basis of Unicef's ChildInfo, Googlemaps, World Bank, FAO

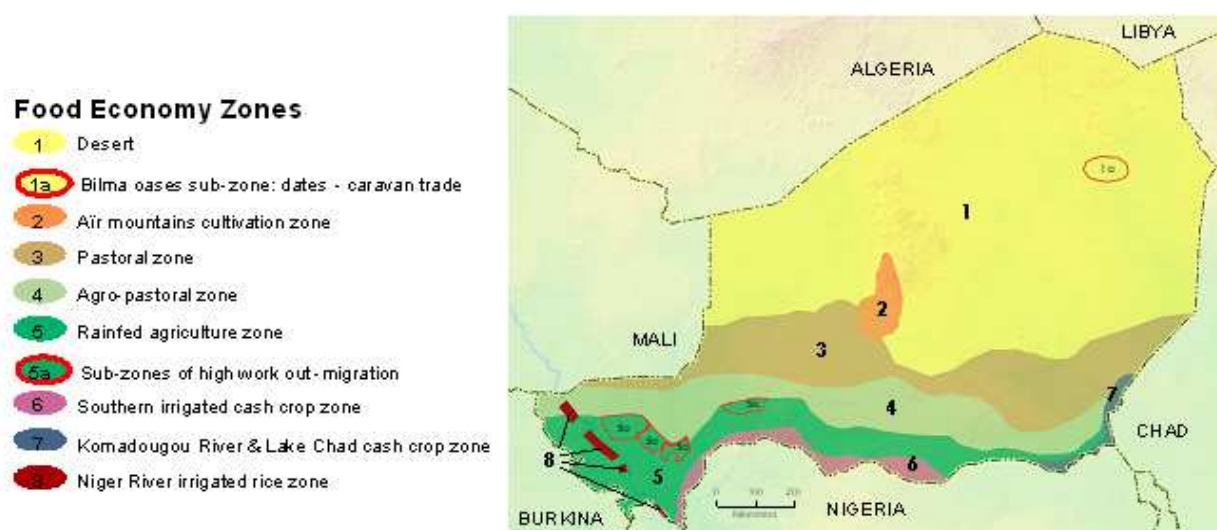
Country features

Niger is a vast and mostly flat Saharan country of 1.267.000 square kilometres with a population of 15.3 million in 2009 (Table 2, Figure 3). Islam is the dominant religion. Population density is low (10.5 people per square Km) but three quarters of the country are uninhabitable or can be used only for raising cattle. As a result, population density in the settled Southern areas is much higher and land scarcity acute. In addition, at 4.1 percent, population growth is among the three highest in the world, as the national fertility rate reaches 7.5 (8.7 in the comparatively fertile Southern regions bordering Nigeria, areas 5 and 6 in Figure 1 inhabited by the polygamous, sedentary and numerically dominant Hausa (DHS

1998)). Such staggering population growth increases the demand for land which is satisfied by migrating towards the marginal lands of the Central region (area 4 in Figure 3). Growth is hampered also by the shortage of human resources. At 29, 38 and 7-11 percent, adult literacy and primary and secondary school enrolment rates are among the lowest in the world (Table 2).

The country is landlocked and the closest port, Cotonou, is about 1040 km away, a fact that makes transport and communications difficult and expensive. 40 percent of GDP and 87 percent of employment are accounted for by subsistence agriculture of millet and sorghum, cattle rearing, and the cultivation of cash crops (onions and cowpeas) while manufacturing and services are dominated by the informal sector. At around 340 \$, Niger's GNI per capita (about 900 US\$ PPP) is among the ten lowest in the world. Though eroding, its dominant communitarian land tenure system makes that income concentration is moderate and, as a result, the ratio of the income share of the top 20% to that of the bottom 40% is a moderate 3.1 (*ibid*).

Figure 3 - Niger; Agricultural Zones



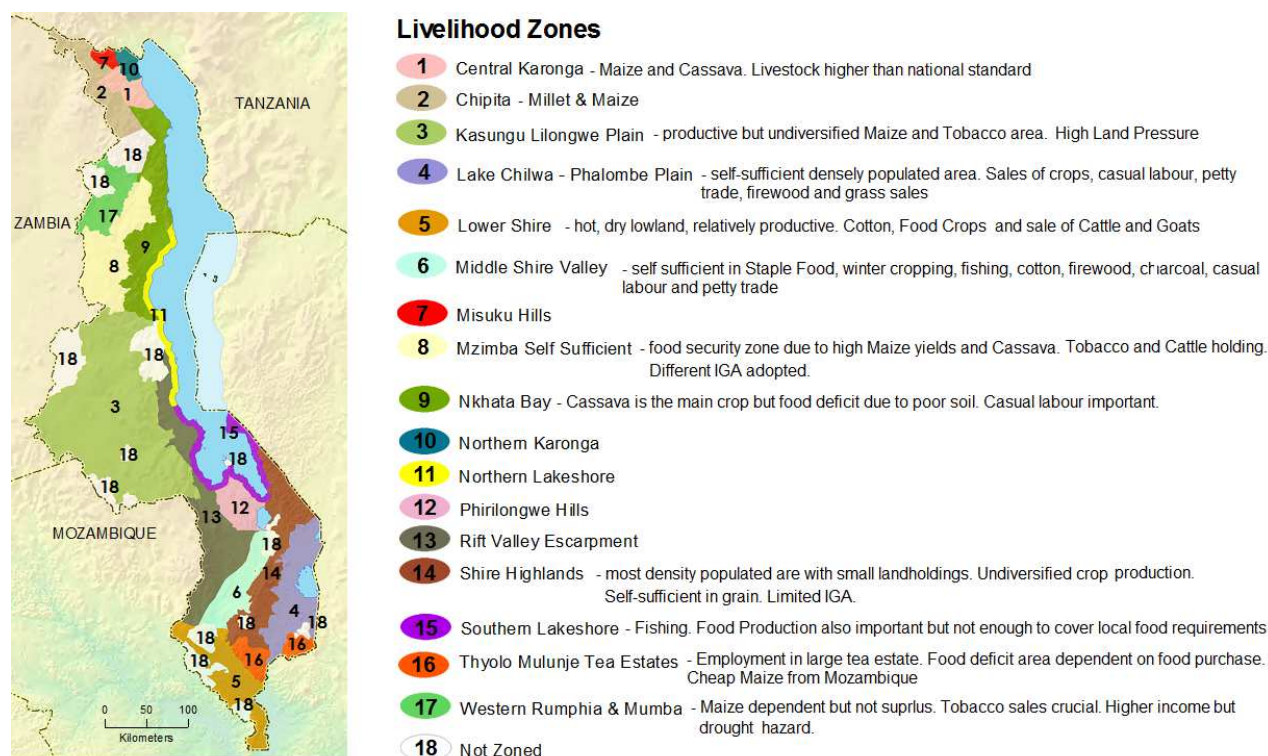
Source: Based on Few's Net, 2005

Food production (mainly millet) per capita has stagnated for decades, is increasingly more volatile, and droughts are recurrent. In addition, marked food price seasonality increases malnutrition every year during the hunger months of May-September. Niger has gradually become dependent on food imports to accommodate its growing population, whereas it does not earn much from exports, apart from a few agricultural commodities and uranium.

Malawi is a small country of 118,480 sq km located in Southern Africa. The dominant religion is Christianity. It comprises a narrow elongated plateau located at around 600 m above sea level (Figure 4). The Northern part of the country is mountainous but the rest of the country has a moderate subtropical climate. Like Niger, it has a population of 15.3 million (Table 2). Population density is 126.9 inhabitants per square kilometer, the sixth highest in Africa (Minot 2010). Population growth has declined somewhat during the last decade but averages around 3.2 percent a year, a rate which leads to a doubling of the population in 18-19 years, a fact that raises pressure on scarce land available, reduces soil fertility and increases migration.

The country is landlocked and the nearest harbors (Beira and Nacala in Mozambique) are at about 1000 Km from Lilongwe and 1500 Km from Northern Malawi, a fact that increases the cost and delivery time of food imports.

Figure 4 - Malawi: Agricultural Zones



Source: Authors' reworking based on FEWSNet and Malawi National Vulnerability Assessment Committee, 2005; 2003.

Agriculture accounts for 34 percent of GDP, 81 percent of employment and 90 percent of exports (World Bank, 2009). Annual rainfall ranges between 800 and 1400 mm in most areas (as against 300-600 in Niger) with a strong seasonal uni-modal pattern in November and April. Agricultural output is more diversified than in Niger, but maize is by far the most important food crop, followed by cassava, sweet potatoes, and sorghum. Maize accounts also for 90 of all calories intake (Table 2). Unlike in Niger, maize and cassava farming is to be found in most of the country. The dominant export crop is tobacco, grown both by small-scale farmers and large estates. Other cash crops are sugarcane, tea, cotton, and coffee, produced mainly by estates which use *ganyu*, the casual farm work provided by smallholders to complement their income. At around 280 \$, Malawi's GNI per capita is also among the ten lowest in the world. The land tenure system is dominated by small farms (0.5-0.8 hectares), with the result that income concentration is a bit lower than in Niger, as the ratio of the income share of the top 20% to that of the bottom 40% is 2.5 (*ibid*). Low average income and a medium income inequality make that poverty affects nearly three quarters of the population (Table 2). The country exhibits better indicators than Niger in the field of health, education and literacy though, at the same time, has to deal with a much greater HIV/AIDS problem as 11 percent of the population 15-49 years of age is infected as opposed to 0.8 percent in Niger (Cornia et al. 2011).

4. Long term changes in food production, prices and food security, 2000-2010

Niger

Niger can be divided in four main agricultural zones. Below the desert lies the Sahel (area 3 in Figure 3). With an average rainfall of 100-300 mm per year and sub-desert climate, this land can be used only for transhumant cattle herding. However, growing population pressure has led to an encroachment of agriculture along its southern part, and 70-80.000 new hectares of land subject to wind and water erosion are being cultivated every year. Second, the agro-pastoral zone (area 4 in Figure 3) is suitable for the extensive millet farming. Yet, due to low yields, most households do not produce enough millet to feed themselves throughout the year, and engage in goat rearing, casual labour, wood selling, small trade and seasonal migration. Third, the rain-fed area (the Maradi and Zinder regions) is characterized by semi-intensive agricultural practices, intercropping of cereals with cowpeas and groundnuts, and livestock rearing.

Food production and availability

Food production is dominated by the subsistence farming of millet and sorghum which account for 78 and 19 percent of cereal output (Beekhuis 2005). The latest 10 years have seen three major shocks in terms of production: 2000/2001, 2004/2005 and 2009/2010¹². Table 3 illustrates the long term trends in farmed land, cereal production, land yields, and imports dependence. These data point to an apparent long term stability of cereal production per capita at around 240-260 Kg and of net cereal availability per capita at around 200-220 Kg which seem to dispel fears of an approaching 'Malthusian trap'. However, low and stagnant land yields and rapid growth of the rural population have caused a migration towards the agro-pastoral and pastoral areas and the subsequent land degradation have gradually eroded food security in the following ways:

- **Year-to-year output volatility.** The expansion of the agricultural frontier towards lands exposed to a high risk of erosion and overexploitation have heightened the vulnerability of Niger's agriculture to climatic shocks, as suggested by the rising frequency of bad harvests: prior to the 1980s droughts were recorded on average every ten years, over the last 20 years they took place every five years, while over 1997-2004 there were three crisis, though over 2005-10 there were one bad year and a semi-bad one.

¹² Since 1960, Niger suffered several food shocks, mainly due to droughts. The main ones of them, i.e. 1973/74 (Dakoussou), 1984/85 (El Bohari), 1990/91, 1993/94, 1996/97 (Matche mai), and 2004/05 (Wazaka gaya ma) have been classified as years of serious food crises (Gouvernement du Niger/DNPGCA 2007).

Table 3-Niger: Long term trends in cereal output and land yields

Year	Population (000)	Cultivated area (000 ha)	Output (000 tons)	Imports over estimated food consumption (%)	Farm land per capita (ha)	Output per capita (Kg/c)	Land yields (kg/ha)	% Output change on previous year	% change in output per capita on previous year
Av.1980-4		4,120	1,582	10.2	0.69	267.6	385.1	-10.3	-13.2
Av1985-0		4,639	1,794	11.0	0.66	256.7	387.2	16	- 1
Av1990-4		6,987	2,035	6.7	0.84	245.3	292.1	14.1	10.4
Av1995-9		7,184	2,381	8.1	0.74	247.0	329.1	8.1	5.1
2000	10,492	7,342	2,126	12.2	0.69	202.7	289.6	-25.7	-28
2001	11,060	7,855	3,102	13.9	0.71	280.5	394.8	45.9	38.4
2002	11,456	7,838	3,228	14.7	0.68	281.8	411.9	4.1	0.5
2003	11,834	8,056	3,515	11.1	0.68	297.0	436.2	8.9	5.4
2004	12,224	7,838	2,665	14.0	0.64	218.0	339.9	-24.2	- 26.6
Av.2000-4		7,786	2,927	13.2	0.68	256.0	374.5	1.8	-2.1
2005	12,627	8,381	3,606	17.8	0.66	285.6	430.2	32.2	13.6
2006	13,045	8,905	3,968	12.6	0.68	304.2	445.6	10.0	6.5
2007	13,716	9,034	3,793	11.4	0.65	276.6	419.9	-4.4	-9.1
2008	14,197	9,919	4,851	....	0.69	341.7	489.0	27.8	23.5
2009	14,693	9,076	3,441	....	0.62	234.2	379.1	-29.1	-31.5
Av. 2005-2009		9,063.4	3,932.2	13.9	0.66	288.5	432.8	7.3	0.6

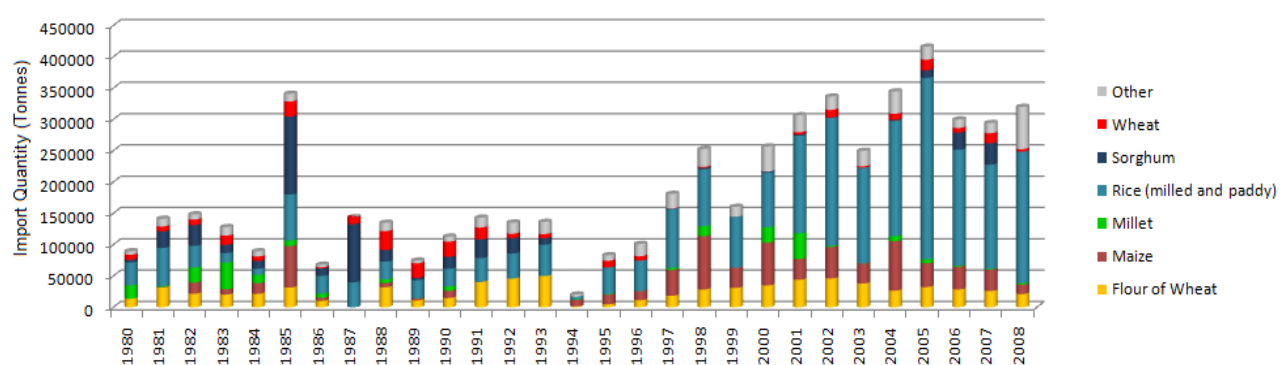
Source: Republique du Niger et al. (2010), FAOSTAT for Estimated Food Supply and Food Consumption

- **Increased inequality in the distribution of land, assets and income.** Lack of safety nets and credit markets force the farmers affected by production crises to sell their assets, mortgage or sell their land at distress prices, and borrow money at usury rates. All this reduces their assets, increases their debt servicing obligations, and erodes their ability to survive future crises. The rising land concentration caused by ever more frequent crises has led to the formation of new classes of medium-large farmers (Abdoulaye and Ibro 2006) and near-landless labourers whose survival depends on casual rural employment. While 88 percent of farmers still own land and sharecropping and land tenancy are still, many of them are now involved in casual farm work.

- **Increased spatial variation in food availability.** Within each region the spatial inequality in food consumption went up due to growing dependence on market purchases and limited private integration between the main regional markets and village markets, which are often not reached by traders because of insecurity, poor roads and weak demand. Detailed micro-studies suggest that rising spatial inequality in food production might also be due to the progressive concentration of the population in the ecologically fragile Northern agro-pastoral zones of Dakoro and Mayahi (Faculté d'Agronomie de l'Université Abdou Moumouni de Niamey, 2006).

- **Growing dependence on volatile imports.** In the 1960s, cereal imports acted as a safety valve during years of bad harvests, while they fell to zero in normal years. However, Niger's cereal trade balance started becoming negative in the 1970s. Food imports (on average 250.000-300.000 tons of cereals a year) originating from North Nigeria and to a lesser extent from Mali, Burkina Faso and Benin have thus become permanent (Figure 5) and constitute an increasingly important component of total food supply and consumption (Table 3) and key determinant of domestic food prices (Cornia and Deotti 2009).

Figure 5 - Niger: Evolution of cereal imports - tons (1980-2008)



Source: FAOSTAT

Increased dependence on food imports causes a number of problems. To start with, lack of good roads raises haulage costs. Transporting a 100 kg sack of millet costs 1500-1750 FCFA from Northern Nigeria, but 7400-11200 from Lomé, depending on the final destination (Beekhuis 2005). Secondly, the millet-producing Sahelian countries are often hit by co-variant weather shocks, a fact which reduces the extent to which imports can cover food shortfalls, while food imports from outside the region entail high transport costs and long delays. Aker (2007), for instance, shows that cross-border prices in Malanville (Benin), Jibia, Illela and Mai Adua (Nigeria) appear to Granger-cause 65 percent of price changes in Niger. In years of low output, Benin and Nigeria consume most of their domestic production and even import

grains from Niger's border area, exacerbating in this way its production deficit (CILSS et al, 2008). This asymmetric integration is particularly marked with Nigeria, a country with a GDP twenty times that of Niger. Unofficial cereal exports to Northern Nigeria may occur even in food crisis years if prices in Nigeria and Naira/CFAF make selling in that market more attractive (as observed after the poor 2001 and 2004 harvests).

Policies to encourage food production

As indicated in section (i), in Niger attempts at raising land yields and cereal production per capita generated limited results. Public policy in this field changed drastically over time. In the early days, the state cereal marketing and food security board OPVN managed most food trade at a price set by the state, stabilized food prices, maintained a food security reserve, and provided subsidized inputs to farmers. Import taxes were abolished and the focus of the new food security policy was on increasing agricultural productivity through a combined distribution of subsidized inputs and agricultural loans, support to basic food crops production and strengthening of institutions for their commercialisation (Republique du Niger, 2000). As a result, the production level and producer prices for cereals, cowpeas and groundnuts increased considerably between 1973 and 1983 (Hamadou 2000).

As in other African countries, this policy - in which both the input and output prices differed from free market prices - was abandoned in the early 1980s following the introduction of structural adjustment programs (SAP) which focused on 'getting the prices right' and on improving allocative efficiency. This change in policy started as an autonomous decision taken in 1982 by the government to face the unbearable burden resulting from 10 years of high public investments and was then endorsed by the International Institutions in 1983 (Mas & Naudet 1992). The reforms of the 1980s and the 1990s had important implications for the functioning of Niger's agro-food sector (World Bank 2009). With the signature of the 1983 IMF Standby agreement, the role of OPVN was drastically reduced. The number of its marketing outlets was cut, its price stabilisation role was abolished and only the task preserved was that of managing a much reduced food security reserve. In 1986, fertilizers subsidies were cut, and private trade and food prices were liberalized, while in 1993 and 1995 veterinary services were privatized and the trade in veterinary products was completely liberalised (FAO 2010c).

The abolition of trade restrictions and distorted producer subsidies and the increase in producer prices were expected to stimulate production and raise incomes in the agricultural sector (Balassa 1986). In reality, however, these measures did not always translate into higher producer prices (Tollens 2009) and, even where they did, the price elasticity of aggregate food supply turned out to be very low (Binswanger 1989). Thus, these policies broadly failed in Niger as well as in other SSA countries affected by severe market imperfections, inadequate infrastructure, and – particularly - lack of investments in agricultural research. Indeed, in such places, output is more responsive to non-price factors, such as technology improvements (Chibber 1989, Binswanger 1989) than to price incentives. Thus, despite these attempts at confronting the structural weakness of Niger's agriculture, the dependence of the country on climatic factors, backward farming techniques, limited input use and extreme price fluctuations did not decrease, while the liberalisation of agricultural trade and prices did not succeed in stimulating production. As a result, agricultural production per capita decreased by 20 percent during the 1980s, cereal imports rose to 7.8 percent of total consumption (Tinguiri 1992), while between 1979-1981 and 1990-1992 the daily caloric intake dropped by 5.6 percent and the consumption of meat/person/day fell from 64 to 53 grams (Blein et al. 2008). A particularly controversial change concerned the outright elimination of farm credits

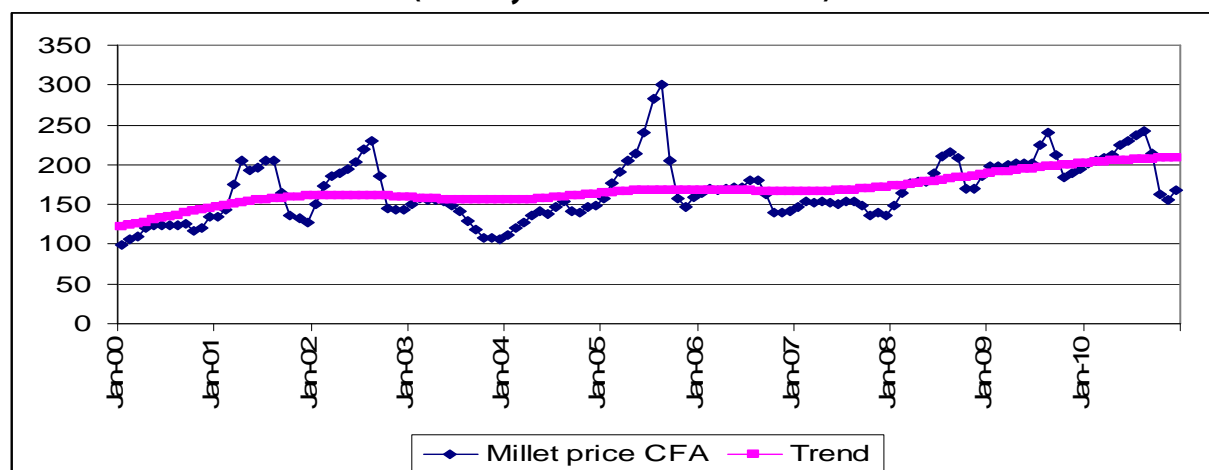
and fertilizers subsidies which worsened the terms of trade of agriculture and delayed the application of more input-intensive techniques (FAO 2010c, Marou Dodo 2005).

No major policy change has occurred since the late 1990s in terms of output diversification through the development of dry-season crops, which require better access to modern inputs, labour-intensive water-conservation techniques and – as a precondition for these increased investments – security of land tenure. A recent survey shows that the rate of adoption of improved seeds in some areas in Niger decreased from an average of 69 % between 1997 and 2001 to 48 % in 2002, as a result of the increasing costs and inadequate supply of improved seeds and fertilizers (Sani and Bagna 2007). To this day, the use of modern inputs and especially fertilizers (the lowest in CEDEAO after Sierra Leone, Blein et al. 2008) remains a major problem (Table 2). Similarly, agricultural R&D spending¹³ decreased from 15.6 percent per year during the 1970s (Mazzucato & Ly 1993) to 3.0 percent between 1981 and 1993 (Stads et al. 2004). In 2001, Niger invested only 0.17 USD per every 100 USD of agricultural output, one of the lowest ratios in Africa (*ibid.*) and lower than the value recorded in 1981 (0.37) and 1995 (0.64).

Food prices

The price of millet rose slowly during the first half of the 2000s (Figure 6). However, between 2006 and 2010 millet prices showed a steady upward trend despite the surplus harvests recorded in 2007, 2008 and 2009¹⁴. On the other hand, starting from 2007 the inter-annual volatility has fallen (see later).

**Figure 6 - Niger: millet price (CFA per kg) and its trend, monthly data
(January 2000 - December 2010)**



Note: The long-term trend component has been obtained with the Hodrick-Prescott Filter.

Source: Authors' calculation on FewsNet data

¹³ In 2001, the National Agricultural Research Institute of Niger (INRAN) accounted for three-quarters of the country's total agricultural research staff and close to 60 percent of agricultural research spending. Between 1991–2003, over half of the budget of INRAN was generated from a World Bank loan, 30 percent was contributed by the Nigerien government and the rest was provided by donors and public and private enterprises (Stads et al. 2004)

¹⁴ The progressive specialization of Benin, Burkina Faso and Mali in non-food cash crops (especially cotton) raised their cereal import needs and reduced cereal-trading opportunities within the Sahel. For Niger this has meant higher costs, and greater dependence from outside Sahel to satisfy domestic needs.

Long term nutritional impact

As a result of the long term stagnation in food production per capita, its increasing instability, growing dependence on volatile imports, stagnant GDP per capita and purchasing power, and persistence of poverty among about 70 percent of the population (Table 2), the nutritional status of a large part of Nigeriens broadly stagnated and in some cases worsened (Figure 7). While The U5MR – which is especially sensitive to the introduction of public health measures such as vaccination campaigns and oral rehydration therapy – steadily declined, this is not the case for most indicators of child nutrition, which instead reflect an increasingly difficult access to nutritious food and poor feeding practices¹⁵.

Indeed, most of Niger's nutritional indicators show a clearly unsatisfactory performance over the last 20 years compared to the average of other SSA countries and the developing countries more generally. In particular, while between 1990 and 2009 the percentage of low birth weights fell by 27 and 13 per cent in the developing countries and SSA respectively, in Niger it increased by 80 percent over 2005-2009. Similarly, despite a downward trend in the developing world and in Sub Saharan Africa, the percentage of under fives underweight (relative to their age) in Niger increased during the last 20 years from 36 percent between 1990-1996 to 41 percent between 2003-2009¹⁶.

Since 1996, the Government of Niger has developed a National Food and Nutrition Policy and a National Plan of action for Nutrition, which has been amended in 2002 and revised in 2006, but it has not been officially adopted by the government, clearly showing the low priority attached to it.

At the same time, since 2005 Niger has a National Nutrition Protocol for the treatment of acute under-nutrition which has been updated several times (2006 and 2009). Yet, despite the huge improvements recorded in 2010 (see later), insufficient resources, a poor National Health Information System and logistical constraints hampered the integration of community based management of acute malnutrition into the health system (Sanchez & Montero 2011).

Malawi

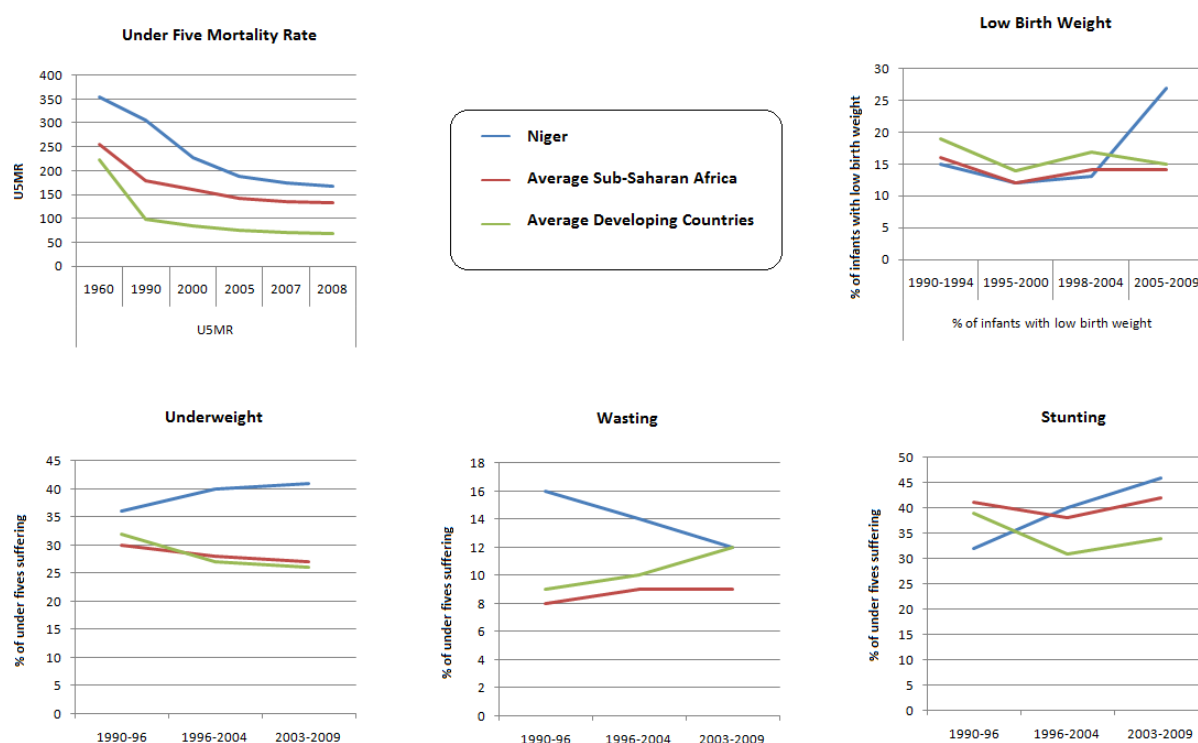
Food production

Food production in Malawi is dominated by the subsistence farming of maize and, to a lesser extent, cassava. Crop diversification is limited, and less than 20 percent of the maize output is marketed. Only around 10 percent of farming households use irrigation, and the majority of households' food productions still are vulnerable to changes in rainfall and soil degradation. As noted in section 3, 85 percent of the population works in agriculture, a fact that raises pressure on land, particularly in the Central and Southern region (Figure 4), where density respectively rose from 87 to 155 people per Sq. km and from 125 to 185 between 1987 and 2008 (World Food Programme, 2010). Falling farm size and soil fertility have thus become an obstacle to the production of enough food for self-consumption even in good crop years (Harrigan, 2008).

¹⁵ WHO, Nutrition at a glance: Niger. Available at [www. http://siteresources.worldbank.org](http://siteresources.worldbank.org)

¹⁶ Niger has higher rates of stunting than some of its neighbors Burkina Faso and Mali.

Figure 7- Niger: evolution of nutritional and mortality data in the last 20 years



Note: To facilitate the comparison with previous periods, the estimates of underweight children follow the National Centre for Health Statistics/WHO reference population and not the new 'WHO Child Growth Standards' introduced in 2006

Source: UNICEF, "The Status of the World's Children" 1997, 2001, 2004, 2009, 2011

Food security correlates with farm size (Table 4) as only households with more than 1.0 hectare can produce enough maize, raise a sufficient number of heads of cattle, and obtain credit for agricultural inputs. In contrast, households affected by poor food security own up to 0.8 hectares, produce a meagre 48.5 kilograms of maize per year and have no access to fertilizers.

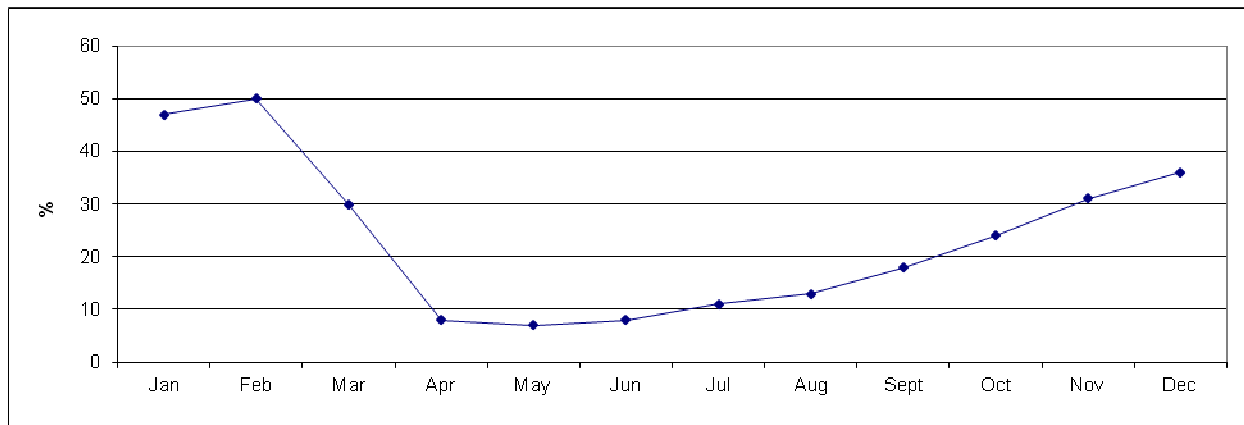
Table 4 - Malawi: Food security situation by size of land holding - percentage values (2008/09)

Food security group	No land	<0.5	0.5-1.0	1.0-2.0	2.0-4.0	>4
Poor	3	12	35	36	12	2
Borderline	2	10	31	33	18	5
Acceptable	2	7	26	36	20	9

Source: World Food Programme, 2010

As in Niger, smallholders are forced to sell part of their crops at low prices immediately after the harvest and to buy food at higher prices for the subsequent 6 to 9 months by selling goats, pigs and chickens and doing *ganyu*, i.e. casual labour in exchange of food or cash (Figure 8).

Figure 8 - Malawi: rural households who rely mainly on food purchase by month in 2009



Source: Authors' calculation on World Food Programme, 2010

However, *ganyu* payment rates fall at times of food shortages (Malawi National Vulnerability Assessment Committee, 2005). Doward et al. (2008) estimate that 60 percent of the household are regular maize buyers and, as such, are vulnerable to maize price fluctuations. Finally, the group of highly food insecure people includes also the destitute and those affected by HIV/AIDS who account for over the 19 percent of the economically active adults (FAO & WFP, 2003).

Table 5 and Figure 9 illustrate the long term trends in harvested land, maize production and land yields. Despite a rise in land yields per hectare due to the agricultural policies discussed in the next section, during the last decade maize production per capita remained broadly stagnant in the 140-240 Kg/capita range. However, food security has been affected as follows:

- **Extreme (and increasing) output volatility.** Even leaving aside the 2002 and 2008 food crises, maize production appears to be extremely unstable and such as not to ensure an adequate long term nutrition to the population, despite recurrent claims by the successive governments that falls in maize output are in part compensated by increases in cassava production.

- **Vulnerability to the rises in international price of fertilizers.** Agricultural policies have consistently emphasized an intensification of the use of fertilizers to increase land yields in low fertility Central and Southern Regions. Figure 9 shows that such policy lead to some progress in this regard. Yet, complete dependence on imported fertilizers, whose prices are closely linked to energy prices (Asareca 2008), increases the vulnerability to changes in international oil prices. A rise in the latter increases production costs and can cause a drop in fertilizer demand which translates – *ceteris paribus* - into lower maize yields and production, or higher maize prices, or in a shift out of those crops that require heavy fertilization (maize, tobacco, tea) and into those (such as roots and tubers) which are profitable also with no fertilizer use (Jayne et al. 2008b). For instance, while at the beginning of the 2000s, the fertilizer support programs, combined with favourable weather, contributed to bumper harvests of three consecutive years, the subsequent rise in the world price of fertilisers and the Kwacha devaluation of 2008 caused a 250 percent rise in domestic fertilizers' prices (Figure 10) which contributed to the food crisis of that year.

The impact of such rise on food insecurity was pointed out by Lewin & Fischer (2010) who estimated that a 25 percent increase in urea prices raises the probability of food insecurity by 30 percent in the central Malawi and 18 percent in Southern Malawi. Other authors suggest that the rise in global fuel and fertilizers prices raises the costs of producing agricultural commodities in developing countries with a good use of fertilizers. The adoption of an adequate fertilizer subsidy program in this context is thus fundamental to stabilize its use (Jayne et al 2008b, FAO 2010b).

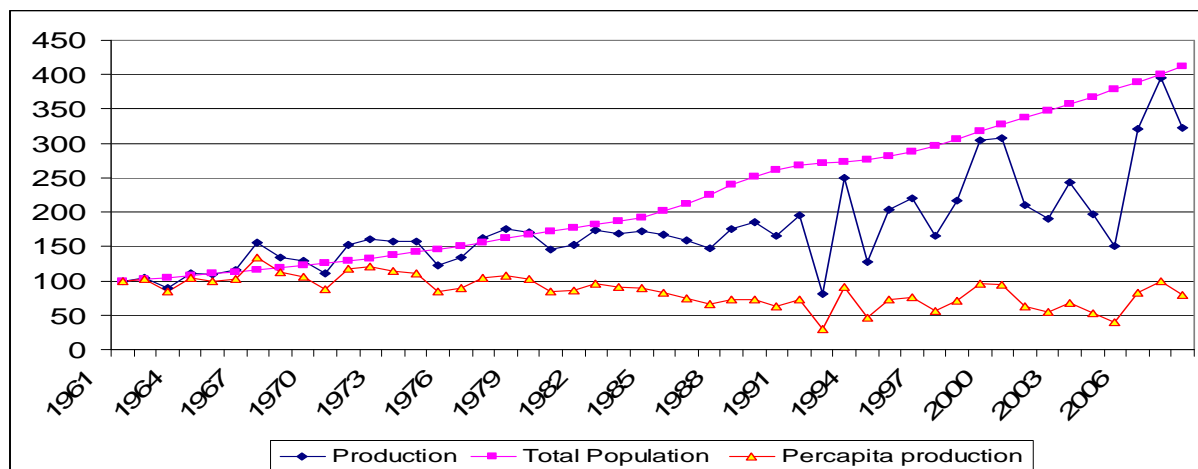
- A still important – if possibly declining - dependence on formal and informal maize imports. In normal years Malawi is able to meet its effective maize demand and maize trade accounts for a minimal proportion of consumption or production (Minot 2010). However, during bad years maize imports rise sharply, exposing the country to fluctuations in regional maize output, and to import competition by bigger countries with better transport infrastructure. Malawi is also the highest informal importer of maize in Southern Africa (FEWSNet, 2010) with annual volumes ranging between 50.000 and 80.000 tons. Yet, the increase of maize output of last few years generated positive formal exports in 2007-2008 which took the form of government-to-government contracts stipulated with Zimbabwe (Table 6).

Table 5 - Malawi: long term trends in land harvested, maize and land yields (2000-2009)

	Total Population ('000)	Area Harvested (Ha, '000)	Production ('000 Tons)	Land harv. per capita (ha)	Per capita production (kg)	Yield (Kg/Ha)	Yearly % change in production	%change per capita production
2000	11,831	1,435	2,290	0.121	211	17,428		
2001	12,194	1,446	1,589	0.118	140	11,844	-30.59	-33.55
2002	12,553	1,488	1,485	0.118	124	10,460	-6.55	-11.71
2003	12,912	1,617	1,847	0.125	153	12,259	24.38	23.84
2004	13,277	1,537	1,608	0.115	121	10,459	-12.94	-21.14
2005	13,654	1,513	1,225	0.110	89	8,093	-23.82	-25.92
2006	14,043	1,762	2,611	0.125	185	14,814	113.14	107.23
2007	14,439	1,215	3,226	0.084	223	26,547	23.54	20.15
2008	14,846	1,596	2,634	0.107	177	16,498	-18.33	-20.57
2009	15,263	2,171	3,582	0.142	234	16,498	35.97	32.25

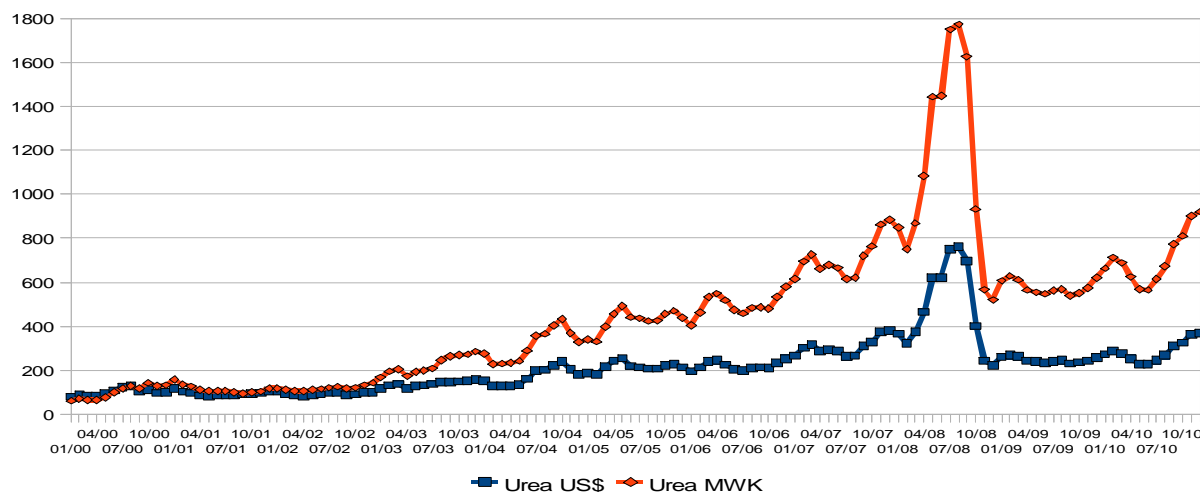
Source: Authors' calculations on FAOSTAT

Figure 9 - Malawi: Indexes of the trends in population, total maize production and maize production per capita - 1961=100 (1961-2009)



Source: authors' calculation on FAO data

Figure 10 - Malawi: urea international and domestic monthly price index in US\$ and Malawian Kwachas - 100=average 2000 (2000-2010)



Source: authors' calculation on World Bank and IMF data

Table 6 - Malawi: Production, and formal imports and exports of maize (2000-2008)

	Production (tons)	Import Quantity (tons)	Export Quantity (tons)	Import Value (1000 \$)	Export Value (1000 \$)	Maize trade balance (1000\$)
	A	B	C	G	H	I=H-G
2000	2,290,018	7,879	11,000	2100	500	-1,600
2001	1,589,437	9,326	9,879	1821	849	-972
2002	1,485,272	348,365	1,644	83380	529	-82,851
2003	1,847,476	61,836	54,604	14086	10,713	-3,373
2004	1,608,349	54,300	12,607	9200	1,833	-7,367
2005	1,225,234	113,300	467	23500	571	-22,929
2006	2,611,486	55,808	1,160	12403	6,179	-6,224
2007	3,226,418	20,180	391,255	6100	100,224	94,124
2008	2,634,701	28,176	21,438	6561	12,858	6,297

Source: authors' calculation on FAO

Food production policies

Food security policy in Malawi has traditionally aimed at self-sufficiency within the context of a development model driven by the exports of cash crops grown on the estate sector (Harrigan 2008). The smallholder sector was regulated by a marketing board (ADMARC) which implicitly taxed the smallholders via procurement prices equal to one third to one half of the market price (*ibid*). This revenue was mainly re-invested in the export-led estate sector. A second function of ADMARC was the stabilization of agricultural input prices through the subsidisation of agricultural inputs, seeds and fertilisers of medium farmers and smallholders so to encourage the production of high-yielding hybrid maize and reach food-self sufficiency. This dualistic policy model broadly succeeded but, at the same time, many smallholder farmers became poor. A third task of ADMARC was food price stabilization by means of Strategic Grain Reserve.

As in Niger, this food supply and security approach came to an end in the 1980s as the Government adopted more than 20 SAPs aimed at liberalizing the food market, raise the producer price of maize and export crops, removing export constraints, and encourage smallholders to export. Input subsidies were eliminated and crop commercialization was privatised, leaving to ADMARC the only role of buyer of last resort (Harrigan 2003). ADMARC continued to implement a policy of pan-seasonal and pan-territorial prices, but the fall in its profits compromised its ability to subsidise the consumer price of maize and its other developmental functions (Harrigan 2008, Smith 1995). In turn, ADMARC's monopoly in fertiliser supply was transformed into a Smallholder Farmers Fertiliser Revolving Fund. This change led to the breakdown of the fertiliser distribution system that, in a context characterised by weak markets, reduced the smallholders' access to inputs and credit indispensable for increasing their productivity. The outcome was a shift to export crops with the displacement of maize production and a sharp decline of hybrid maize production (Bohne 2009). However, after the liberalisation, the input and output markets failed to become competitive thus compromising the ability of the export sector, while neither the public nor the private sector were capable of controlling food price volatility.

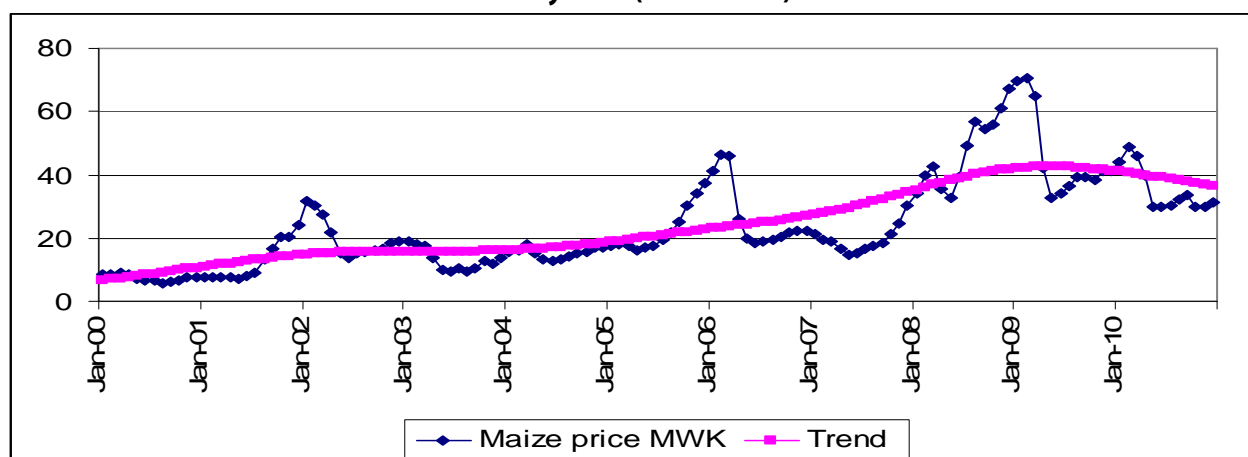
The growth rate of GDP stagnated for twenty years, traditional livelihoods were eroded and inequality among smallholders increased. It was also clear that the inability of government to put in place proactive policies depended also on a lack of a well defined food security strategy. In the 1990s, *ad hoc* social policy and food security measures were introduced within the context of the Social Action Fund (Chinsinga 2007). Furthermore, the government launched an Agricultural Sector Adjustment Program with the aim of improving food crop productivity through targeted subsidies, the adoption of high yielding varieties and crop diversification. The achievement of food security was hampered, however, by the droughts of 1992 and 1994 that led to the collapse of the Smallholder Credit Association; by the reduced role of ADMARC in remote areas abandoned by the private sector; and by the removal of subsidies which raised fertiliser prices and discouraged maize production (Sahley et al. 2005, Zant 2005). In 1999, under the pressure of donors, the Strategic Grain Reserve was taken over by the National Food Reserve Agency (NFRA), an independent body financed and managed by donors and working on a cost-recovery basis (Zant 2005) with the role of stabilising the supply and prices of staples.

The situation was made worse by discrepancies in opinions between government and donors. The former targeted national maize self-sufficiency by stimulating production and productivity through subsidised inputs, while the UN agencies aimed at ensuring household food security through safety nets, and the World Bank and USAID advocated a fast liberalization. As a result, by the end of the 1990s, Malawi became heavily donor dependent: official development assistance was 25 percent the GDP, and donors provided almost all the development budget. In 2000 Malawi qualified for relief under the HIPC Program. Despite these different views in 1998, the government introduced with the support of some donors a free agricultural inputs distribution programme, the Starter Pack, aimed at increasing productivity in agriculture, raising the use of fertilizers and promoting food security through interest free credit packages directed to well-to-do farmers (Zant 2005). In the 2000s, the fertiliser subsidy program was broadened so as to support poor farmers without funds for buy fertilizers (Africa Research institute 2007, Dorward et al. 2008). In 2008, the government reinstalled the ban over private trade of maize whose market returned to be fully controlled by ADMARC. The 2000s witnessed also the launch of many programs focused on agricultural development and food security that aimed at strengthening food security by supporting subsistence farmers, feeding programmes for malnourished children, public works initiatives and direct transfer programmes. Despite this and other efforts, the high prices of fertilisers (see above) and of maize (see next section) compromised the country's objective to achieve food security.

Food prices

The 2000s were characterised by a clear upward trend of maize prices with spikes in 2001/2002, 2005/2006, 2007/2008, 2008/2009 (Figure 11). It is likely therefore that failure to increase in a stable way food output affected food security through a steady increase in prices.

Figure 11 - Malawi: nominal average price of maize (kwacha per kg) and its trend component - monthly data (2000-2010)



. Note: the long-term trend was computed with the Hodrick-Prescott Filter.

Source: authors' calculation on FEWSNet

Long term trends in nutritional status

Due to the lack of an effective agricultural and food policy, by the mid-1980s, even if self-sufficient in maize production, Malawi recorded a child stunting rate of 45-65 percent which was a clear reflection of the dramatic rise of households poverty and food insecurity (Quinn 1986). In addition, the frequency of food security hazards increased over time while the ability of the population to cope with such hazards declined (Ministry of Agriculture and Food Security Republic of Malawi 2010). However, despite the quasi-stagnation in GDP/capita signaled by the national accounts (Table 2), the incidence of poverty (based on household surveys) declined during the last 6-7 years, suggesting that food consumption poverty may have also declined slowly – though remaining still above the 50 percent mark (Table 7).

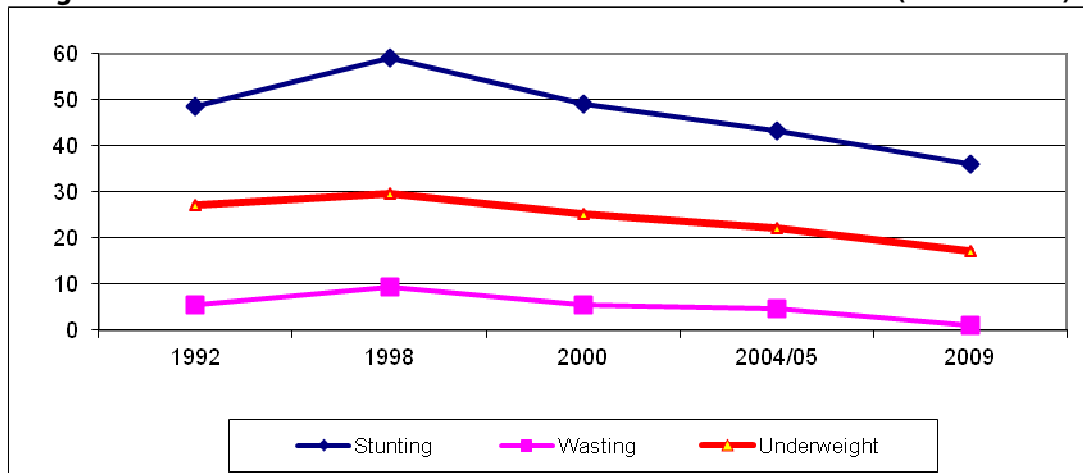
Table 7- Malawi: Incidence of poverty and ultra-poverty (2004-2009)

	2004	2005	2006	2007	2008	2009
Poor	52	50	45	40	40	39
Ultra- poor	22	21	17	15	15	15

Source: authors' calculations on NSO data

Though child malnutrition depends on several factors (feeding and care practices, parental education, knowledge of food processing, access to quality health care services, disease incidence, cultural beliefs, capacity to implement nutritional programs and so on), the reduction in the incidence of poverty (and improvements in vaccination rates) seems to be behind the steady gains in all DHS based indicators of child malnutritional illustrated in Figure 12.

Figure 12 - Malawi: Trends in the Under-five Children Malnutrition (1992 – 2009)



Source: authors' calculation on DHS, HIS, NSO data

5. Seasonal price fluctuations, food security and malnutrition

In both Niger and Malawi, food security and nutritional status are severely affected by considerable intra-annual fluctuations in the prices of the main staples. It is in fact well known that food security, body weight, and child and adult malnutrition and mortality rise systematically during the 'hunger season' which in normal years spans May/June-October in Niger (Loutan et al. 1984, USAID 2007) and November to March in Malawi (WFP et al. 2010).

Three main factors explain the deterioration in nutritional-health conditions during such period: (i) first, just before the onset of the rains (the beginning of the hunger season), the households exhaust their stocks of grains and have to buy staple food on the market at very high prices. Such an increase in market demand pushes upwards staple prices to their highest intra-annual level; (ii) second, the hunger season coincides with the onset of the rainy season. As a result, water quality deteriorates as rains cause surface contamination of customary water sources raising the risk of waterborne diseases, while stagnant water increase the risk of malaria transmission. Rates of morbidity may rise as well for due to poor hygiene and a rise in respiratory diseases which are particularly dangerous for the biologically weak, children ahead of all; (iii) third, the hunger season is also characterized by the onset of the labor intense planting season. Caregivers often leave their infants with grandparents or older children during the working day exposing children to poor feeding and caring practices. In brief, conditions of limited food availability, increased morbidity and reduced time for child care provoke every year a dramatic increase in acute malnutrition in young children.

Of particular interest is the nutritional impact of the seasonal food price fluctuations observed in low-income agricultural countries. The main reason of the price fluctuations are the high storage costs faced by wholesalers and government agencies, the lack of appropriate storage facilities at the household or community level, lack of consumer credit to households and the limited coverage of public- sponsored consumption-smoothing mechanisms such as cereal banks (where households can deliver for instance a bag of millet after the harvest and get one back with only a small charge during the lean season), public works schemes, and subsidized and – in case of acute crises - free food distribution programs.

Economic theory (Sahn 1989) suggests that the increase in food prices (between harvest time and the hunger season) charged by wholesalers reflects purchase costs, warehousing, bagging, labor/handling, transport and management costs, as well as physical losses due to pests, rotting, theft, etc., and the opportunity cost of tying up one's money in the stored crops. As demand increases and stocks decline, the increase in food prices reflects also speculative profits by the wholesalers who engage in inter-seasonal arbitrage. However, in years of abundant harvests, the wholesalers may run losses as they over-stock in anticipation of future demand. All in all, it appears that storage and transaction costs cannot explain fully the high variation of prices during the lean season across years (*ibid*).

Staple prices fluctuate widely also because of lack of consumer credit for the smallholders faced with the need to pay for school fees, ceremonial costs for marriages, funerals and return prior loans. Lack of credit at reasonable rates thus forces smallholders to sell much of their crops right after the harvest at very low prices and, six month later, to borrow money to buy food at a very high price (between 50-100 percent more than at harvest time) a situation that entails implicit borrowing interest rates of between 100-200 percent.

Public policy has dealt with this problem in a variety of ways (Devereux 2008):

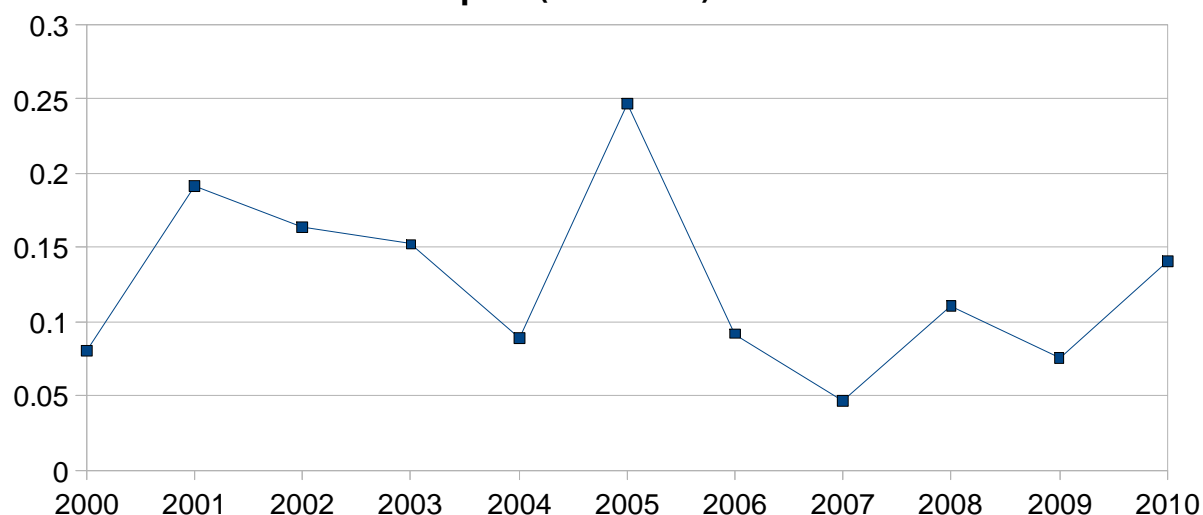
- By improving 'production-based entitlements' Q_{fsc_h} by means of input subsidies aiming at increasing the amount of food produced and used for self-consumption by rural households;
- By improving 'trade based entitlements' of household h by ensuring pan-seasonal (and often pan-territorial) pricing of the main food staples, by near-stabilizing food price P_f through the operations of state marketing boards or food emergency stocks and state subsidized sales. Additional measures to stabilize P_f have concerned investment in efficient public/private storage, investment in infrastructure to improve market integration and the promotion of cereal banks through an initial injection of funds or food;
- By improving 'labor based entitlements' Q_{w_h} through the launch of public work schemes aiming at supporting the household incomes during the lean season;
- By rising the 'transfer based entitlements' T_h by means of a variety of food aid programs in cash or kind;

though during the last two decades the international community has – rightly or wrongly – encouraged the abolition of the first two interventions (which deal with the underlying causes of the problem), strengthening the last two, and emphasizing the role of food imports to stabilize domestic prices during periods of rapid food price escalation. Overall, strong faith in the efficiency of market forces (which remain however underdeveloped in many SSA countries) and in the poverty alleviating effect of social assistance have somehow led to neglecting the seasonality problems discussed above. To control if this perception is correct, hereafter we analyze how food price seasonality has evolved in Niger and Malawi during the last decade. As a measure of price seasonality we use the coefficient of variation of millet and maize prices respectively. A high coefficient of variation suggests a high degree of intra-annual price instability which increases the uncertainty of price anticipations from the local households (as well as by traders and government agencies) and therefore creates difficulties in selecting, planning and managing the allocation of their resource. The evolution over time of this index thus provides some initial clue on whether such problems has improved, remained the same, or deteriorated.

Niger

Figure 13 suggests that the strong food price seasonality affecting this country has not declined during the last decade, but has rather followed a cyclical behavior with a major spike recorded on occasion of the 2005 food crisis/famine.

Figure 13 - Niger: coefficient of variation of yearly seasonal fluctuations in the millet price (2000-2010)



Source: authors' calculations on national price data

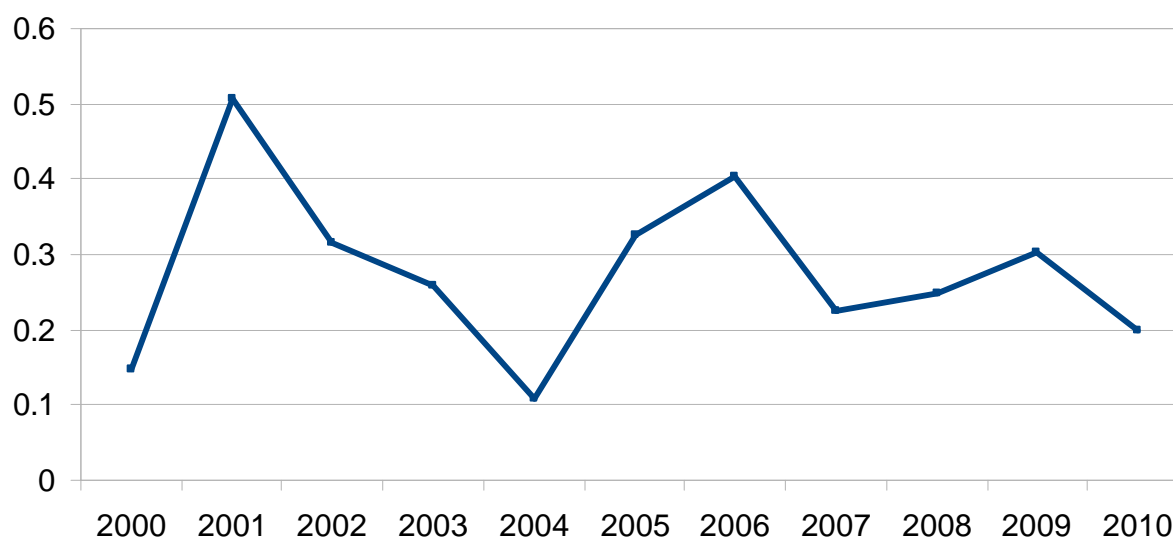
As already noted, in Niger the traditional approach to food security pivoted around the state cereal marketing and food security board (OPVN). After the adjustment policies of the 1980s, the trading and price stabilization function of OPVN were eliminated, and price stabilization was entrusted to imports and social assistance. While – as noted - releasing free or low-priced food during the lean season may in principle help reducing seasonal price volatility, Niger's experience showed a clear failure in managing strategic stocks (see later). At the same time, the overall environment did not facilitate the private sector's adoption of those instruments that can reduce the seasonal price fluctuation, such as futures, options and weather-indexed insurance.

Malawi

In Malawi, maize prices start increasing around September-October, the period when most of households run out of stock of own food production, and reach their peak in January/March just before the maize harvest. Unfortunately, as the CFSVA survey shows, the dependence of poor households on market purchase of maize is higher in February, when the prices are at their peak, and falls to 8 percent in April (WFP et al. 2009). On the other hand, major price declines occur between April to June which is the period just after harvest by which time most households have maize from their own production (Chirwa, 2009). As noted in Tschirley et al. (2004), despite having the most comprehensive government involvement in maize marketing of all Southern African countries, between 1994 and 2003 Malawi exhibited the highest seasonality of increases in retail maize grain prices (90 percent), compared to 50 percent in Southern Mozambique and 65 percent in Zambia. However, it would appear that

the intra-annual variability of maize prices slightly declined during the latter part of the decade (Figure 14 – see also Figure 9).

Figure 14 - Malawi: coefficient of variation of intra-annual seasonal fluctuations in maize prices (2000-2010)



Source: authors' calculations on FEWSNet

6. Food price dynamics, nutritional status and public policies under crisis conditions: Niger's 2004-5 and 2009-10, Malawi's 2001-2 and 2008-9 crises

Niger's 2005 and 2010 food crises

During the decade under exam, Niger experienced two major food crises which reached near-famine conditions in about 30 percent of the country. The impact on food security and child malnutrition have been marked in both of them, with effects on child malnutrition equally or even more severe than those due to the long term stagnation at low level in millet output. However, the causes, nutritional impact and responses to these two crises differed considerably.

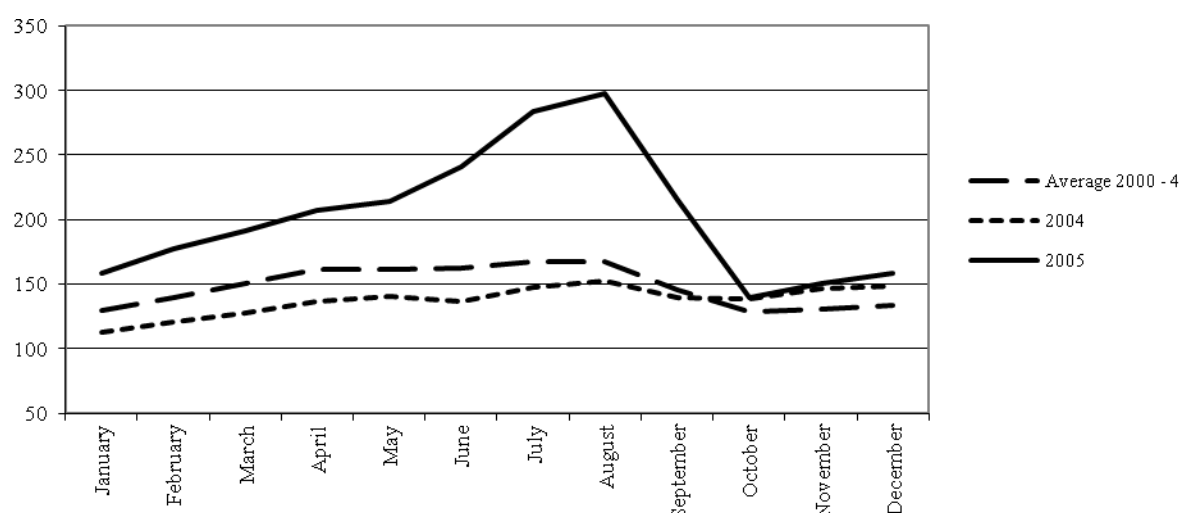
The 2005 food crisis

Between March and September 2005, 2.5–3 million people from low income families were affected by a severe food crisis. Price tensions started emerging in November 2004, following the poor 2004 harvest, and by July-August 2005 the millet consumer price reached a level 80 per cent higher than the average of the prior five years and twice that of 2004 (Figure 15). What were the causes of such crisis? The 2004 drought and locust infestation resulted in a cereal production fall of 24 per cent in the 2004 harvest in relation to the prior year, though of only 10 percent compared to the prior five-year average). Output fell by more than 25 per cent in 19 departments (WFP 2005). Yet, the main source of decline in food availability was a sharp decline in official food imports (mostly from Nigeria) which in 2005 fell by 65 per cent and were only 16 per cent of those recorded during the 2000–1 food crisis. In addition, significant amounts of grains were exported unofficially from Niger to Nigeria (CILSS 2006). This import collapse was due in part to a bad harvest in Niger's traditional suppliers and a

generalized rise in millet prices throughout the region. In addition, import parity prices for millet from key markets in Nigeria remained above domestic prices for the entire 2004/2005 season. In addition, between January and October the naira appreciated by between 5 and 7.5 per cent, thus reducing the incentives to export cereals to Niger (Terpend et al. 2006).

Figure 15 - Niger: monthly consumer price of millet - CFAF/Kg

(2005, 2004 and average 2000–04)



Note: a one-tail t test of the significance of the monthly changes (year on year) confirms at the 10.9 per cent probability level the hypothesis that the 2005 prices were significantly higher than those recorded over 1994–2004. The probability rises sharply if the test is restricted to May–October.

Source: authors' elaboration on the SIMA Dataset.

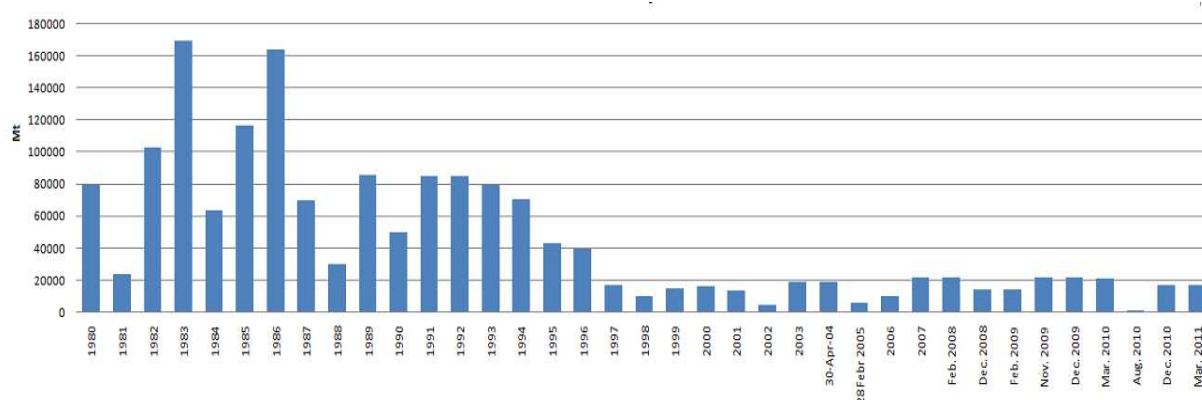
An abnormal behaviour of food markets exacerbated the drop in food availability. Indeed, the rise in consumer prices (Figure 15) was accompanied by a growing divergence between the producer prices paid in small versus large collector markets and between producer and consumer markets (Cornia & Deotti 2008, Table 6)¹⁷. Such growing divergence suggests a surge in the profits of the fewer than twenty wholesalers who control the marketing process in Niger. An econometric analysis for 1997–2005 (Michiels et al. 2006) suggested that the 2005 price rise was exacerbated by expectations of price rises, the procurement policies of aid agencies, and speculation by wholesalers. At the same time, a fuel price shock in 2004 increased transport costs and spatial arbitrage opportunities declined significantly in 2005, making trade unprofitable across key markets, especially in the most affected areas (Aker 2007).

The price increase and food crisis was exacerbated by a delayed response by donors and by the Government decision of forbidding free food distributions by aid agencies during the first seven months of 2005. The Government ability to make use of a Food Security Reserve was also severely eroded. Indeed, after the SAP of the 1980s and 1990s, food security was no longer to be achieved by holding a food security stock (or its financial equivalent) but by relying on

¹⁷ During the crucial months from October 2004 to January 2005 producers in small markets received on average 82 percent of the price paid in large collector markets, against an average of 91 per cent during 2000–2004. Second, the 2005 rise in consumer prices was due in part to growing differences between producer and consumer prices in relation to the 2000–2004 average. Indeed, the average nationwide difference during July–September 2005 (27.4 per cent) was considerably higher than that recorded during the same period of 2000–2004 (12.5 per cent).

imports. As a result, the government's food security and price stabilisation reserve dwindled from 150,000 tons in 1983 (Gromotka & Bendow 1992) to 80,000 in 1991, and 12,000-20,000 between 1996 and 2004 (Figure 16). In 2001 the government planned to set aside a cash reserve equivalent to 20,000 tons of millet but this plan was never implemented. In 2004, it was equally decided to raise the level of the National Reserve Stock (NRS) to 110,000 tons (comprising a physical stock of 80,000 tons in cereals – the National Food Security Reserve – and a financial reserve to purchase 30,000 tons of cereals in case of major crisis – the Food Security Fund) to be used to face emergency situations. However, this decision was never respected, and in the last eight years the NRS never exceeded 20,000 tons (Figure 16) as in times of good harvest, when prices were low and food was available, the stocks were not replenished, and purchases took place only during crisis years, contributing in this way to an increase of already high prices in the local markets. The Government also allocated very limited resources to other support measures (e.g. cereal banks and food/cash for work) and opposed the cancellation of user-fees in public health centres.

Figure 16 - Niger: Level of the National Food Security Reserve - tons (1980-2011)



Source: for 1980-90: OPVN data in Gromotka and Bendow (1992) 1991-2010 data are from CCA-SAP

The rise in millet prices (P_f) would not have caused a large nutritional impact had it not been for the simultaneous and related erosion of the food entitlements of several social groups and in particular the agro-pastoralists who were hit by both a drop in food self-provisioning (Q_{fsc_h}) and in the price of the sheep and goats (P_j) they sold to buy millet during the lean season (Table 8). The pastoralists were also affected by the fall in the millet/cow price ratio (Table 8) and rise in fodder prices. Despite this, they suffered less acute nutritional problems than the agro-pastoralists as they owned larger herds. In turn, onion farmers were affected by the decrease in the price of their crops relative to that of millet and weak demand. Third, the exchange entitlements of landless labourers dropped due to a surge in the supply of casual labour (WFP 2006), a drop in labour demand, and a fall in wage rate.

Table 8 - Niger: Changes in terms of trade between millet and various entitlements (2003–04, 2004–05)

	Quintals of millet per female goat			Quintals of millet per cow			Quintals of millet per 100 kg of onions			Quintals of millet per 20 days rural wage°		
	03/04	04/05	% change	03/04	04/05	% change	03/04	04/05	% change	03/04	04/05	% change
Oct	1.5	1.0	-33.3	12.6	7.8	-38.1	3.4	2.1	-37.6	2.45	0.97	-60.3
Nov	1.4	1.0	-28.6	12.1	7.7	-36.4	3.7	2.2	-40.6	2.39	0.92	-61.5
Dec	1.5	1.1	-26.7	11.9	7.4	-37.8	3.6	1.8	-50.2	2.37	0.91	-61.5
Jan	1.5	1.0	-33.3	11.0	6.6	-40.0	3.0	1.2	-59.8	2.25	0.86	-61.7
Feb	1.4	0.9	-35.7	10.3	6.2	-39.8	2.2	1.1	-51.4	2.05	0.77	-62.4
Mar	1.2	0.8	-33.3	9.6	5.6	-41.7	1.5	0.9	-43.8	1.88	0.70	-62.4
Apr	1.2	0.7	-41.7	9.1	5.0	-45.1	1.3	0.9	-31.1	1.81	0.68	-62.7
May	1.1	0.7	-36.4	8.5	4.5	-47.1	1.2	0.9	-25.2	1.75	0.65	-62.7
Jun	1.1	0.6	-45.5	8.8	3.7	-58.0	1.4	0.9	-31.0	1.78	0.58	-67.6
Jul	1.0	0.5	-50.0	8.1	3.5	-56.8	1.3	1.0	-22.5	1.68	0.47	-71.9
Aug	1.0	0.5	-50.0	7.8	3.6	-53.8	1.3	1.2	-11.1	1.62	0.47	-71.0
Sept	1.2	1.0	-16.7	8.5	5.4	-36.5	1.7	2.0	17.6	1.78	0.68	-61.6

Source: Authors' calculations based on data provided by SIMA, SIMB and EPAD-Niger. Notes: the terms of trade are expressed as the number of 100kg sack of millet per head of livestock, 100kg of onions, or 20 days of agricultural work. EPAD-Niger suggests a stable daily wage of CFA Francs 625 and 1125 for 2004–5 and 2003–4.

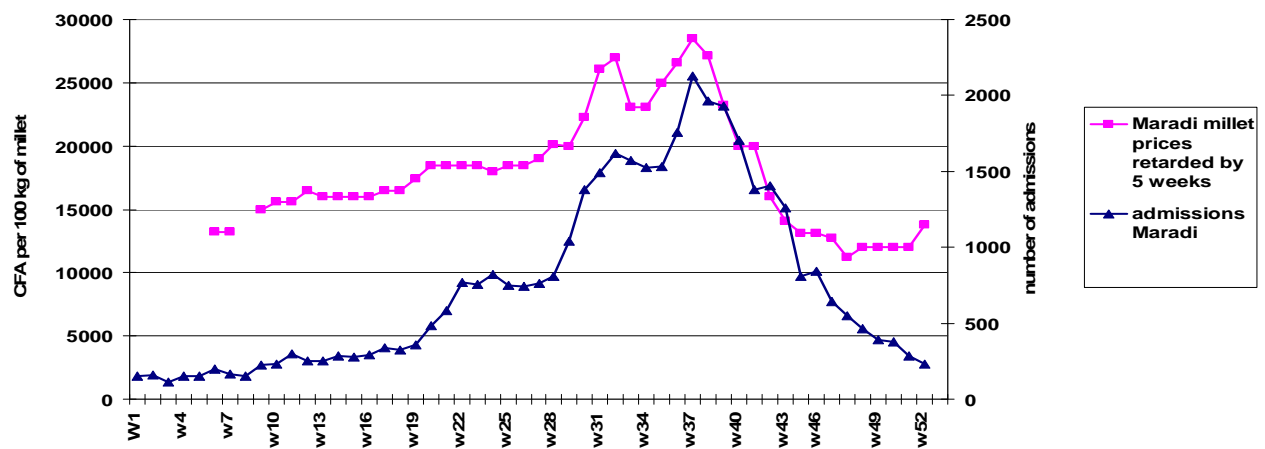
Families relying on migrant remittances were hit harshly as the latter might have been affected by fewer chances of finding seasonal jobs and depressed wages. The nutritional impact of the food crisis was extremely pronounced.

In Niger there are three kinds of nutritional centres: CRENI (In-Patient Intensive Nutritional Recovery Center) for children suffering from severe acute malnutrition, poor appetite and complication, who need to be hospitalised; CRENAS (Out Patient Nutritional Center for Severe Malnutrition) for children suffering from severe acute malnutrition but with good appetite and without complications, who are therefore subsequently treated at home; CRENAM (Out-Patient Nutritional Center for Moderate Malnutrition) for the treatment of moderate acute malnutrition. Cornia and Deotti (2008) note that the number of under five children admitted to CRENI-CRENAS centres run by Médecins Sans Frontières (MSF) in Maradi Department rose tenfold in 2005 in relation to a normal year. As shown in Figure 17 a rise in millet prices correlates with a lag of 5 weeks with the number of child admissions to MSF centres.

Regression analysis of the relationship between the rise in millet prices, decline in the prices of the entitlements and rise in the number of MSF-France feeding centres was carried out for the years 2002-5 for the Maradi department (no data were available for the entire country). While there are data on the monthly price of cows and goats it was not possible to compile time series over 2002-5 for the other four entitlements (onions, firewood, and casual wages and remittances). The results of Model 1 in Table 9 confirm that the rise of millet prices (P_f) and fall in the value of the entitlements (P_j) raised in a sizeable and statistically significant way the number of child admissions to feeding centres.

In turn, Models 2 and 3 shows that the number of MSF feeding centres in operation (measured also with the dummies variables D1 to D4) rose in a statistically significant way to the number of child admissions.

Figure 17 - Niger: lagged weekly millet price and admissions to MSF feeding centers in Maradi (2005)



Source: Cornia and Deotti (2008)

Models 2 and 3 implicitly assume that the opening of new centres is a random variable, possibly causing in this way a problem of circularity and endogeneity (i.e. the number of admissions depends on the 'supply' of places in feeding centres which in turn allows a growing 'demand' for admissions to be satisfied, thus increasing the number of admissions and the number of feeding centres). To deal with this bias, Model 4 introduces as an instrumental variable the lagged child admissions, and the results confirm to a very large extent the findings of models 1 to 3. In conclusion, the results presented in Table 9 confirm that the rise in child admissions to MSF feeding centres in Maradi during 2005 was explained to a considerable extent by an abnormal rise of millet price (P_f) and parallel drop in that of goats and cows (P_j). While the lagged opening of new feeding centres contributed to the rise in admissions, its impact was less important than that due to the changes in millet, cow and goat prices which explain between 55 and 72 percent of the admissions.

As for the underlying causes of nutritional crisis which hit Niger in 2005, it appears that more than by a decline in domestic millet production the crisis was due to a Sahelian and domestic 'market failure' signalled by the drop in food imports and an increase in trade margins which raised wholesalers' profits in a period of crisis. The decline in the prices of various entitlements (goats, cows, firewood, cash crops, and wage rate of casual labour) was also major factor in precipitating the rise in child malnutrition. The crisis would also have been less severe had different food security policies, a comprehensive monitoring system, and adequate domestic and international aid relief been in place.

The 2010 food crisis

Between March and August 2010, Niger was hit by a new crisis due to a huge decline in the September 2009 harvest, which dropped by 29.1 percent compared to 2008. The cereal deficit was estimated at 410,000 tons of cereals (against 600,000 in 2004-5). At the same time, the 2009/2010 season recorded the highest fodder deficit (67 percent of national needs) of the last 10 years (WFP 2010) and fodder prices more than doubled in relation to the previous years in some departments (FEWS NET March 2010).

Table 9 - Niger: Regression analysis of admissions of children to MSF feeding centers, Maradi (2002–2005) (dependent variable: log child admissions lagged 5 weeks)

	Model 1	Model 2	Model 3	Model 4
Constant	94.360***	54.289***	50.920***	62.293***
Log admission – ₆				0.306***
Log price range 1 millet ^b	- 0.151	- 0.391**	0.109	- 0.046
Log price range 2 millet ^b	1.018***	0.782***	0.841***	1.071***
Log price range 3 millet ^b	2.556***	2.255***	2.184***	1.875***
Log cow price	- 2.919***	- 0.034	0.071	-2.121***
Log goat price	- 5.652***	- 4.869***	-5.032***	-3.535***
Dummy 1			0.373***	
Dummy 2			0.555***	
Dummy 3			1.121***	
Dummy 4			1.164***	
Log number of centers		0.726***		
R2 adjusted	0.852	0.879	0.878	0.872
Durbin – Watson	0.874	0.813	0.835	0.829
F statistics	232.96***	243.70***	158.90***	343.51***
Numb. Of obs	208	208	208	202

Notes: *, **, *** indicate that the parameters are significantly different from zero at the 1, 5 and 10 per cent probability level; ^b The three price ranges were identified on the basis of a Chow test which shows that the slope of the relation between millet prices and lagged child admissions was affected by two structural breaks.

Source: Authors' calculations.

Yet, contrary to what happened in 2005, the fall in millet production was limited to Niger, as weather conditions did not deteriorate in the rest of the region. As a result, regional food imports compensated much of the domestic output shortfall. Already in February 2010, each week Niger imported 10.000 tons of cereals, though this flow slowly declined due to a 10 per cent appreciation of NAIRA/FCFA exchange rate since November 2009 and growing demand in northern Nigeria (WFP 2010). According to SIMA, both cereals and fodder were available in the market, due to important difference in the prices between trans-border markets, which persisted after taking into account transport costs and taxes (WFP et al. 2010).

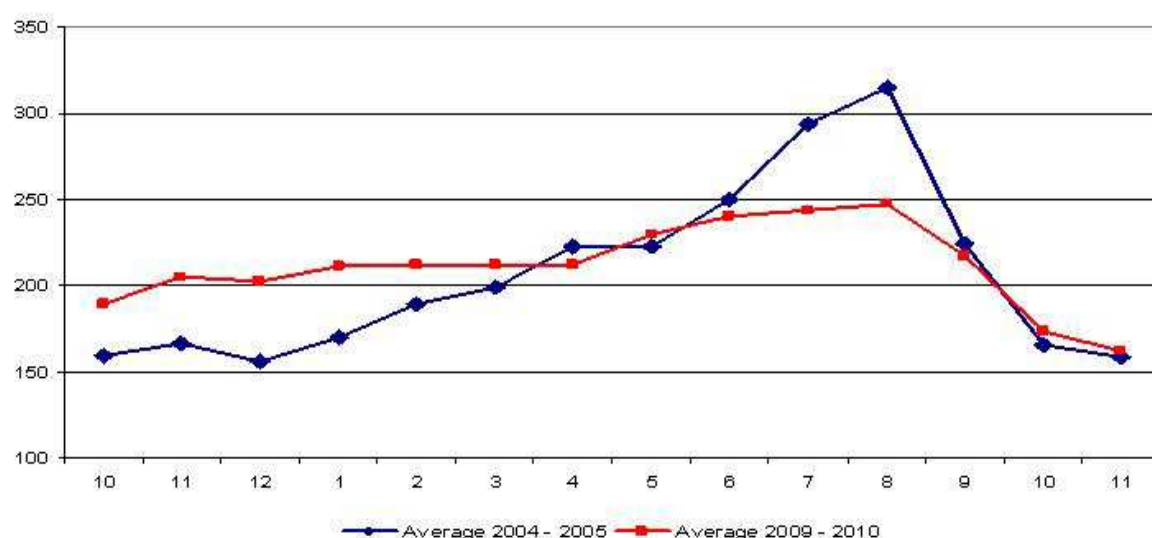
In addition, the response to the food crisis was far more positive than in 2005 (De Sardan 2011). While in 2005 President Tandja consistently denied the existence of a crisis, the new government did not conceal the gravity of the 2010 crisis and immediately appealed for food aid. The domestic response also improved, as free food distributions took place right at the onset of the crisis. In turn, child malnutrition was monitored closely, more effective treatment protocols were developed, aid programs were decentralized, and a better coordination mechanism between international organizations, NGOs and the government was put in place (*ibid*). As a result, while millet prices increased by 97 percent between October 2004 and August 2005, the rise during the same months of 2009/10 was of only 27 percent (Figure 18).

The slower increase in the price of millet during the 2010 lean season (and the more favorable dynamics in the price of goats, cows and onions, as compared to 2004-5) caused

smaller erosion in the terms of trade of pastoralists and agro-pastoralists (compare Tables 10 and 8). Moreover, the worsening of the terms of trade lasted less in 2010 than in 2005 (ibid).

In contrast to 2005, the most serious deterioration in terms of trade was suffered by the pastoralists, and considerable losses of livestock occurred between March and July 2010 in several parts of the country due to the concentration of animals in few areas with inadequate water sources, the large 2009 fodder production deficit, considerable export of fodder towards neighboring countries, and other factors (OCHA 2010).

Figure 18 - Niger: Trend in millet prices (CFAF per Kg) between October 2009 and November 2010 (red square line), compared with that recorded over October 2004 and November 2005 (blue line)



Source: authors' elaboration on SIMA data.

However, the subsidized sales of animal feeding from the Government and FAO, interventions targeted at the treatment of ill animals and, from June, livestock purchases (if at very low prices) by traders from Nigeria contributed to improve the situation (ibid). As a result, while during the 2005 crisis the terms of trade started to improve only in October, they began to rise in August 2010. However, some small pastoralists and poor agro-pastoralists did not benefit from the normalization of the situation, as they had already lost or sold almost all their livestock (WFP & Republic du Niger 2010).

Thirdly, wage rates were cut of up to 50 percent (FEWSNET 2010). In particular, between December and February, there were new inflows of laborers in Niamey, causing wage rates to fall to about 500 CFAF per day or 3500-4000 per month, approximately half the pre-September 2009 level. Many of the new arrivals joined the firewood and forage markets. In March 2010 there was also a massive migration of 2000 people per month towards Nigeria and Lybia, according to Caritas estimation (OCHA 2010). Despite the aggregate level of analysis, Table 10 suggests that also for rural laborers the entitlement erosion was less in 2010 than 2005. Data on child admissions to feeding centers suggest that – despite a greater flow of food imports, a better policy response, a modest increase in millet prices, and a less acute erosion of food entitlements, the 2009/10 crisis witnessed a surge in the number of children admitted to feeding centers (Figure 19).

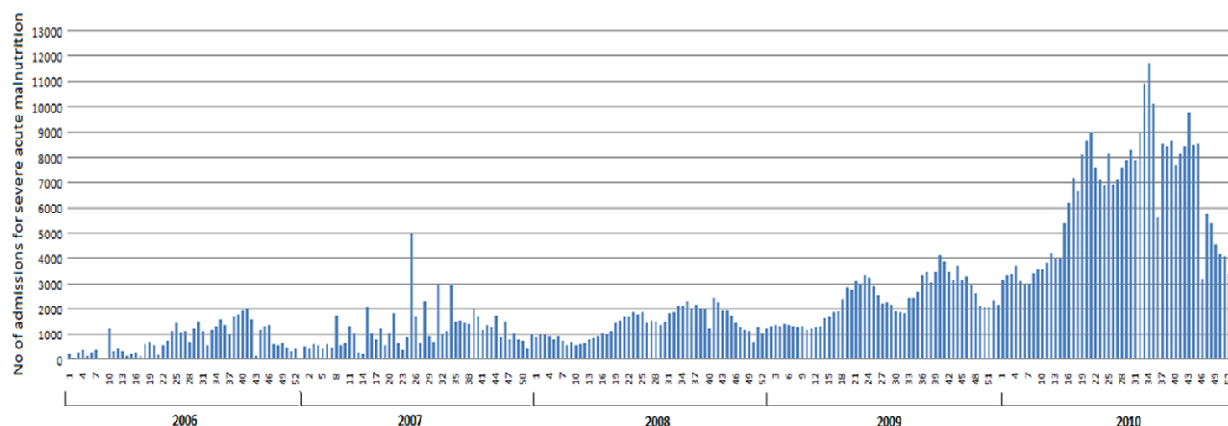
Table 10 - Niger: changes in the terms of trade between millet, livestock, onions and rural wages (2005-2009 and 2009-2010)

	Quintals of millet per cow			Quintals of millet Per female goat			Quintals of millet for quintals of onions			Quintals of millet per 20 days rural wage °		
	2005- 2009	2009-2010	% change	2005- 2009	2009- 2010	% change	2005- 2009	2009- 2010	% change	2008- 2009	2009- 2010	% change
October	9.03	8.39	-7.1	1.18	1.21	2.5	2.75	2.55	-7.2	1.18	0.55	-53.8
November	9.25	7.79	-15.8	1.2	1.21	0.8	3.08	2.67	-13.6	1.17	0.53	-55.0
December	8.8	7.43	-15.6	1.28	1.12	-12.5	2.88	2.49	-13.5	1.08	0.51	-52.4
January	8.3	6.87	-17.2	1.13	1.02	-9.7	2.13	1.87	-12.0	1.01	0.49	-50.9
February	8.31	6.76	-18.7	1.11	1	-9.9	1.61	1.58	-2.0	1.01	0.49	-51.8
March	8.38	6.48	-22.7	1.04	0.94	-9.6	1.30	1.40	7.5	1.00	0.48	-52.3
April	8.12	5.87	-27.7	1.08	0.92	-14.8	1.16	1.24	7.0	1.00	0.47	-52.7
May	7.93	5.36	-32.4	1.07	0.92	-14.0	1.17	1.35	14.7	1.00	0.45	-55.2
June	7.69	5.27	-31.5	1.05	0.86	-18.1	1.35	1.60	18.9	0.99	0.43	-56.1
July	7.13	5.25	-26.4	0.97	0.87	-10.3	1.40	1.69	21.2	0.89	0.42	-52.8
August	7.39	5.86	-20.7	0.97	0.87	-10.3	1.83	2.24	22.4	0.83	0.41	-50.5
September	8.16	7.57	-7.2	1.04	1.07	2.9	1.98	2.55	28.4	0.94	0.47	-50.2

Notes: the terms of trade are expressed as the number of 100 kg sacks of millet obtainable by selling one female goat, 100kg of onions, or 20 days of agricultural work. For the latter, FEWS NET reports a constant daily wage of CFA Francs 500 and 1000 for 2009–10 and 2008–9.

Source: Authors' calculation based on data by FEWS NET.

Figure 19 - Weekly admissions of children to nutritional centres for severe acute malnutrition (2006-10)



Source: UNICEF Niamey 2011

Indeed, their number was about three times higher than in 2009 (a year which recorded a good harvest) and five times than 2008. In particular, admissions of malnourished children to feeding centres were already 60 percent greater in January 2010 (four months after the harvest) than a year earlier, with significant increases in Maradi and Zinder. The peak of child admissions was reached in August 2010, when on average 10,900 children were treated against severe acute malnutrition every day.

Clearly, factors other than the prices of millet, fodder and exchange entitlement or the epidemiological problems typical of the lean seasons explain such a sharp increase in child admissions to feeding centres. The main one was the decision of the Government of Niger and donors led by UNICEF to upscale the response to the acute and chronic problems of child malnutrition which had beset the countries for ever and which had increased in intensity in 2010. Clearly, the country learned from the mistakes of 2005. The greater political attention to the issue of child malnutrition materialized in: (i) a sharp increase in the number of feeding centres, which tripled in relation to 2009, with the largest rise recorded for the CRENAS (Table 11) and in their better integration within the national health system. Moreover, while during the 2005 food crisis the only NGO active in child feeding was MSF-France, by 2010 the number of such NGOs rose to twenty and the number of nutritional centres they run in the country under the coordination of UNICEF rose to 812; (ii) a shift in 'growth standards' used to identify malnourished children from the NCHS to the 2006 WHO standard. With this change, approximately eight times more children were classified as severely malnourished, compared with the previous scale (Minetti et al. 2009). OCHA (2010) argues that such shift is the major explanation of the sharp increase of both moderate and severe malnutrition figure between 2009 and 2010; (iii) an increased capacity of the existing CRENI and CRENAS in terms of number of children they were able to treat thanks also to the supply of essential drugs and ready-to-use therapeutic food (RUTF) (Deconick et al. 2010). The latter permits even severely malnourished to be treated at their home, thanks to a new ambulatory service which overcomes most of the difficulties due to the poor coverage of health services in Niger, and the launch of a WFP-UNICEF sponsored Blanket Feeding Operation (OCHA 2010).

Table 11 - Niger: number of nutritional centres in operation (2005-2010)

	MAS		MAM	Total
	CRENI	CRENAS	CRENAM	
2005	24	263	574	861
2006	34	296	619	949
2007	33	303	477	813
2008	39	258	495	792
2009	39	209	322	570
2010	45	775	657	1,477

Source: UNICEF-Niamey

The regression results (Table 12) confirm (as observed in 2005) the strong correlation between millet prices and child admission to feeding centres (elasticity 1.8-2.1). The millet parameter is only slightly less than that computed for 2005 (Table 9). This is true also for the prices of the exchange entitlements (cows) while that of goats has the wrong sign. The parameter of the number of feeding centres in operation on a monthly basis¹⁸ is high and is strongly significant, confirming that a large part of the increase in admissions was explained by the greater 'political will' shown by government and donors. Finally, the hunger season dummy in turn is highly significant and absorbs in part the effect of cow prices whose parameter in model 2 loses significance. The results do not change significantly if the number of child admissions is lagged by one month (Model 3). Thus, the rapid expansion in the number of feeding centres in 2010 appears to have played a greater role in explaining the rise in child admissions to feeding centres than in 2005, though the gradual rise of millet prices observed over 2006-10 explains a still significant proportion of the surge in child admissions. Finally, the modest loss of entitlements of the agro-pastoralists who sells goats did not affect child malnutrition (cfr. Table 8 and 10), while the substantial fall in the price of cows and the subsequent deterioration in the millet/cow exchange rate turns out have been significant for child malnutrition.

Meanwhile, survey data compiled by WFP suggest that the acute-severe and chronic malnutrition remains above the emergency threshold of 15 percent in all regions, with peaks in the two traditional granaries of the country (acute malnutrition of 17.8 percent in Zinder and chronic malnutrition of 58.5 percent in Maradi). Figure 20 also shows that the incidence of acute-severe malnutrition was higher in 2010 (16.7 percent) than in 2005 (15.3 percent). However, these results are not comparable, as the 2005 survey refers to the post harvest month when malnutrition tends to decline, while that of 2010 refers to June, i.e. beginning of the hunger season. Be as it may, it is clear that the adoption of good short-term policy interventions is not enough to reduce the food insecurity of the country.

Malawi's 2002 and 2008 food crises

As noticed by Chirwa (2009) price swings are not new in Malawi, however their frequency seems to have increased.

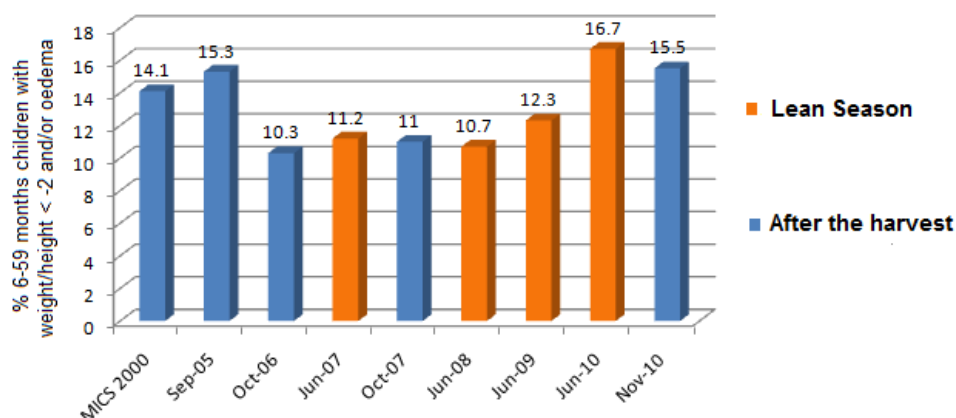
¹⁸ Such time series was estimated by the authors on the basis of past trends and of official annual data.

Table 12 - Niger: Log-log regression of number of child admissions to feeding centers (2006-10)

	Model 1	Model 2	Model 3 (Dependent Variable lagged one month)
Constant	-4.686	-12.384**	-6.496
Log millet price	2.105***	1.887***	1.028**
Log cow price	-3.018***	-1.056	-1.798**
Log goat price	5.725***	3.864***	5.515***
Hunger season	0.411**	0.364**	0.485***
N Feeding centers		0.775***	0.690***
Adj R2	0.63	0.73	0.75
F statistics	26.53***	32.97***	36.16***
Durbin Watson	1.23	1.31	0.97
N.obs	60	60	59

Source: authors' calculations on data provided by Unicef- Niamey (child admissions) and FewsNet (millet, goat and cow price).

Figure 20 - Evolution of global acute malnutrition rate (in %) among 6-59 months old children (2000-2010)



Source: based on MICS 2000 and 2006, CDC-Unicef 2006, INS 2007-2010

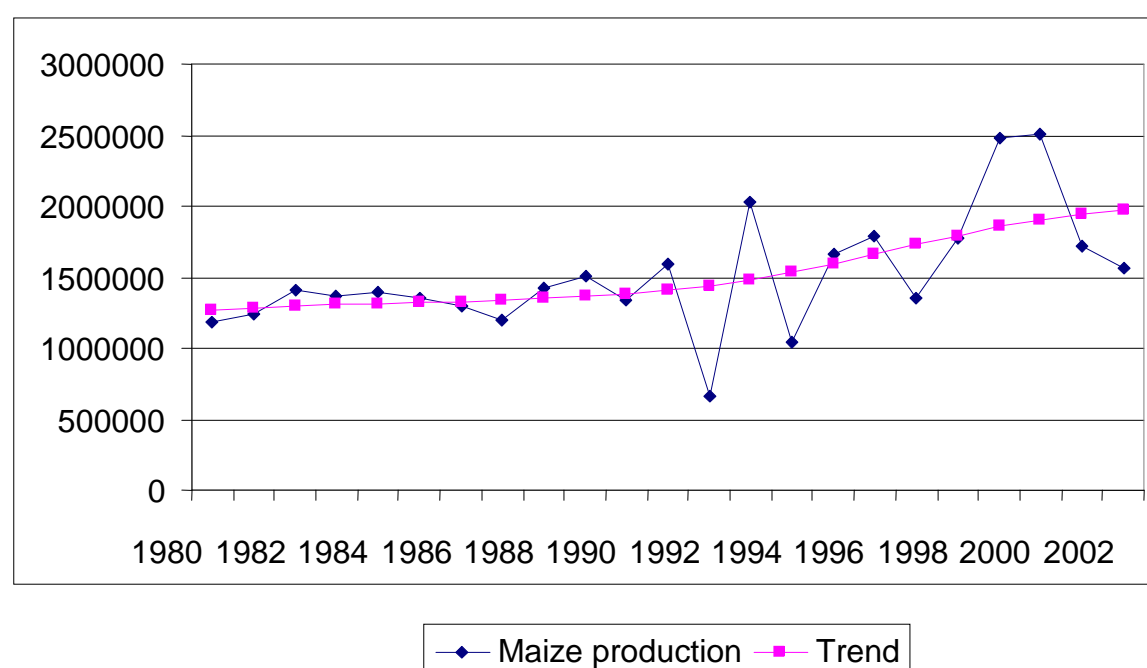
The 2001/2 famine

As noted by Stevens et al. (2002), a food production shock, caused by localized flooding in the central and southern regions during February and March 2001, reduced maize production from a record high of 2.5 million tons in 1999/00 to 1.7 million tons in 2000/01 (Figure 21), and created a national maize deficit of 300,000 tons. However, this fall in food production was preceded in 1999 and 2000 by a record high surplus, so that the 2001 output level was only a bit below the long term trend.

The magnitude of the food gap in 2001/2 was underestimated by the government and donors due to exaggerated forecasts of roots and tubers production by the Ministry of Agriculture. This misguided belief – that Malawi had a ‘maize deficit’ but not an overall ‘food deficit’ and that households would be able to buffer the deficit with carry-over stocks from the previous bumper harvest – persisted until early 2002, and slowed the public response.

The delayed response was also caused by the fact that, at the start of the consumption year in April 2001, ADMARC and the National Food Reserve Agency (NFRA) claimed to hold over 60,000 MT in maize stock. Originally, the Strategic Grain Reserve (SGR) was managed by ADMARC but, as noted in section 3.2 (ii), the IMF, EU and other donors felt that the SGR should be run by an independent entity (the NFRA) on a cost-recovery basis. Lacking its own resources, the latter had to borrow heavily to purchase 167,000 MT of maize from ADMARC in 1999. By July 2000, food stocks held by ADMARC or the NFRA were near the full storage capacity of 180,000 MT. However, given the high debt incurred by NFRA and the high level of grain stock, on IMF advice the NFRA reduced the SGR from 165,000 to 60,000 tons, so as to service its debt. Thus, the SGR was being gradually emptied on the advice of the IMF, to the extent that almost no maize was left in reserve by the time decision-makers and donors finally recognized the scale of the famine in late 2001. The IMF argued that its advice was predicated on “wrong information” received about crop production from the Ministry of Agriculture, and that “the advice would have been correct if the information was correct” (Devereux 2002).

Figure 21 - Malawi, maize production and trend - metric tons (1980-2002)



Note: The long-term trend was computed with the Hodrick-Prescott Filter
Source: authors' calculations on FAO data

Tense relations with the donors added to a slow and inconsistent policy response. In 2001-2 the Muluzi government was accused of economic mismanagement, governance failures and corruption. As a result, in addition to the IMF's decision to suspend its balance of payment support, DFID, the EU and USAID froze their development assistance and DANIDA left the country. It was only after reports of starvation-related deaths had been published by the media that the donors reversed their hard-line stance and offered food aid without conditions.

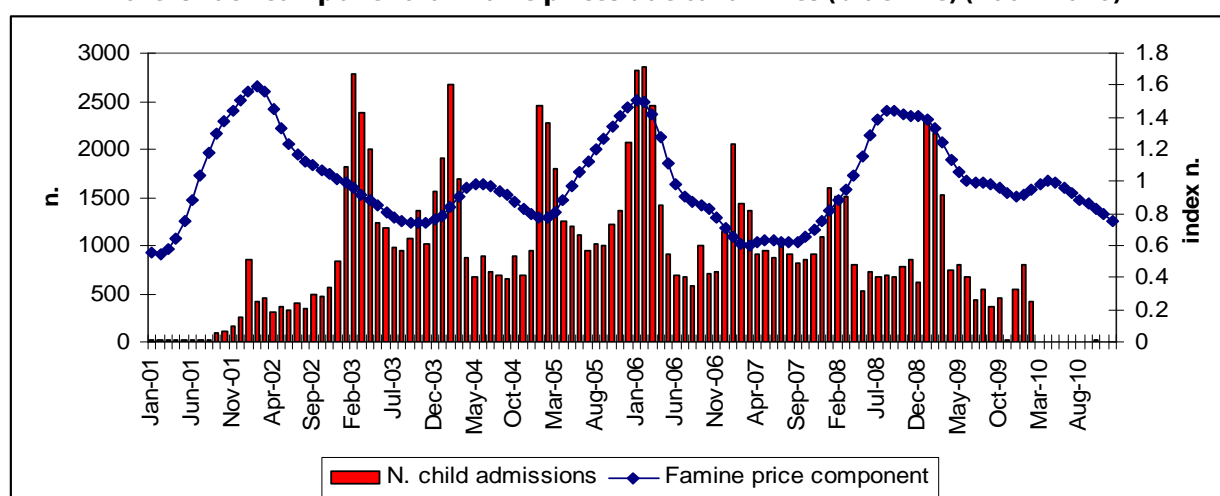
These "failures of information" explain why the government was slow to order food imports. In June 2001, after it had become clear that there would be a maize deficit, the Government announced a plan to buy locally (and resell at subsidized prices) 70,000 tons and to procure 150,000 tons on the international market. But the local purchase plan did not work, due to the low price initially offered by ADMARC. Even after a price adjustment sellers were scarce, as in the meantime maize prices had jumped 10-fold between harvest time (May 2001) and January 2002. Furthermore, the import program started only after ADMARC had slowly purchased the prescribed 50,000 tons locally (Devereux 2002).

Not only was the import plan started late but the actual delivery of maize took much longer than anticipated. If food stocks had arrived by December 2001, the famine might have been averted, however unfolding logistical problems led to fatal delays (Devereux 2002). In reality, imports arrived at an average rate of 15,000 tons/month (instead of the 50,000 projected for October-November 2001), so that by April 2002, only 94,000 tons of maize had arrived. A first cause of this delay was the same floods that affected food production. They hindered food import and distribution programs as roads, bridges, railway lines and other means of transport were washed away. Handling problems in the Mozambican ports of Beira and Nacala through which imports were being forwarded contributed to the delay. In this respect, the fact that Malawi (like Niger) is land-locked makes it particularly vulnerable to transportation and trade bottlenecks and to increases in transport costs. Thirdly, problems were encountered also with Malawi's trucking system, which is a political monopoly. Indeed, the 2001/2 crisis affected the entire Southern African region which experienced a generalized increase in maize prices. As a result, some of the Malawian trucks were diverted to richer Zambia and Zimbabwe, attracted by higher prices and better transport infrastructure. According to Harrigan (2008), "the events of 2001/02 showed that as a relatively small country in the sub-region Malawi is acutely exposed whenever a regional food shortage occurs since its larger neighbors Mozambique, Zambia, Zimbabwe have first call over food imports by virtue of their greater size and purchasing power and better connections with South Africa and overseas markets".

Thus, the vast majority of Malawians in rural areas was affected by sheer lack of food at the local level, limited penetration of imports in rural areas due to transport problems, and rising prices. During the famine, 15 percent of households received food assistance from extended family members and only 19 percent obtained food aid from NGOs (Bryceson & Fonseca 2006). After the declaration of the National Food Crisis by President Muluzi in February 2002, the government, UN, Humanitarian Agencies, donors and several NGOs worked for the procurement and distribution of emergency aid by implementing five main activities, i.e. the Food for Work initiative, the HIV/AIDS programme, the School Feeding programme, the Supplementary and therapeutic feeding programme and the Direct Transfer programme. This represent and important shift in the role of donors in implementing food security in Malawi from funds provision and budget-support to a more oriented project and programme support.

The impact of the famine on malnutrition and mortality is poorly documented and remains the subject of debate (Menon 2007). Reports of a famine affecting rural areas emerged in October 2001. However, Government and donors did not act until civil society groups presented evidence supporting the reports coming from the countryside. The famine was finally publicized in February 2002, i.e. when the toll in terms of deaths by starvation and severe food insecurity was already very high: from January to April 2002 alone, between 500 and 1,000 people died of hunger or hunger-related diseases in the Southern and Central regions (Menon 2007) making the 2002 famine one of the worst in living memory. Unlike in the case of Niger in 2005, the data on the admission of children to feeding centers are few and far between and do not allow to detect major increases in the number of malnourished children admitted to feeding centers (Figure 22).

Figure 22 - Malawi: Number of child admissions to NRU feeding centers (left scale) in relation to the 'shock component' of maize prices due to famines (blue line) (2001-2010)



Note: The explanation of how we calculated the famine price component can be found in footnote 30

Source: Authors' calculation on Malawi's Ministry of Health and FEWSNet

The 2007/8 and 2008/9 food crisis

Unlike in 2001/2, the maize price peak of 2007-2008 and 2008-2009 – and the ensuing increase in child malnutrition - happened in a context of a growing maize production (Figure 9). Good rains and improved access to seeds and fertilizers led in May-June 2007 to a bumper crop estimated by the Ministry of Agriculture at 3.22 million tonnes (Table 5) which, according to Government estimates, generated a maize surplus of one million tons. As a result, the Government issued tenders to private traders to export 450 thousand tons (Jayne and Tschirley, 2009). Yet, by late 2007 the private traders had managed to export only 283 thousand tonnes due to difficulties in purchasing maize on the domestic market. The Government pledged to export the remaining 167 thousand tonnes (Minot, 2010). In addition, following a surplus projection of 600,000 tons from the 2006/07 maize harvest, the exportation of 400,000 tons to Zimbabwe was allowed.

This un-realistic 'export drive' led to a rapid price escalation which started in late 2007/early 2008 and raised Malawi's maize prices 100-150 USD per ton above those in the neighbouring countries. This forced the government to suspend further exports, restore the legal monopoly of ADMARC on maize trading and ban private trade, in an attempt to moderate

the price increase (Jayne et al. 2008, Minot 2010). In addition, the official estimates of a bumper harvest masked localised shortages, the informal importation of over 50 thousand tonnes of maize (FEWSnet 2008b), and rationing by ADMARC. Thus, the official estimate of the May 2007 harvest was – as in 2001/2 – overoptimistic, and that the planned maize exports were potentially dangerous.

As reported by Jayne et al. (2010), in May 2008 the Government announced that the country had produced another sizeable maize surplus, estimated at 500 000 tons. Under these circumstances, the government main concern was to guarantee a floor price for the overproduction (so as to benefit the small farmers) and to accumulate food security stocks. To this aim, ADMARC was instructed to purchase a quantity of maize greater than in the previous years and at a price that increased over time to outbid private traders. However, in response to the rush for maize and of its limited availability in the market maize prices rose again dramatically, while by August, ADMARC and the NFRA had procured only 60,000 tons, i.e. less than the demand for grain at ADMARC depots during the upcoming lean season. By early August 2008, only 2–3 months after the reportedly good harvest, maize prices had reached historic highs. In August, the Government of Malawi announced a ban on private maize trade, which was then transformed in September by the obligation of traders to operate within the official floor and ceiling prices. As the latter was well below the market price, several traders simply stopped buying grain. At the same time government stipulated a contract with a large trader to supply maize to ADMARC and fixed a purchasing price far above the ceiling price. Further, from the end of 2008 to the beginning of 2009, maize import price from South Africa, net of transport costs, were significantly below prices in Malawi. As a consequence, private traders applied for import licenses that were not approved as – it was argued – the country had sufficient maize supply. As a result, the domestic maize price start to rise and the imports were not enough to prevent it.

Thus, rationing of maize sales by ADMARC in both 2007 and 2008, continuous net imports of maize from neighboring countries, and domestic prices in Malawi higher than those of regional neighbors seem to suggest that official maize production figures in recent years were systematically overestimated. In addition, this erroneous information on domestic production¹⁹, together with the maize export drive and the subsequent pricing interventions exacerbated the spikes in maize prices that happened in late 2007 and 2008. Speculation in the domestic market following high international food prices (Chirwa 2009, FEWSNet 2008b), inflationary pressure, exchange rate devaluation, and possibly the increase in the cost of urea (Figure 10) were also additional factors. Evidence of the problems affecting in 2008 the domestic maize market is provided also by the difficulties faced in late 2008 by WFP in sourcing maize for their school feeding and relief operations.

Also in the case of the 2007/8 and 2008/9, the nutritional impact of the crisis is less than well documented. In early October, 2008, the Malawi Vulnerability Assessment Committee released a report estimating that 1.5 million rural households had run out of maize and were forced to purchase their residual food requirements at prices that were extremely high. The data on malnourished children at feeding centers (Figure 21) signals a rapid increase in admissions at feeding centers. While in the pre-crisis 2006 this number averaged around

¹⁹ The World Bank (2003) has observed that crop estimates do overstate food production in Malawi. This information about domestic maize supply and maize stocks can affect the behavior of actors in the market and thus have an impact on food prices. One reason of all this is the uncertainty over trade flows of maize, which exacerbate the imperfect nature of information on maize production and availability.

500-800 children a months, it reached the level of around 1500 in early 2008 and of 2000 in early 2009.

Regression analysis of child admissions to feeding centres, 2003-2009

In contrast to the case of Niger, data on the admissions of children to feeding centres in Malawi seem to be heavily influenced by the number of feeding centres in operation and the availability of food and therapeutic nutrients to be distributed among the children. This explain for instance why the number of admissions to feeding centres hardly budged on occasion of the 2001-02 crisis and 2010 price increase. This is why, since no meaningful regression analysis of the relation between child admissions to feeding centres and maize prices could be carried out for the famine years of 2001-02, the analysis below focuses only on the 2003-2009 years. Likewise there are no data on the exchange entitlements as there are no available time series on *ganyu* wages, and the prices of poultry, small animals and other goods sold by smallholders during the hunger season. With the limited data available, we were therefore simply tested in a log-log framework (Table 13) the hypotheses about the impact of maize prices, number of feeding centers, time trend, and hunger season on the average number of children admitted to feeding centre over 2003-09.

Table 13 - Malawi: Log-log regression analysis of the impact of the maize price on child admissions to feeding centers (2003-09)

	Model 1	Model 2
Constant	3.697***	4.391***
Log maize price	0.670***	0.275**
N feeding centers	0.030***	0.030***
Time trend	-0.020***	-0.012***
Hunger season		0.613***
Adj R2	0.62	0.77
F statistics	45.42***	71.23***
Durbin Watson	1.13	1.70
N.obs	84	84

Source: authors' calculations on official data

Table 13 confirms that the price of maize affects in a statistically significant way the number of children admitted to feeding centers though the value of the parameter (elasticity) is smaller than that of millet in Niger (see Tables 9 and 12). The same is true for the number of feeding centers, while the opposite holds for the hunger season. In addition, the time trend has negative and significant parameters suggesting there are some endogenous factors (e.g. medical improvements) which gradually reduce the admissions of children to feeding centers.

Lessons from Niger's 2005 and 2010 and Malawi's 2002 and 2008-9 food crises

(i) Niger's 2005 and Malawi's 2002 crisis. These crises were very similar. In both countries: (a) the initial trigger was a drop in food output (causing a - food availability decline, FAD - crisis) which followed however several good harvests, so that food output was not much below the long term trend; (b) food imports – which the structural adjustment policies of the 1980s-

1990s were assigned a central role in ensuring food security – failed because of Niger's and Malawi's landlocked-ness, remoteness, poor transport infrastructure and rise of food prices in their regions caused by covariant weather shocks. In the end, the sharp rises in domestic food prices were largely due to a failure of imports which could not cap domestic prices and cover the domestic food shortfall; (c) in both cases whatever food surpluses existed in their region were diverted to larger and richer neighbours, including because of the exchange rate appreciation of their currencies (MF, regional market failure, crisis). Short term food security in tiny countries may thus be affected by exchange rate variations driven by export bonanzas, expansionary policies, fast growth and so on in neighboring large economies; (d) at least in the case of Niger, inefficiencies in the domestic market raised the differentials between the producer prices paid to smallholders and consumer prices which benefitted a minority of large farmers and – especially - the few large oligopolistic traders who dominated the national market (MF, regional market failure, crisis); (e) in both cases, public policy and donor response were grossly inadequate (FID, food intervention decline, crisis). Both governments denied for long the existence of a famine and intervened with considerable delay and reluctance when deaths by starvation, and a surge in admissions of malnourished children to feeding centres had risen out of control. The responses of both governments were however inadequate as their food safety reserves had declined due to the new policy of relying on food imports to cap domestic prices. Also, the interventions of both governments were poorly targeted, with the result that in Niger only 72 percent of the poor received food aid as compared to almost 80 percent of the non poor (World Bank 2009).

Niger's 2005 versus 2010 crises

A comparison between these two crises shows that many lessons were learned from the 2005 crisis: (a) in both crises the initial trigger was a decline in food production caused by adverse climatic conditions (FAD crisis). Niger's fragility to climatic shocks and volatility of food production is chronic and affects food security and child malnutrition in both famine and non-famine years. Long term food production policies do not seem to have been able to reduce output and price volatility and Niger is thus likely to have to face a food emergency every three-four years. This calls for changes in policies on long term food production and population growth; (b) while failing in 2005, food imports increased rapidly during 2010 (as other Sahelian countries were not hit by the drought) (no regional MF). As a result millet prices rose only modestly during the 2010 lean season, while the prices of exchange entitlements (e.g. cows and goats) declined less than in 2005. Therefore, the exchange entitlements of smallholders and herders Q_{jH}/P_f fell by only 10-20 percent as opposed to 50-60 percent in 2005; (c) it is unclear whether also in 2010 the ratio producer/consumer prices deteriorated; (d) in 2010 the public policy response was substantially better. In 2005 the failure of the Early Warning System (EWS) - which monitored only food production and prices - led the Government to develop in 2007 a national contingency plan for food security and nutrition which included a more comprehensive EWS providing information not only on cereal output and prices, but also on imports, the nutritional status of the population and vulnerability of rural households. Thanks to this information, and – especially – to the greater political will, in 2010 the Government immediately drafted an emergency plan and called for international aid which was delivered in a more timely fashion than in 2005²⁰. The domestic

²⁰ In 2005 the Government requested food aid for 78.000 tons against an estimated deficit of 505.000 tons, while the donors largely ignored the first appeals by WFP and the government in late 2004. The donor contributions started to arrive 8 months after the first request, when the cost to save one child's life had risen from 1 to 80 USD

food security response was also far better than in 2005. Indeed, in December 2009, the Food Security Fund stood at nearly 43.000 tons, and the National Security Stock at 22.000 tons, still below the target fixed earlier on (FewsNet, Niger Food Security Update, January 2010), but substantially higher than the 5.000 tons available in 2005. (e) The specific measures to respond to the crises also differed. In 2005, the response basically consisted in carrying out subsidized sales of millet at about half the market price (100 FCFA per Kg.), a price still out of reach for the poorest. The 2010 response consisted instead of an immediate free food distribution of 52000 tons to over one million beneficiaries which were targeted more precisely than in 2005, subsidized sales of 60.000 tons of cereals to vulnerable households, cash for work for 23.000 households, cereal banks and the distribution of 18.000 tons of forage in the most affected areas; (f) Despite this better and more timely response, the number of children admitted to feeding centres rose as fast, or faster, than in 2005. The econometric analysis carried out in this paper has shown, however, that the huge increase in admissions of malnourished children was due to a considerable extent to the trebling of the number of feeding centres and the adoption of a new nutritional protocol which includes among the population at risk also children affected by moderate malnutrition, placing the emphasis on the prevention of malnutrition and not only on its treatment. Clearly, by 2010, child malnutrition had become – at last - a key policy issue.

Malawi's 2002 and 2008-9 crises

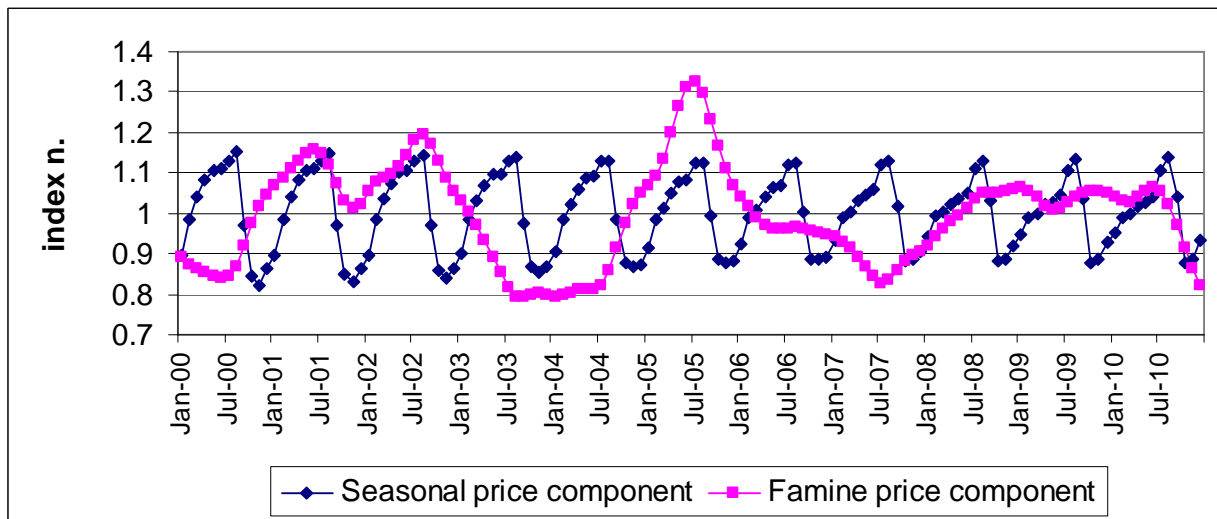
The two crises share a number of similarities but at the same time differ markedly in several respects: (a) while in 2002 maize production declined by 34 percent (FAD crisis), in 2008 and 2009 Malawi recorded bumper crops which led the government to declare a large maize surplus and issue export licenses to private traders; (b) the 2002 crisis can be represented as an '*import crisis*' as the drop in domestic output was exacerbated by the decline of maize imports for the reasons discussed above, while that of 2008-9 was an '*export crisis*', caused by the exportation of 400.000 tons of maize to neighboring countries and a subsequent price escalation which was exacerbated by a tripling of fertilizer prices; (c) in both cases there were 'informational failures' (FID crisis) as the government and ADMARC massively over-estimated the output of cassava and tubers. These "information failures" explain why the government was slow to order food imports in 2002 and allowed food exports in 2008-9. In addition, the 2002 market operations of ADMARC were slow and problematic and failed because the prices offered consistently trailed behind the rise in market prices. ADMARC's market interventions in 2008 were equally confusing, led to a sharp rise in maize prices and barred private traders to import maize from South Africa at lower prices; (d) the response to the 2001-2 crisis was very slow and inadequate, and only in February 2002 the government declared a national food crisis, while the donors response was delayed. In both 2002 and 2007/8-2008/9, the nutritional impact of the crisis is not well documented. Yet, there is evidence that the number of malnourished children admitted to feeding centers doubled in relation to the prior year.

a day. In contrast, two thirds of the emergency appeal launched in April 2010 were delivered as of September 2010.

7. Comparative impact of long term, seasonal & famine price changes on child malnutrition

This section aims at disentangling the relative impact of the three different price components (long term, seasonal, famine/food crises) discussed in the prior sections on child malnutrition over the decade 2000-2010, though data limitations on the number of child admissions to feeding centers force us to limit our econometric test to 2003-9 in the case of Malawi and 2006-10 in that of Niger. To do so, we first decompose the overall monthly millet and maize prices into three components, i.e. (a) a trend price component, (b) a seasonal price component, and (c) famine price component (Figures 24 and 25). To carry out such decomposition, we relied on the 'multiplicative method'²¹. We already extracted the 2000-2010 price trend from the observed time series of maize/millet prices (see Figures 6 for Niger and 11 for Malawi). We then decompose with the multiplicative method the difference between price time series and its trend (see footnote 30 for the method used in the decomposition) into a seasonal price component, a famine price component, and a residual term. Figure 23 presents the results of the decomposition into the seasonal price and famine price component for Niger (the residual term is ignored), and Figure 24 does the same for Malawi.

Figure 23 - Niger: seasonal and famine price components - monthly data (2000-2010)

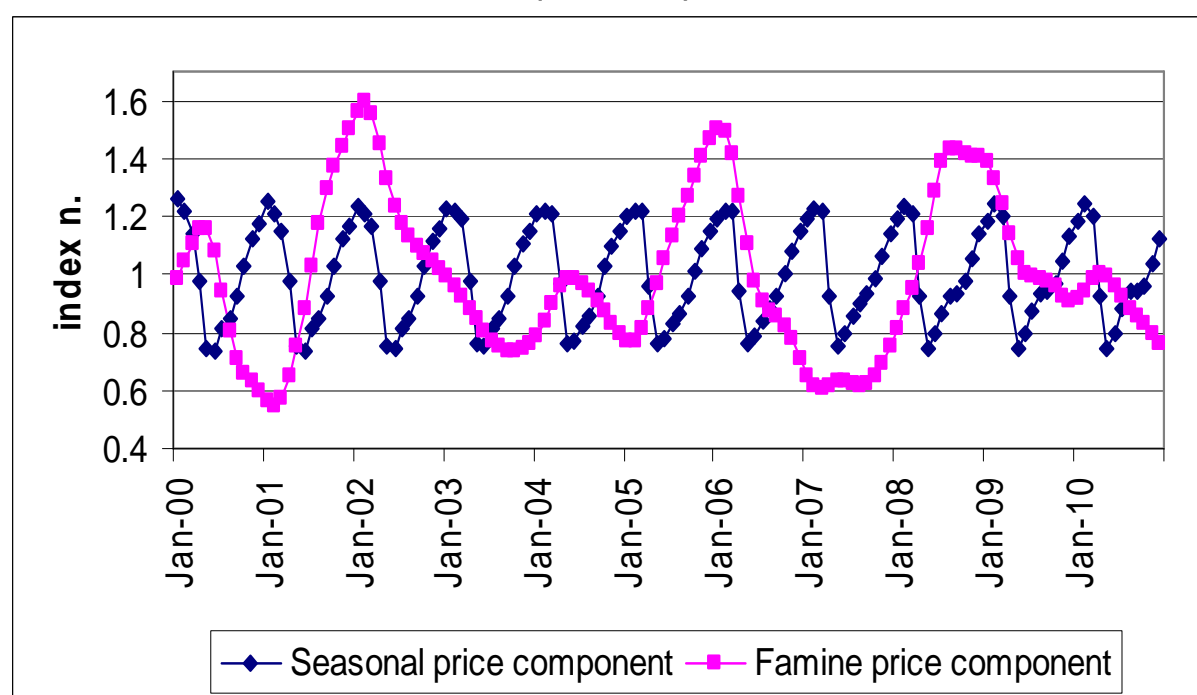


Source: authors' calculation on SIMA data.

²¹ The monthly time series (m), from 2000 to 2010, of the domestic price ($P_{c,m}$) of the commodities (c) taken into consideration, maize for Malawi and millet for Niger, have been disaggregated into four components: (i) A long term trend price component ($T_{c,m}$), (ii) a seasonal price component ($S_{c,m}$), (iii) a famine price component ($F_{c,m}$) and residual random component ($R_{c,m}$) (Harvey, 1990). Examination of the graph for trend and seasonal components and the F-tests for seasonality, have suggested that these effects interact, to generate the observed time series, according to a multiplicative model specified as following: $P_{c,m} = T_{c,m} * F_{c,m} * S_{c,m} * R_{c,m}$. These components were estimated with two methodologies. The X-12 Monthly Seasonal Adjustment Method (Findley et al., 1998) has allowed to distinguish the seasonal and the random effects separately and the long term components in the aggregate. The famine component is often of irregular length and difficult to estimate due to the economic assumptions required. In order to overcome these issues, the long term trend component has been calculated with the Hodrick-Prescott Filter and then subtracted from the above mentioned aggregate for the estimate of the famine price component.

Figure 6 confirms that the price of millet has been rising steadily in Niger over the last decade, while Figure 23 shows that the overall trend in the price of millet is characterized by a strong – and only slightly declining – seasonal price component as well as by a 2005 price spike due to a famine. Interestingly, the 2010 famine price component is less pronounced than those of 2001, 2003 and 2005. In turn, Figures 9 and 24 provide the same info for Malawi which also exhibits a growing trend in maize prices over the decade, a strong seasonal price component, and three food price spikes in 2002, 2006 and 2008-9 in correspondence to the crises analyzed above.

Figure 24 - Malawi: seasonal and famine price components - monthly data (2000-2010)



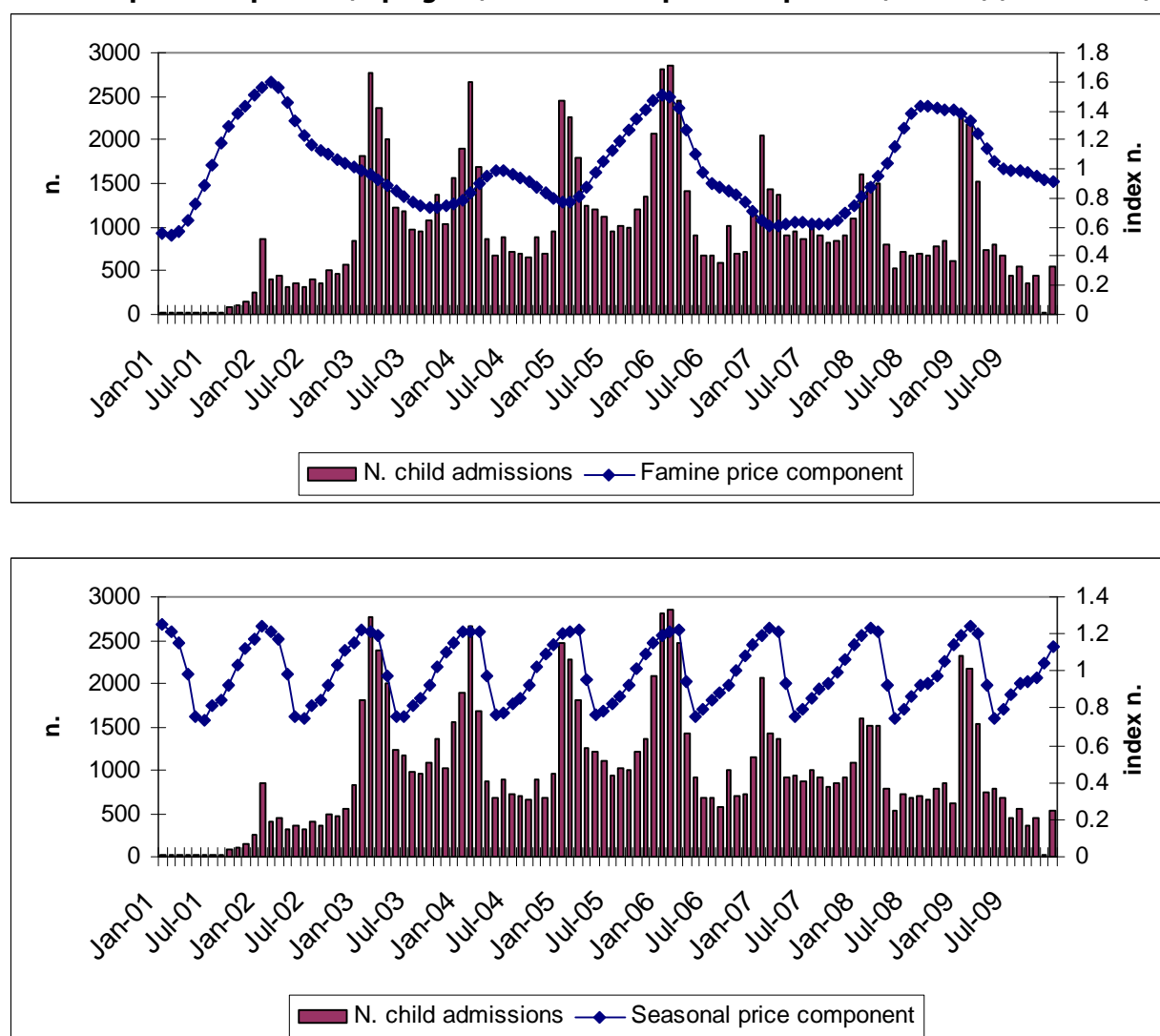
Source: authors' calculation on FEWSNet data.

We now plot these three price components against the number of admissions of malnourished children to feeding centers (as done below for Malawi), conscious of the fact that such data are incomplete (i.e. no data available for 2001-2 and 2010) and subject to an unknown measurement error, and that changes in admission protocols may bias the graphical analysis and the results of the subsequent regression. Figure 25 shows that admissions of children to feeding centers move in line with the seasonal price component and, less so, with the famine price component.

Finally, to disentangle quantitatively the importance of long term food prices (and the related production policies), seasonal price variations, and price spikes observed on occasion of famines and we carry out a log-log regression of the number of malnourished children admitted to feeding centres on the three price components discussed above and on two key control variables i.e. the number of feeding centres and the dummy 'hunger season'. Given the log-log approach followed, the parameters are the average 'elasticities' of child admissions to feeding centres given a one percent variation in each one of the regressors (with the obvious exception of the dummy hunger season).

Table 14 presents the results of such an analysis for the total number of child admissions to feeding centres.

Figure 25 - Malawi: Number of children admitted to Nutrition and Rehabilitation Units and famine price component (top figure) and seasonal price component (bottom) (2003–2009)



Source: authors' calculations on data from FEWSNet, and Malawi's Ministry of Health

The results clearly suggest that – for the time span indicated - the trend price component (of maize) in Malawi has a negative and significant impact on child admissions to feeding centres, possibly suggesting that, for many households, nominal incomes rose faster than maize prices, while – though in a highly unstable way – food production per capita rose during the last decade (see Table 9) including because of the policy attempt of intensifying output through a more intensive use of fertilizers and other inputs. In contrast, the seasonal maize price component consistently shows in both Model 1 and 2 the largest and most significant impact on child admissions to feeding centres – highlighting in this way the importance of this neglected aspect of child malnutrition. The seasonal price components has on average over 2003-2009 a bigger effect than that of the trend price component and of the large (but infrequent) food price spikes observed in 2006 and 2009. Confirmation of the importance of seasonality on child malnutrition is confirmed by Model 3 in which the 'hunger

season' dummy explains the largest parts of child admissions while at the same time it renders the parameter of the seasonal price component (with which it is strongly correlated) statistically non significant. Finally, the number of feeding centres rises markedly and significantly the number of child admissions (suggesting that public policy may help in treating the backlog of chronically malnourished children), but does not alter the significance and size of the parameters of the three price components being investigated. All this obviously suggests that to improve food security and reduce child malnutrition there is a need to intensify efforts both to increase long term maize supply, as well as to smooth the price seasonal cycle by investing in storage and cereal banks and by providing a broader access to credit. Thirdly, the impact of the famine price component on child admissions on occasion of food crises is also important but is less large (and less statistically significant) than the seasonal price component (whose parameter is about six times bigger than that of famine price component). This result may be biased, however, by the fact that lack of data on child malnutrition prevented to include in the analysis the famine year of 2002. The adjusted R² of the regressions in Table 14 are broadly acceptable, while the value of the Durbin Watson in Model 2 possibly signals the omission of other variables or the presence of spurious correlation.

Table 14 - Malawi and Niger. OLS log-log regression of number of child admission to feeding centres on different price components

	Malawi 2003-9			Niger 2006-10		
	(1)	(2)	(3)	(1)	(2)	(3)
Constant	5.914***	1.139***	5.710***	1.062**	-0.613	1.056**
Log trend price/100 component	- 0.769***	- 0.572***	-0.702***	12.05***	10.624***	11.84***
Log seasonal price component	1.676***	1.908***	-0.189	1.926***	1.727***	1.089
Log Famine price component	0.333	0.219*	0.331^	-2.881***	-2.012**	-2.699***
Log Residual term	0.239	0.744	0.381	-2.567	-3.341	-2.183
Log number feeding centres		1.205***			0.427***	.....
Hunger season dummy			0.782***			0.317***
Adj R ²	0-30	0.86	0.39	0.84	0.86	0.85
F statistics	9.91***	107.93***	11.73***	72.84***	73.13***	66.6***
Durbin Watson	1.30	0.85	1.44	1.04	1.27	1.21
N.obs	84	84	84	60	60	60

Note: *, **, *** indicate that the parameters are significantly different from zero at the 10, 5 and 1 percent level of probability.

Source: authors' calculation on official data.

The analysis on Niger (covering only the years 2006-2010) points to a somewhat different story. All three models presented indicate that the main factor explaining the increase in admission of malnourished children to feeding centers is the price trend component, a fact broadly consistent with the data of Table 3 and Figure 6 which seem to suggest that the outright stagnation in millet production per capita (linked to ineffective food production policies and to a rapid population growth) lead to a steady increase in millet prices and to

rising child admissions to feeding centers over the long term. Also in this case, Models 1 and 2 suggest that the seasonal component of the price of millet appears to be a major determinant of child malnutrition, a fact that - as in the case of Malawi - is confirmed by the significance of the dummy 'hunger season' and by the fact that the seasonal price component is no longer significant when the dummy is included, a fact that suggests that the two variables move closely in line with each other. Finally, the famine price component is strongly significant and negative, a fact that should not surprise as during the period covered (2006-2010) millet prices have hardly jumped during the food crisis of 2010 (see Figures 18 and 22) despite a major drop in food production, thanks to a quick increase in imports and to effective government responses to the crisis. Also in this case, it appears that the control variable 'log number of feeding centers in operation' (a policy variable - which rose sharply in 2010 but not before) explains a non-negligible part of the log of the total number of children admitted to feeding centers. In both Niger and Malawi, the residual term is not significantly different from zero. Also in this case, the statistical tests seem acceptable, while the stability of the parameters across models suggests they are robust.

8. Overall conclusions and some policy lessons

This paper has shown that in Niger and Malawi (and possibly other SSA countries with similar structural characteristics) the drivers of domestic staple prices have to be found not only - or not primarily - in changes of international food prices. These are obviously important, but may not be the main culprit of persistently high and rising levels of child malnutrition in parts of SSA. Changes in domestic food production, the persistence of strong food price seasonality, and recurrent famines/crises have exerted an important upward pressure on domestic prices and - through them - on the nutritional status of children even during years of stable or falling international prices.

This paper is not meant to provide policy prescriptions. But some suggestions emerge from it about areas on which policy research ought to be intensified. First of all, the comparison between Malawi and Niger suggests that policies aiming at intensifying agricultural production and raising land yields - especially among smallholders - (as done in a controversial way in Malawi by subsidizing high yielding seeds, fertilizers and other inputs) may help reducing child malnutrition. Several studies (Dorward et al. 2010, IFPRI 2011) on the *Farm Input Subsidy Program* introduced in 2005 in Malawi for maize confirm its role in increasing the fertilizer rate of consumption. Subsidized programs for seeds and fertilizers should involve the private sector from the beginning and facilitate a transition towards market-based arrangements (von Braun et al. 2008) and should not substitute for an intensification of traditional input use, such as traditional varieties, labor, manure (Abdoulaye et al. 2000, Reeder & Tisdall 2007). At the same time, the lack of an alternative long term agricultural policy after the SAP approach in agriculture of the last 20 years appears to be a key determinant of child malnutrition in Niger. As noted in section 4, areas where research should focus further are agricultural intensification, technological innovation, control of population growth and greater budgetary allocations than at present. Several of these concerns were raised by the recent "Conférence Internationale sur la Sécurité Alimentaire et Nutritionnelle au Niger" of March 2011, which noted that the structural cause of the recurring famines and food crises was slow food production and rapid population growth. In the absence of improvements in these areas, Niger and several other nations in the region will continue to be affected in the future by recurrent famines and devastating food price seasonality.

Secondly, the persistence of strong seasonal food price variations appears to be a major determinant of child malnutrition, as admissions clearly rise – year after year – even in periods of relatively abundant harvests because of limited investments in storage at the collective and household level, limited credit availability, and inadequate policy responses in the field of strategic food reserves. The market-based price stabilization mechanisms introduced by the SAP of the 1980s and 1990s have proven to be too weak to deal with price seasonality and instability in countries like Niger and Malawi, where inter-temporal and spatial price arbitrage by private traders is hindered by lack of infrastructures (transport, communication, storage), limited competition, the distorting impact of economic decisions in larger and richer neighboring countries and the limited development of insurance, hedging and future contracts. As noted in section 5, research should ascertain whether food price seasonality can be dealt with only through targeted transfers and/or public works (at done at the moment) or also by improving food production (see above), by using flexible mechanisms to ensure some degree of pan-seasonal pricing for the main food staples, greater investment in efficient public/private storage, infrastructure to improve market integration, and the promotion of cereal banks (Devereux 2008). On the other hand, erratic government interventions in grain markets have to be avoided as they may cause uncertainty and under-investment in seasonal storage, transport and logistical networking, (Minot et al. 2007).

Finally, child malnutrition was found to rise, as expected, during recurrent famines which still stalk many African countries with surprising regularity. Here too, comparison between the four food crises/famines analyzed in the paper suggests a number of policy lessons: the first is that reliance on food imports to cover domestic production shortfalls in countries like Niger and Malawi is a dangerous strategy. Both countries are small, poor, landlocked and with a poor transport infrastructure. Both neighbor larger and richer economies whose exchange rate variations can shift large amounts of food towards them. And both depend on imports from countries which are often affected by covariant shocks. There is a need therefore for rethinking policy responses in the field food security during crises. Most likely, this rethinking should consider assigning a greater role than done during the last two decades to a more efficient early warning system, larger domestic or sub-regional food security reserve, free food/fodder distribution, cereal banks, public work schemes and active management of child malnutrition. The response to the Niger crisis of 2010 is, in many respects, a positive example of how governments and donors can respond to a food crisis. Such response also paved the way to the implementation of a long term nutritional strategy which combines actions directed at satisfying immediate needs at the individual level (e.g. the nutritional rehabilitation through intensive care or therapeutic feedings) with actions at the households level. In contrast, analysis of the Malawian famines of 2002 and 2008/9 suggests that new rules of interventions are needed for parastatals so as to avoid the ‘informational mistakes’ behind the food crises of 2002 and 2008/9 which exacted a very high price in terms of child malnutrition.

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