What Became of the Food Price Crisis in 2008?

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Abstract

In this paper we discuss causes and consequences of the price boom on food markets in 2008. We argue that fundamental market forces of demand and supply were the main drivers of this development. Deficits in global food supply and declining inventories pushed prices upwards and led to expectations of further imbalances. Speculators on futures markets played a minor impact on prices, but exuberant expectations of *all* market participants had an influence. Despite the steep price decline in the second half of 2008, due to good harvests and the global economic slowdown following the financial crisis of 2008, hunger continued to advance. With econometric estimates we illustrate that reducing hunger requires not only agricultural production and productivity to grow but also governance to improve. Such changes take time. If the world economy recovers from the economic slowdown without food production growing sufficiently to replenish stocks food prices and hunger may rise again.

JEL Classification: Q1 – Agriculture; Q11 - Aggregate Supply and Demand Analysis, Prices; Q17 - Agriculture in International Trade; Q18 - Agricultural Policy, Food Policy

1 Introduction[1]

Between 2006 and mid-2008 world market prices of cereals, oil seeds, and dairy products more than doubled. The United Nations Food and Agricultural Organisation (FAO) estimated that the number of hungry people increased from 848 million people in 2003-05 by 75 million to about 923 million at the end of 2007 (FAO 2008a).[2] Moreover, the International Food Policy Research Institute (IFPRI) registered social unrest due to high food prices in more than 60 developing countries (von Braun 2008, p. 6). Governments and aid organisations around the world called for immediate action. Then, in the second half of 2008 prices of cereals fell sharply by about 40%, and prices of oil seeds and dairy products dropped to their levels of early 2006. The price development of food commodities in 2009 was non-uniform. In June of that year FAO raised again the alarm with the estimate that more than one billion people go hungry every day, some 100 million more than one year earlier (FAO 2009a).[3] This development was not only grim news, but also raised puzzling questions. How come that hunger got more severe despite declining prices? Must we expect another price hike in the near future? Why did prices rise so high in the first place? What are the consequences of higher food prices on the poor? What can be done to reverse the trend of more people going hungry? These are the questions addressed in the following discussion.

The paper is structured as follows. Section 2 illustrates global and regional developments of production, utilisation, and prices of cereals, the most important

[1] We thank Barbara Becker, Marco Ferroni, Pradeep Itty, Gebhard Kirchgässner and Tom Rutherford for helpful comments on an earlier draft.

[2] As explained in FAO 2008b, p. 7, these were provisional estimates for the regional and global level, not for the country level. Country data are only available as averages for the years 2003-05.

[3] Upon request FAO explained that the 2009 estimates are based on preliminary FAO-data and an unpublished scenario calculated with a model described in USDA 2008, p. 38 ff.

staple food. Section 3 analyses the major driving forces of these developments. Section 4 takes a look at the impact of speculative investors on food commodity prices. Section 5 discusses the impact of high food prices on the poor. Section 6 concludes and explains with econometric estimates that interventions in the agricultural sector alone will not suffice to reduce hunger.

2 Global production, utilisation, and prices of cereals

Global cereal production and consumption during the past forty years was characterised by a steady growth trend with an average growth rate of roughly 2% per year. Annual surpluses and deficits tended to cancel each other out in short periods. However, that pattern changed in the decade after 1998. Figure 1 illustrates that in nine out of eleven years global production was lower than or just equal consumption. Accelerating global consumption and weather-related production shortfalls, above all in major exporting countries, were the main causes for an accumulated global food deficit of roughly 150 million tons between 1998 and 2008. This was the main reason for declining inventories and soaring prices. Figure 1 shows that global stocks decreased on average by more than 3% p. a., and that the stock-to-utilisation ratio declined from about 37% to less than 23% in 2009. In 2007 cereal inventories had fallen to 430 million tons, which meant reserves for not more than 70 days of consumption – the lowest reserve ratio of the past 50 years, and certainly a trigger for increasing prices. In response to the price rise a significant increase in cereal production occurred in the years 2007 and 2008. World cereal production was estimated to have reached a new record of 2’290 million tons in 2008, exceeding total consumption and bringing stocks up to 510 million tons. Cereal production in 2009 is provisionally estimated at 2’238 million tons, just equalling global demand (FAO 2009b).

Tables 1 and 2 show a regional breakdown of the demand and supply development between 1998 and 2008. The data indicate that the growth of utilisation exceeded the growth of production in Asia and Africa, while production grew slightly faster than utilisation in Latin America and the developed world.[4] The increasing divergence of production and utilisation was particularly marked in Africa, but the Asian deficit is significantly larger in absolute terms. In the aggregate it is still true that the developed world produces a cereal surplus that covers the deficit of the developing world.[5] This is also expressed by the fact that almost 75% of the production increases in 2007 and 2008 occurred in the developed world. Developing countries were hardly able to benefit from the price hike by increasing production.

Figure 2 shows that the FAO Food Price Index, comprising prices for meat, dairy products, cereals, oils, and sugar, declined in real terms from a historical high in 1973-74 to a historical low in 1987.[6] After fluctuating around that low level for a quarter of a century, real food prices started to soar again in 2003 and hit their peak in mid-2008. In the beginning, index changes in nominal terms were relatively moderate with growth rates between 5% and 10% per year, but accelerated to more than 20% in 2007 and 40% during the first 6 months of 2008. Figure 3 depicts the price rise of the most important cereals and oils and fats since 2002-04. Prices for wheat, maize, and oils more than doubled, while the rice price more than tripled until mid-2008. Prices then collapsed in the second half of 2008, and started to rise again modestly in 2009. Although the nominal FAO Food Price Index reached

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[4] Growth rates in Table 2 are exponential growth rates, computed as: $r = \ln (x_0 / x_n) / n$, with x as quantities in the first and last year and n as the number of years. Note that these growth rates do not take into account the intermediate values of the series.

[5] Of course, this does not mean that all developing countries are net cereal importers and all industrial countries net exporters.

[6] The five price indices are weighted by the average export shares of each of the commodity groups for 2002-04.

unprecedented levels in 2008, the index in real terms remained below the levels of the early 1970s. However, nominal cereal prices were in the first half of 2009 still 50% to 100% higher than before the crisis.

3. Driving forces on the demand and supply side

It is generally agreed that population and (per capita) income growth in developing countries were the prime movers of global food utilisation between 1998 and 2008. This is not only true for Asia, with particularly dynamic markets in China and India, but also for Africa and Latin America (see Tables 1 and 2). In all developing regions employment in non-agricultural activities and urbanisation increased as well. Both factors added to growing shares of populations who are net food buyers, another cause for a growing demand pressure on food markets. In addition the food consumption patterns of an emerging global "middle class" changed towards diets that are richer in meat and dairy products. The calorie intake from these foodstuffs is much more intensive in terms of both grain (fivefold) and water use (tenfold) than from a diet based on cereals (e. g. Evans 2008; FAO 2003). Hence, over the last decade dietary changes contributed substantially not only to a growing demand for grains, but also to an increasing demand and scarcity of water, which may have limited the growth of cereal production in some world regions.

In industrial countries the demand for bio-fuels has become an important new source for a growing demand of grain, vegetable oils, and sugar cane (e. g. FAO 2008d).[7] Bio-fuels are competitive with fossil fuels at crude oil prices between 60 and 70 US$ per barrel (von Braun 2007, p. 7), a price level that was reached the first time in early

[7] These bio-fuels are often called „first generation bio-fuels". „Second generation bio-fuels" are based on wood and other residues. They play a minor role at the time being, but may become more important in the future.

2006 and has prevailed or was surpassed since then (EIA 2009). In the European Union (EU) and North America subsidies and regulations to speed up market penetration boosted bio-fuel production. World ethanol production more than tripled between 2000 and 2008, with growth rates of 30% p. a. and more during the last four years of that period.[8] The price impact of these developments was probably considerable, as the commodity demand for bio-fuels comprises already sizeable shares of world production. In 2007 about 11% of the global maize production and roughly 7% of global vegetable oils were used for bio-fuels. The tremendous growth rates resulted in substantial changes in land use and the decline of grain stocks. In the USA maize displaced soybeans, and in the EU and other countries oilseeds displaced wheat (FAO 2008d; Mitchell 2008). There can be no doubt that both the land reallocations and the declining stocks contributed to the price boom of these commodities.

Table 2 presents a breakdown of the regional growth of demand and supply between 1998 and 2008 into two five-year periods. Asia experienced a slight growth of demand and a declining production in the first period between 1998 and 2003. The increasing production gap was mainly filled by a drawdown of stocks. After 2003 the growth of both demand and supply gained momentum, but during this period production outgrew demand. Nonetheless, demand was higher than production, and the gap was compensated by (increasing) net imports. In Africa the growth rates of utilisation and production were relatively stable in the two five-year periods (with production slumps in 1999/2000 and 2007, see Table 1). As utilisation grew permanently faster than production the region's dependence on imports increased as

[8] Assuming future crude oil prices in the range quoted above and no major policy changes in OECD countries some forecasters expect production to double again up to 2017 (OECD-FAO 2008).

well. Latin America also experienced relatively stable growth rates in the two five-year periods, with a notable dent in production in the years 2005 and 2006 (see Table 1). Although production growth exceeded consumption growth the region is still a net importer of cereals. For the developing world as a whole the growth rates of utilisation and production were substantially higher in the second five-year period than in the first five-year period. This pattern also holds for the developed world, which faced notable production setbacks in the years 2002, 2003 and 2006 (see Table 1). The data indicate that the strongest pressure on global food markets occurred in the second five-year period – through demand growth in excess of production and through reduced stocks resulting from production gaps in the first five-year period. The observation of relatively stable food prices in the first period and the steep rise in the second period, as shown in Figures 2 and 3, are compatible with this time pattern of developments.

Apart from these fundamental driving forces at least three other price-enhancing factors must be considered. First, the increasing energy prices from 2002 until the second half of 2008 pushed up costs for food production and distribution. The cost of fertiliser almost tripled between mid-2007 and mid-2008 (DairyCo 2009), and other energy-related costs went up in virtually all parts of the food value-chain, i.e. cultivation, processing, shipping, transportation (and refrigeration in the case of meat and dairy products)[9]. Second, between 2002 and 2008 the US-Dollar depreciated against other reserve currencies by roughly one third. As virtually all transactions on international food markets are denominated in US-Dollars, traders factored this depreciation into world market prices. Third, when the price hike reached its peak in

[9] For an illustration of the sizeable impact on cultivation costs in the USA see for instance Mitchell 2008, p. 6.

2008, governments in 15 countries had imposed export restrictions on food commodities with the aim to protect their domestic consumers (von Braun et al. 2008, p. 5). These measures backfired in three ways. First, they exacerbated the pressure on world market prices; second, farmers in countries with export restrictions could not fully benefit from higher world market prices and their supply responses were curbed; third, the export restrictions weakened the trust in the international food trade system. This latter effect contributed very likely to the international investments in agriculture, which were undertaken or planned by private and public investors on an unprecedented large scale over the last years (Cotula et al. 2009).

Taken together, all these considerations strongly support the hypothesis that fundamental market forces were the predominant drivers of the food price rise. They were superimposed by price-raising effects of energy and environment policy, trade policy, the depreciating US-Dollar and increasing energy prices. Prices declined steeply in the second half of 2008 after markets were informed about good harvests and after the financial crisis had turned into a global economic slowdown reducing demand expectations. Without the market fundamentals the boom and bust cycle would not have been conceivable.

4. The role of speculation

The impact of speculation on food prices was and is a hotly debated topic. On the one hand some observers argue that speculators on futures markets for food commodities created a price bubble, and that current regulations should be tightened to restrict speculation more strongly (e.g. Masters 2008, p. 1; UNCTAD 2008, p. v; Lieberman 2008). Such thinking is even topped by the requests of radical critics like Jean Ziegler, the UN's former Special Rapporteur on the Right to Food, to put an

"outright ban on futures trading of agricultural commodities" (Ziegler 2008, p. 32). On the other hand a well-known school of economic thought holds the opposite view that speculators help to smooth and stabilise the movement of prices over time (e. g. Friedman 1953). Speculators can only exist in the long run if they make profits from buying at low and selling at high prices. In doing so, they reduce the difference between minimum and maximum prices, which contributes to price stability over time. Hence, "speculators are either useful or they destroy themselves" (De Jasay 2008, p. 28). This school of thought implies that speculation generally follows market fundamentals and price development, not the other way round. However, this does not mean that *all* speculators at *all* times are price followers. In other words, the main direction of causality from prices to speculation may go along with a minor reverse causality from speculation to prices (e.g. Gilbert 2008). This point of view is captured by the metaphor that the impact of speculation is the "white crest on top of a wave, not the wave itself" (Chalmin 2005, p. 7).

Some of the sceptics or critics of speculation base their allegations on the false assumption that an overshooting of prices is always and exclusively caused by speculators.[10] This misunderstanding neglects the fact that price bubbles can result from misled expectations of *all* market participants. It is therefore helpful to briefly classify the main actors on futures markets for food commodities in order to see how they interact and what is required to determine their impacts on prices (see also Gilbert 2008, p. 4). The first group of actors are hedgers or commercials. Commercials trade commodities physically on cash markets, either as producers, processors, or merchants. They usually offset their positions in cash markets with

[10] A good example is for instance Wahl (2008, p. 2) who proposes to introduce trade registers on food markets "where only traders who are hedging are allowed", totally ignorant of the fact that speculators are indispensable counterparts to satisfy hedging needs.

opposite positions in future markets, the standard procedure of hedging against price risks. The second group are speculators or non-commercials, which generally trade in the short term, based on views about price developments. Their motivation is not to hedge against price risks, but to make a profit from expected price movements on which they bet. It is important to understand that speculators are necessary counterparts for hedgers, whose positions usually don't cancel each other out. The third group are investors who regard commodities as assets, like equities, bonds, estates, etc. They usually take long positions through commodity index certificates or swaps, which are provided by banks and other financial institutions. Contrary to short-term-oriented speculators investors hold positions in the longer run, but of course they are also speculators (and counterparts of hedgers) as they bet on future price developments. This is the class of actors whose involvement in commodity markets has grown dramatically over the last years and who are suspected by some observers as the main drivers of the price boom.[11]

There can be no doubt that financial investors have built up large long positions on commodity markets between 2003 and mid-2008. The assets allocated to index traders and swap dealers have risen from 13 billion US-Dollars at the end of 2003 to 161 billion US-Dollars as of June 2008[12], 17% of the total market value of 945 billion US-Dollars (Masters 2008, p. 2; CFTC 2008, p. 3). This twelve-fold increase paralleled the price rise discussed in section 2, and it is this coincidence that usually serves as the empirical proof that speculation was a major, possibly *the* major determinant of the price hike. But of course, the correlation between the increase of

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[11] A fourth group are so-called "locals" who trade very short-term high frequency price movements; for the present context this type of speculation is not relevant.

[12] The data comprise contracts traded on the 33 US markets regulated by the Commodity Futures Trading Commission, CFTC.

market positions and prices does not explain the direction of causality. As investors do not trade physical quantities (their trades are usually settled in financial terms) some observers strictly negate any causal connection between index trading and price movements. With a view to the oil market *The Economist* (2008a, p. 18) used a particularly colourful metaphor: "... since no oil is ever held back from the market, these bets do not affect the price of oil any more than bets on a football match affect the result". However, bearing in mind that a causal feedback from speculation on prices cannot be excluded on theoretical grounds, this comparison oversimplifies the case. Hence, to shed light on the effect of speculation two empirical questions must be answered. First, were the long positions of financial investors during the recent price boom exceptionally high in relation to the hedging needs in the market? Second, did speculation lead prices of commodities or did speculation follow prices, as is usually assumed?

Sanders, Irwin, and Merrin (2008, 2007) discuss both questions in detail. A core aspect of their empirical work focuses on analysing the development of a speculation index proposed by Working (1960), which is based on the proportion of speculative positions and hedging needs.[13] The authors find that average index values across nine markets of agricultural commodities between 1995 and 2008 range from 1.12 to 1.14, "implying that speculation is barely large enough to meet total hedging demands" (Sanders et al. 2008, p. 11).[14] At the same time the authors cannot find a discernible time trend of speculation growing relative to hedging for the period in

[13] Working's index T is calculated as: $T = 1 + SS / (HL + HS)$ if $HS \geq HL$, or $T = 1 + SL / (HL + HS)$ if $HL > HS$; SS = speculation short, HL = hedging long, HS = hedging short, SL = speculation long.

[14] These estimates are based on data from Commitments of Traders (COT) reports. When using more detailed data from the Commodity Index Traders (CIT) report, which puts all index traders into the category of speculators, Working's index for 2006-08 is shifted up to 1.27. However, as CIT-data are not available for earlier years it is not possible to test for the existence of a time trend.

question. Moreover, comparisons of Working's index for 2006-08 with previous studies on periods between the 1950s and the 1980s reveal that recent speculative levels relative to hedging needs are not in excess of historically observed values (Sanders et al. 2008, p. 12 f).

Of course, these results say nothing about the validity of the traditional paradigm that speculation follows hedging. To test this hypothesis Sanders, Irwin, and Merrin (2007) carried out Granger causality tests, essentially using the same data[15] as for the previously discussed analysis. Their results convey two clear messages. "First, traders' positions do not show a systematic and pervasive tendency to lead returns. ... Second, the results clearly demonstrate that positions *follow* returns. In particular, non-commercial traders increase long positions after price increase: they are trend followers" (Sanders, Irwin, and Merrin 2007, p. 10). These results are compatible with results from other econometric analyses such as Gilbert (2008), Gorton, Hayashi, and Rouwenhorst (2007), Bryant, Bessler, and Haigh (2006), and IMF (2006, p. 164 ff). With varying models, data, and methods all these studies conclude that there is no or very little evidence for the presumed impact of speculation on prices, but very strong evidence for causality in the opposite direction.

Finally, a report of the Commodity Futures Trading Commission (CFTC), based on the analysis of millions of swap dealer and index trader contracts between January and June 2008, illustrates that there is *no* significant positive correlation between the development of commodity prices and the number of contracts held by investors (CFTC 2008, p. 22 ff). Other CFTC-data for the longer period 2006 to 2008 also illustrate that long positions of index traders and prices are not highly correlated

[15] From 1995 to 2006.

(CME Group 2008). These analyses cover markets for crude oil, wheat, corn, soybeans, and cotton. However, similarly uncorrelated variations of speculative positions and prices are also observed in other commodity markets. For instance, the highest concentrations of speculative long-only positions over the last years occurred frequently in the livestock futures market, but price increases on this market were very modest. On the other hand, strong price increases were observed for commodities for which futures markets do not or hardly exist, e.g. durum wheat, beans, rice, and fluid milk (Sanders, Irwin, Merrin 2008, p. 15).

It is worth mentioning that virtually all analyses on the impact of speculation are flawed by the assumption that actors on commodity futures markets fall neatly into the categories of hedgers who want to protect themselves from price risks and speculators who want to make a profit from bets on future price movements. This clear-cut division of market participants and motivations is a fallacious description of the real world. Irwin has put this in apt words: “The behaviour of hedgers and speculators is actually better described as a continuum between pure risk avoidance and pure speculation. Nearly all commercial firms labelled as ‘hedgers’ speculate on price direction and / or relative price movements ... Just last week ... the CFTC stated that ‘These trader classifications have grown less precise over time, as both groups may be engaging in hedging and speculative activity’“ (Irwin 2008, p. 2). Indeed, why on earth should producers, processors, and merchants, who were fully aware of supply shortages and declining stocks after 1998, not have expected food prices to rise and try to hold back commodities? The fact that inventories actually declined does not mean that expectations did not drive prices up. As Roger Bootle emphasised, for prices to grow it is sufficient that “physical traders *want* to hold bigger stocks, they must not succeed” (The Economist 2008b, p. 67).

The bottom line of all these considerations is that financial investors were not the main drivers of price developments on food commodity markets, and that it is unrealistic to assume that only non-commercials "develop a view on the market". All market participants derive price expectations from observed demand, production, trade, and changes in stocks. As commercials trade on both futures and cash markets it can be assumed that their price expectations are even more decisive than those of speculators. Nonetheless, the rule of "no smoke without fire" also applied in 2008: prices probably overshot (to an unknown extent) due to "exuberant" expectations of all market participants, but changes in market fundamentals were the main drivers of the boom and bust cycle.

5. Effects of high food prices on the poor

Judgements about the impact of rising food prices on the poor provoked similarly controversial statements as in the case of speculation. Some observers proclaimed "a silent tsunami, threatening to plunge more than 100 million people on every continent into hunger" (WFP, World Food Programme 2008, p. 1), or emphasised that "progress towards achieving internationally agreed hunger reduction targets has suffered a serious setback" (FAO 2008c, p. 4). Others concluded that "higher food prices can be an incentive to increase agricultural production in Africa" (Peltzer 2008, p. 1) or suggested that with higher food prices "for the majority of the world's poor … the dream of a 'chicken in every pot' is becoming more attainable because world food supply is rising again" (Kharas 2008, 1).

The effect of rising food prices on the poor is certainly a double-edged sword. While higher prices reduce the purchase power of one part of poor households they increase incomes of others. The net effect depends on some crucial starting

conditions and the extent and timing of responses to the price shock. Evidence strongly indicates that there are more net food-buying households than net food-selling households among the poor, which is true even in rural areas (e. g. Ivanic and Martin 2008; Seshan and Umali-Deininger 2007; Byerlee Myers and Jayne 2006; Ravallion 1989). As net food buyers lose from rising food prices there are more losers than winners among the poor. Moreover, Aksoy and Isik-Dikmelik (2008, p. 12) note in a study covering nine countries that among the poor population net buyers are poorer than net sellers. Assuming that this result also holds true in general the food price increase hit most of all the poorest of the poor who could often not afford a sufficient diet even before the price hike.

Two dampening or counteracting forces can alleviate the negative effects of price rises. First, about 50% of all net food-buying households spend less than 10% of their expenditures on food[16] and therefore suffer only mildly from food price increases. Second, the incomes of many rural poor who are landless and work as farm labourers may increase with growing incomes of net food sellers due to higher prices (Aksoy and Isik-Dikmelik 2008, p. 10 and p. 13 ff). However, the evidence discussed before suggests that negative effects of purchase power reduction exceed such secondary income effects, at least in the short run. Both the severity and the headcount ratio of poverty go up. Ivanic and Martin (2008, p. 20) estimate that the price rise of 2008 led to an average increase of poverty rates of 4.5 percentage points (using the poverty line of 1 US-Dollar, corrected for purchase power parity,

[16] Unfortunately the authors do not provide data on the share of *poor* marginal net buyers. If most of the net buyers are relatively rich, a small impact of food price increases on this group is no consolation for the poor. Moreover, the fact that many households switch between being net buyers in one year and net sellers in the next year exacerbates the empirical problems.

PPP).[17] If this result is extrapolated to the global low-income population of 2.3 billion people, the price hike may have added another 100 million people to those who live in absolute poverty. Compared with the 75 million additional undernourished people estimated by FAO, and considering that the correlation between the percentage of undernourished people and the headcount ratio of the poor is about 0.75[18], this figure may be on the pessimistic side, but the order of magnitude is plausible.

The optimistic judgements about the impact of higher food prices quoted above may be relevant when longer time horizons and higher income groups are considered. Aksoy and Isik-Dikmelik (2008, p. 11) conclude from their data that net food buyers were *in general* richer than net food sellers. This means that higher food prices on average transfer incomes from richer to poorer households. From that point of view higher food prices are pro-poor. However, as explained before, this transfer effect does not hold for people below or near the conventional poverty lines of 1 and 2 PPP-Dollar a day. Indeed, Aksoy and Isik-Dikmelik (2008, p. 12) also find that among the poorest 40% of the population net sellers are richer than net buyers. Therefore they also conclude that people living *near* or *below* these poverty lines lose on a net basis from high food prices.

Regarding longer-term effects, some observers point to low food prices during the last decades as an important cause for the prevalence of high rural poverty rates in many countries. Therefore, they argue, higher food prices result not only in higher incomes of net food sellers but also offer welcome opportunities to mobilise

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[17] The sample is again nine countries, and seven countries are the same as those in the sample of Aksoy and Isik-Dikmelik. Dessus, Herrera and Hoyos (2008) estimated the impact of higher food prices on the urban poor for 73 countries and found comparable changes in the urban poverty rates with the 2 PPP$ poverty line.

[18] Estimated for 90 countries, year 2004; data source: World Development Indicators 2008.

agricultural investment and boost production and productivity of farmers in general. This is seen as a particularly important potential for poor smallholders in Africa whose productivity is far below that of most farmers in other regions of the world (e. g. World Bank 2008; Kharas 2008; Peltzer 2008). However, as mentioned in section 2, the supply response of developing countries to the price hikes in 2007 and 2008 was very small and illustrates the low price elasticity in the short run.[19] Particularly smallholders face many and high barriers to increase production, such as fragmented landholdings, limited access to water, insecure property and user rights, deficient extension services and producer organisations, insufficient access to productive technologies, and insufficient access to markets for intermediate inputs, capital, and outputs. In addition, deficient infrastructure and wanting public services may contribute to high production and transaction costs, and many farmers suffer from oligopolistic market structures or producer prices administered at levels far below market prices. Overcoming these barriers is a time-consuming process and requires many public interventions that were missing or ineffective for years and decades. Therefore the short-term negative effects of higher food prices will at best be compensated with delays of several years. We will take up that point again at the end of the next section.

For some observers it came as a surprise that FAO reported an additional 100 million undernourished people in mid-2009 after food prices had declined by some 40%. The reasons for this surge are threefold. First, the financial crisis and the economic slowdown in 2008 had negative effects also in developing countries and on the incomes of the poor. Second, foreign direct investments as well as other capital flows

[19] Moreover, it should be noted that the growth of cereal production in industrial countries was primarily achieved with an expansion of land put under the plough; the EU, for instance, shelved a programme that obliged farmers to leave 10% of cultivated land fallow.

and remittance flows declined, which also reduced incomes of the poor. Third, food prices on world markets are still between 50% and 100% above the level before the price boom, and in many developing countries prices on domestic markets declined less than on world markets. Hence, despite declining food prices the global economic slowdown had direct and indirect negative impacts resulting in another surge of poverty and hunger – that is as indisputable as the same effect caused by the price rise before.

6. Conclusions: What should be done to reduce hunger?

The food price crisis instigated many ambitious policy proposals, suggesting that market imbalances and poverty and hunger can and should be reduced simultaneously (e. g. UN High-Level Task Force 2008; von Braun et al. 2008; FAO 2008b; OECD-FAO 2008; Welthungerhilfe et al. 2008; Oxfam 2009; World Bank 2008). Although these proposals have many recommendations in common they are not identical. They reflect different views, interests, and priorities, and include sometimes contradicting conclusions and recommendations. Nonetheless, virtually all proposals suffer from two flaws, which we discuss in more detail below. First, they focus almost exclusively on supply-side measures in the agricultural sector and neglect other determinants of hunger. Second, with or without intention, they suggest that decisive results can be achieved relatively quickly – an unlikely scenario.

Contrary to the exclusively supply-side-based reasoning we hypothesise that the reduction of hunger requires not only growing food production, but also the improvement of public governance. This hypothesis can be derived from two strands of thinking and empirical insights. First, Sen (1982) and later Drèze and Sen (1989) illustrated that famines and hunger are not only caused by a shortage of food but

also by other economic, social, and political factors. Simply speaking, Sen's original conclusion was that famines do not occur in democracies, which usually show higher quality of governance than other political systems. This approach of thinking overcame the traditionally sector-focused view of the time. Second, there is evidence for the African saying that "there is hunger where there is war". Indeed, comparing war statistics and statistics on the prevalence of hunger (inside and outside of Africa) reveals that all countries suffering from armed conflicts display high rates of people being undernourished. And of course, wars and civil wars are the greatest threat to the quality of governance.

Based on these strands of thinking and evidence we analyse the determinants of hunger with a simple econometric model of three equations, which combines the supply-side view and the governance aspect. The first equation explains that the prevalence of hunger in a country is a function of the cereal production per capita, the general level of economic wellbeing (measured with per capita income or, alternatively, the headcount ratio of poverty), the proportion of people living in rural areas, and the quality of governance. Per capita cereal production acts as a sort of "catch all" indicator to capture the domestic capacity of basic food supply. In addition we have estimated this equation with a variable "staplepc", which is the sum of cereal production and roots and tubers production per capita.[20] The average income (or poverty) indicator represents the major determinant for total food demand per capita, which can be satisfied with domestic production and imports. The rural population indicator is included to reflect the fact that many of the rural people are often thinly dispersed over large areas, which creates "pockets" of hunger that are particularly

[20] The weight-specific energy content of both types of staple crops is very similar.

difficult to eliminate. The second equation states that cereal production per capita is a function of the arable land per capita, the cereal yield per ha, and the share of roots and tubers production in the total staple food production. In many developing countries roots and tubers are substitutes for cereals, i.e. we expect cereal production per capita to be lower where roots and tubers production is higher. The third equation explains that cereal yields per ha are a function of fertiliser input, the amount of water available relative to the size of agriculture, the level of education of the adult population (among others the farmers), and the percentage of people living in rural areas. The last variable reflects the fact that larger proportions of rural (agricultural) population force farmers to put more marginal land under the plough, which tends to reduce yields per ha. In functional form these hypotheses can be written as:

(1) $\text{hunger} = a_0 + a_1\ \text{cerealpc} + a_2\ \text{incomepc} + a_3\ \text{rural} + a_4\ \text{governance}$
(alternatives: staplepc instead of cerealpc, poverty instead of incomepc)

(2) $\text{cerealpc} = b_0 + b_1\ \text{arablepc} + b_2\ \text{yield} + b_3\ \text{roots\&tubers}$

(3) $\text{yield} = c_0 + c_1\ \text{fertiliser} + c_2\ \text{water} + c_3\ \text{literacy} + c_4\ \text{rural}$

Definitions of the variables and sources of the data are given in the appendix. Our samples include only developing countries and countries in transition. Table 3 displays the results of OLS-estimates. The prefix “ln” denotes the natural logarithm of the respective variables. As noted in section 1, FAO’s most recent data on the prevalence of undernourishment are averages for the years 2003-05. All explanatory variables refer to the same period. We report only estimates of the equation specifications with the highest ρ-values and R^2s.

Equation (1.1) uses per capita income as the indicator for economic wellbeing. All parameters have the expected signs and are significant at conventional levels. Equation (1.2) includes poverty as the indicator for economic wellbeing, and again all variables are significant. Equations (1.3) and (1.4) estimate the logarithm of the dependent variable, and with both per capita income and poverty all parameters are highly significant. Equations (1.5) and (1.6) use per capita cereals plus roots and tubers production instead of cereals alone, and again all variables are highly significant. All estimates support the hypothesis that the quality of public governance has a significant and sizeable influence on the proportion of undernourished people: the difference between the best and the worst quality of governance in our sample implies a difference in the proportion of undernourished people of about 17 percentage points. Equations (2) and (3) confirm the influence of the most frequently quoted supply-side determinants of cereal production and yield per ha. Cereal production per capita is higher the higher the arable land per capita, the higher the yield per ha, and the lower the share of roots and tubers production. Finally, cereal yield per ha is higher the higher the input of fertiliser and water, the higher the level of education, and the lower the proportion of the population living in rural areas. All parameters are highly significant.

The Shapiro-Wilk test indicates for equations (1.1), (1.3), (1.4), (1.6) and (2) that the error terms are not normally distributed, which compromises the validity of our ρ-values. Given that we have some developing countries and countries in transition in our sample where the quality of data may be rather limited, it is not surprising to find outliers that disturb the shape of the error term distribution. Estimation results after eliminating outliers are presented in Table 4, and in each case the Shapiro-Wilk test now indicates a normal distribution of the error terms (the countries we eliminated are

listed at the foot of Table 4). Significant parameter changes result only for equation 1.1, where the variable “rural population” becomes insignificant. In all other equations changes of parameter values are very small to moderate, and the statistical significance of parameters with the full and reduced samples are virtually identical.

The estimates of equations (2) and (3) reflect important supply side variables addressed in the policy proposals mentioned above. Increasing food production by pushing up the productivity of smallholders is paramount among the recommended measures. However, as discussed in section 5, the growth of smallholder production is hampered by many barriers, and overcoming them is probably as time-consuming as the improvement of public governance. Nonetheless, the most prominent policy proposals recommend a broad range of interventions to enhance smallholder production with “emergency packages”, suggesting that quick results may be possible (e. g. UN High-Level Task Force 2008; von Braun et al. 2008). This is for many countries an unrealistic perspective. In Sub-Saharan Africa, where progress is needed most, yields per ha grew by roughly 1% p. a. between 1960 and 1975, and stagnated since then (World Bank 2008, p. 51). The situation is similar in agriculture-based countries also outside the region. Since the mid-1980s public expenditures for agriculture stagnated as a share of GDP, and aid for agriculture declined in absolute and relative terms (World Bank 2008, p. 7 and p. 41). Therefore it is difficult to see how massive investment programmes could be financed and suddenly produce high growth rates of yields, where such developments were amiss for decades. Quick fixes are also unlikely as long as the presumably best way to increase agricultural yields is fiercely debated. Controversial discussions about smallholder production vs. larger farming systems, about “industrial” vs. “organic” modernisation, and about the most important crops to be targeted for innovation are far from over. Again, these

topics have been high on the agenda since years and decades, and it is very unlikely that the controversies will end in the foreseeable future. Of course, a variety of approaches will be followed in any case, but the current uncertainties on the most promising choices are not helpful in speeding up the modernisation process.

Many recommendations included in the policy proposals to reduce food prices, poverty, and hunger simultaneously would require solving conflicts between powerful interest groups. The successful conclusion of the Doha trade negotiations is a case in point. But when and how a compromise for the particularly critical agricultural trade package can be found is unpredictable, and therefore future incentives from the trade system to increase food production in developing countries are unknown. This is also true for the disposition of governments to impose export restrictions in case food prices rise anew. It is very likely that governments would raise trade barriers as they did in 2008. Such distortions create mistrust in the food trade system and are an incentive for foreign investments in agriculture, which on their part may have negative effects on the poor in the receiving countries. In this context it is uncertain to what extent unfair and harmful crowding-out processes and expropriations of mostly poor farmers can be prevented, and whether the investments will also result in higher food security in receiving countries (e. g. Cotula et al. 2009). In a similar way it is unforeseeable whether governments in industrial countries will modify policies to promote bio-fuel production and consumption. Politicians feel the urgency to make headway in limiting greenhouse gas emissions and to diversify the fuel mix and suppliers. If one also takes into account the interests of farmers to keep the market for bio-fuels alive and growing, it is far from clear whether policy changes to limit or reduce bio-fuel demand will be put in place in the foreseeable future. Finally, it can only be hoped that the requests for new regulations of futures markets of food

commodities will not do more harm than good. Maximum limits for speculative positions exist since long, and regulators must be very careful not to overreact in imposing restrictions that might adversely affect the liquidity and jeopardize the smooth functioning of markets.

All in all, the policy proposals to simultaneously reduce imbalances on food markets and hunger and poverty are politically warranted and full of good intentions. But they are normative appeals, loaded with wishful thinking, controversial ideas, many uncertainties, and conflicting interests. Humanitarian emergency interventions to alleviate the worst forms of hunger can achieve results in the short run. But the implementation of most policy and aid activities to reduce hunger on a sustained basis, inter alia the required improvement of governance, will take more time than envisaged. The requested measures will be watered down due to conflicts of interests and will probably be less effective than suggested by overly optimistic proponents. That makes a quick and decisive turnaround in the trend of hunger and poverty as unlikely as a fast reduction of food prices to levels before 2003. Food prices will only continue to fall if the development of demand and supply will result in stocks growing to levels that eliminate expectations of supply shortages. If that happens through a continued recession of the world economy the result will be growing poverty and hunger despite falling prices – a continuation of the trend observed in the first twelve months after mid-2008. If the world economy recovers, the impact on food prices depends on the proportion between the growth of global food production and demand. If food production grows faster than demand, food stocks will grow and prices will come down. Both effects would be good for the poor and the hungry. But if the world economy recovers quickly and leads again to food

demand outgrowing production prices will remain high and the next price increase may be just around the corner.

Appendix	**Data definition and data sources**
hunger	Percent of population underonurished. FAO, FAOSTAT Food Security Statistics. http://www.fao.org/economic/ess/food-security-statistics/en/
cerealpc	Production of cereals, t per capita. FAO, FAOSTAT Food Production Statistics. http//:www.faostat.fao.org. Data on population: World Development Indicators 2009, The World Bank.
incomepc	Per capita income, corrected for purchase power parity. World Development Indicators 2009, The World Bank.
poverty	Headcount ratio of the poor, 2 PPP$ poverty line. World Development Indicators 2009, The World Bank.
rural	Percent of population living in rural areas. World Development Indicators 2009, The World Bank.
governance	Quality of governance, World Bank “Governance Matters” indicator. http://info.worldbank.org/governance/wgi/index.asp
arablepc	Arable land, ha per capita. World Development Indicators 2009, The World Bank.
yield	Cereal yield, kg per ha. World Development Indicators 2009, The World Bank.
roots&tubers	Share of per capita roots and tubers production in the production of cereals plus roots and tubers. FAO, FAOSTAT Food Production Statistics. http//:www.faostat.fao.org.
fertiliser	Fertiliser input, 100 g per ha of agricultural land. World Development Indicators 2009, The World Bank.
water	Freshwater withdrawal for agriculture, m^3 per km^2 agricultural land. World Development Indicators 2009, The World Bank.
literacy	Literacy rate in percent of adult population. World Development Indicators 2009, The World Bank.

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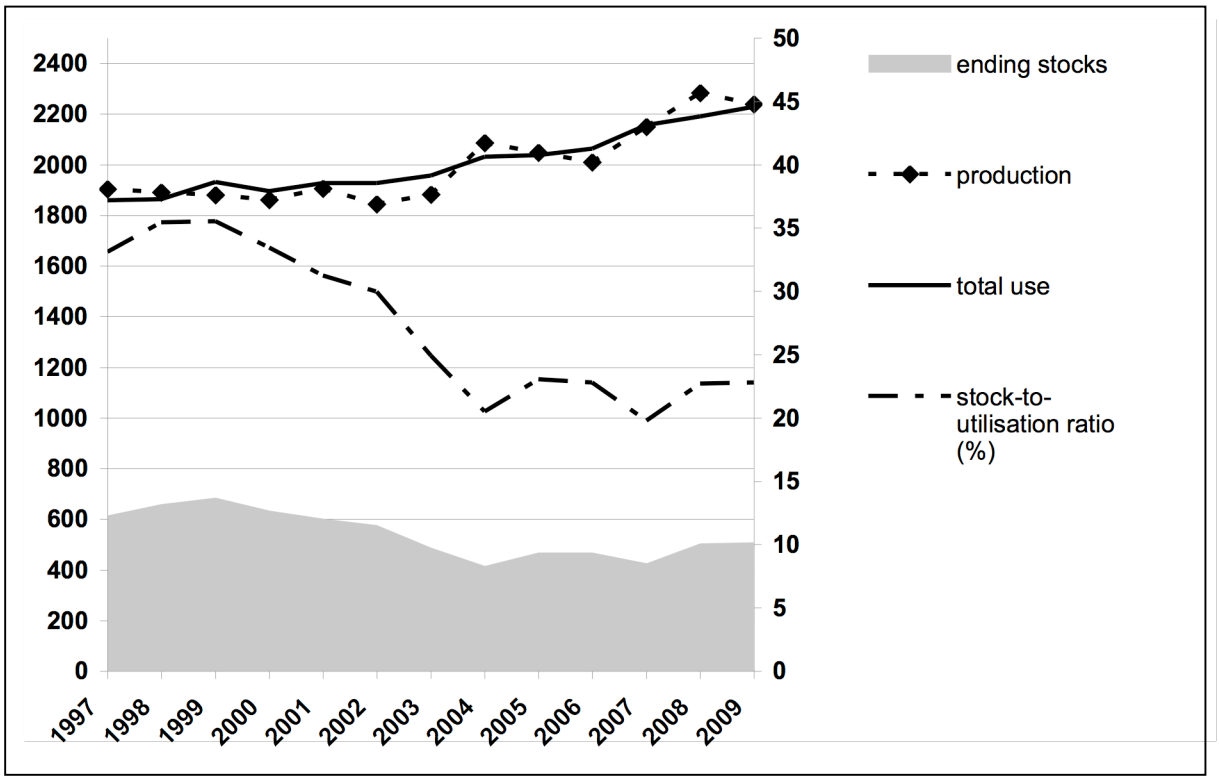
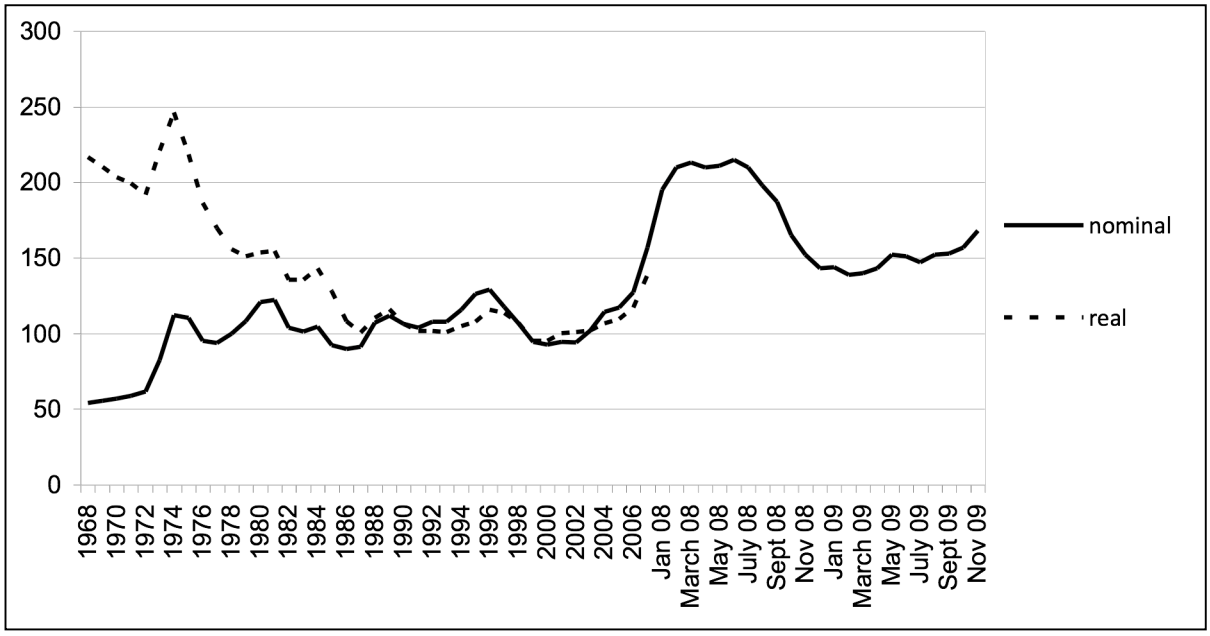
Figure 1: World cereal production, use and stocks 1997 – 2009 (million tons)



Source: FAO STAT 2009 (Data include milled rice, not cereals for beer production.)

Figure 2: Development of FAO food price index



Source: FAO 2009b

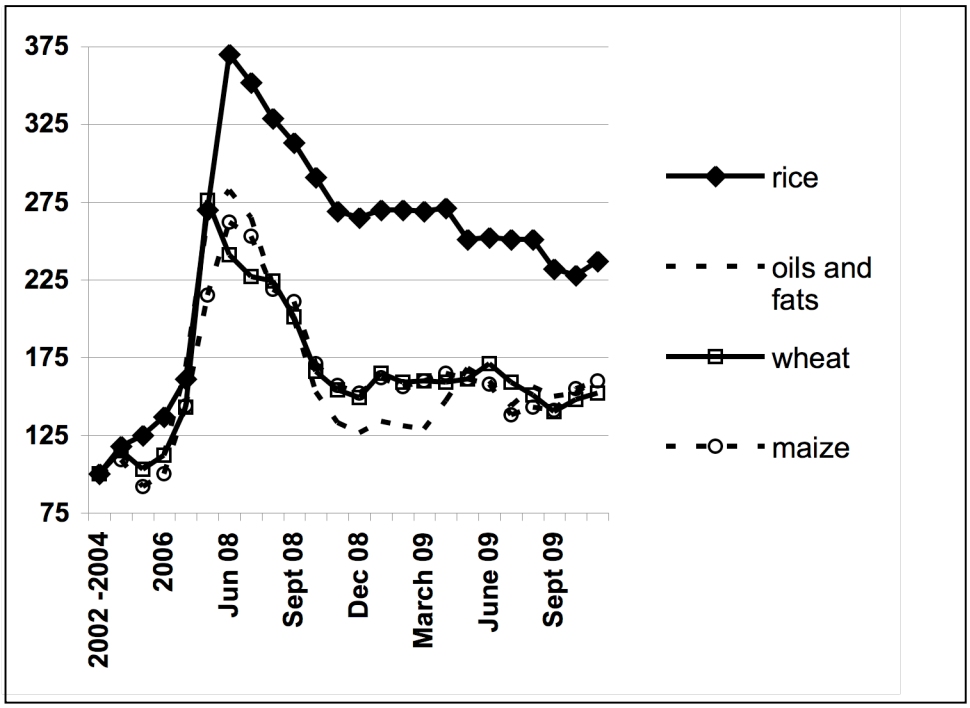


Figure 3: Development of price indices of cereals and oils and fats

Source: FAO 2009b

Table 1: Cereal utilisation, production and trade, by major regions (million tons)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Asia											
Utilisation	899	977	918	931	931	937	1094	966	982	1008	1022
Production	839	851	815	820	815	820	998	891	911	951	947
Utilisation – Production	60	126	103	111	116	117	96	75	71	57	75
Imports – Exports	76	81	80	76	56	60	81	77	78	75	91
Stock-Utilisation Ratio	51	49	47	43	40	33	23	24	29	25	27
Africa											
Utilisation	141	172	128	155	161	165	178	180	187	190	195
Production	110	108	106	110	111	124	130	132	145	134	144
Utilisation – Production	31	64	22	45	50	41	48	48	42	56	51
Imports – Exports	35	41	41	46	48	43	49	51	48	51	50
Stock-Utilisation ratio	15	15	17	14	14	12	12	13	14	19	15
Latin America											
Utilisation	138	143	140	152	157	160	169	166	170	177	183
Production	124	124	129	141	138	152	162	144	148	171	176
Utilisation – Production	14	19	11	11	19	8	7	22	22	6	7
Imports – Exports	14	22	10	14	16	12	10	19	15	6	10
Stock-Utilisation ratio	9	8	10	9	10	8	11	12	7	8	8
Developing world											
Utilisation	1107	1162	1145	1163	1164	1189	1296	1234	1264	1298	1320
Production	1040	1040	1007	1026	1006	1045	1238	1134	1156	1203	1214
Utilisation – Production	67	122	138	137	158	144	58	100	108	95	106
Import – Export	106	117	106	109	95	90	111	120	181	108	124
Stock-Utilisation ratio	46	40	38	38	35	29	23	23	22	22	23
Developed world											
Utilisation	756	770	751	765	763	766	734	805	798	828	877
Production	851	840	854	880	838	838	847	915	854	925	1027
Utilisation – Production	-95	-70	-103	-115	-75	-72	-113	-110	-56	-97	-150
Imports – Exports	-108	-117	-103	-107	-99	-88	-114	-122	-113	-106	-124
Stock-Utilisation ratio	23	22	22	21	22	19	17	23	24	16	15

Source: FAO STAT 2009

Table 2: Cereal utilisation, production and trade; totals and growth rates for 10-year and 5-year periods, by major regions (million tons)

	Total	Growth	Total	Growth	Total	Growth
	m t	% p.a.	m t	% p.a.	m t	% p.a.
Asia	**1999-08**	**1999-08**	**1999-03**	**1999-03**	**2004-08**	**2004-08**
Utilisation	9766	1.29	4694	0.83	5072	1.75
Production	8819	1.22	4121	-0.46	4698	2.92
Utilisation – Production	947		573		374	
Imports – Exports	755		353		402	
Africa						
Utilisation	1711	3.30	781	3.19	930	3.40
Production	1244	2.73	559	2.42	685	3.04
Utilisation – Production	467		222		245	
Imports – Exports	468		219		249	
Latin America						
Utilisation	1617	2.86	752	3.00	865	2.72
Production	1485	3.56	684	4.16	801	2.98
Utilisation – Production	132		68		64	
Imports – Exports	134		74		60	
Developing world						
Utilisation	12235	1.78	5823	1.44	6412	2.11
Production	11069	1.56	5124	0.10	5945	3.04
Utilisation – Production	1166		699		467	
Import – Export	1161		517		644	
Developed world						
Utilisation	7857	1.50	3815	0.26	4042	2.74
Production	8818	1.90	4250	-0.31	4568	4.15
Utilisation – Production	-961		-435		-526	
Imports – Exports	-1093		-514		-579	

Table 3: Regressions for prevalence of hunger, cereal production and yield

Equation	(1.1)	(1.2)	(1.3)	(1.4)	(1.5)	(1.6)	(2)	(3)
Dependent variable	hunger	hunger	ln_hunger	ln_hunger	ln_hunger	ln_hunger	cerealpc	yield
cerealpc		-0.002	-0.001	-0.001				
		(0.018)	*(0.000)*	*(0.000)*				
ln_cerealpc	-1.842							
	(0.001)							
ln_staplepc					-0.214	-0.212		
					(0.000)	*(0.017)*		
poverty								
ln_poverty		4.5844		0.361		0.426		
		(0.000)		*(0.000)*		*(0.000)*		
ln_incomepc	-5.487		-0.343		-0.453			
	(0.002)		*(0.000)*		*(0.000)*			
rural	0.112		0.010					
	(0.054)		*(0.004)*					
ln_rural		4.799		0.359	0.359	0.383		-500.1
		(0.005)		*(0.000)*	*(0.004)*	*(0.001)*		*(0.009)*
ln_governance	-20.01	-13.81	-0.689	-0.761	-0.731	-0.844		
	(0.012)	*(0.043)*	*(0.025)*	*(0.023)*	*(0.024)*	*(0.022)*		
arablepc							626.5	
							(0.000)	
ln_yield							163.9	
							(0.000)	
roots&tubers							-153.9	
							(0.000)	
ln_fertiliser								252.9
								(0.000)
water								0.003
								(0.000)
ln_literacy								634.2
								(0.002)
constant	86.46	1.321	5.731	1.003	6.705	1.678	-1108.4	-257.6
	(0.00)	*(0.914)*	*(0.000)*	*(0.127)*	*(0.000)*	*(0.054)*	*(0.000)*	*(0.847)*
Shapiro-Wilk								
$\rho > z$	0.006	0.136	0.028	0.069	0.127	0.024	0.066	0.129
R^2	0.53	0.50	0.60	0.65	0.61	0.63	0.70	0.64
No. of observ.	125	90	125	90	125	90	110	110

Values in brackets are ρ-values for robust standard errors.

Table 4: Regressions after eliminating outliers

Equation	(1.1)	(1.3)	(1.4)	(1.6)	(2)
Dependent variable	hunger	ln_hunger	ln_hunger	ln_hunger	cerealpc
cerealpc		-0.001	-0.001		
		(0.000)	*(0.001)*		
ln_cerealpc	-1.594				
	(0.002)				
ln_staplepc				-0.232	
				(0.010)	
poverty					
ln_poverty			0.353	0.414	
			(0.000)	*(0.000)*	
ln_incomepc	-6.763	-0.324			
	(0.000)	*(0.000)*			
rural	0.08	0.008			
	(0.116)	*(0.010)*			
ln_rural			0.377	0.384	
			(0.000)	*(0.000)*	
ln_governance	-13.44	-0.746	-0.761	-0.966	
	(0.020)	*(0.006)*	*(0.017)*	*(0.004)*	
arablepc					609.9
					(0.009)
ln_yield					157.7
					(0.000)
roots&tubers					-151.2
					(0.000)
ln_fertiliser					
water					
ln_literacy					
constant	89.68	5.778	0.968	2.026	-1061.9
	(0.00)	*(0.000)*	*(0.121)*	*(0.014)*	*(0.000)*
Shapiro-Wilk					
$\rho > z$	0.102	0.596	0.193	0.171	0.375
R^2	0.55	0.63	0.62	0.69	0.71
No. of observ.	124	122	86	86	109

Values in brackets are ρ-values for robust standard errors.
Outliers eliminated: equation (1.1): Democratic Republic of Congo; equation (1.3): Democratic Republic of Congo, Eritrea, Haiti; equation (1.4): Mauritania, Lithuania, Tunisia, Turkmenistan; equation (1.6): Mauritania, Lithuania, Tunisia, Turkmenistan; equation (2): Romania.