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# Food, Feed and Fuel: when competition starts to bite

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Early in 2007 crowds in Mexico City took to the streets in protest against fast rising prices of maize, their main staple food. These riots were first in a long line of popular protests, especially in low-to-medium income food importing countries, as prices soared on. By the end of the year the humanitarian as well as political urgency of the matter became clear. This time targeted assistance was to be provided not to the victims of a drought, a tsunami or a conflict, but to victims of the market. Yet, to avoid repetition, the international community is now looking beyond the emergency at various high level conferences, such as the UN Conference on the Global Food Crisis, held in Bern, April 28-29, the Food Summit, in Rome, June 3-5, 2008, and the G8 meeting in Japan, July 7-9, 2008.

How can it be that prices suddenly fly so high on an increasingly open globalized food market, in a year with reasonably good harvests? Is there some market imperfection at play that could be eliminated or is this a volatility that results from globalization itself that needs to be countered by safety nets? For many countries the trade and production statistics are yet to be released to unravel what actually happened. Nonetheless, uncountable numbers of reports and press articles have already been published on the subject. All major international organizations concerned (FAO, OECD, World Bank, IMF, WFP), research institutions (IFPRI: Von Braun, 2007, IFPRI, 2008) and the private sector have presented their views on the subject. While these show remarkable agreement as to the list of causes underlying recent developments, they attribute different weights to each and, consequently, the policy conclusions they reach are far from unanimous.



After describing the price rise and its consequences for the poor, we discuss explanations, a combination of long term trends and short term occurrences that, taken together, would seem to signal a lasting transition to a raw material constrained economy. Hence, the final sections of this overview discuss the prospects within this perspective and list some new questions that may then arise.

## 1. The rise in food prices and its impact on the poor

After an almost century-long decreasing trend in real world food prices, with over the last 50 years only two interruptions lasting longer than two years (1973-75 and 1979-1984), the trend started shifting by the turn of the millennium. Part of the rise is seen to amount to a change in the unit of account (figure 1), as the US dollar depreciated significantly during this period for reasons that may be considered external to the food system. Nevertheless, even for this part the change is quite real in countries whose exchange rate follows the US dollar.

The latest commodity projections of OECD-FAO (2008) predict the price rise to be lasting, with depending on the commodity, prices 30% to 80% above their average level in the past decade.

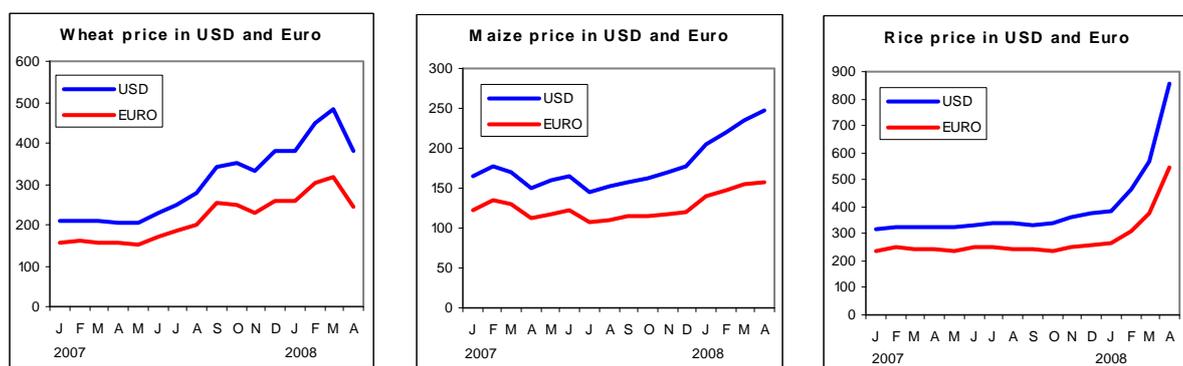


Figure 1: World food prices 2007-2008 in USD and Euro (per tonne)  
(Source: FAO (2008b))

## 2. Impact on the poor

Increasing international food prices create a gain or a loss, depending on whether one is a net seller or a net buyer, and whether the change on the international market permeates through.

Hence, the poorer urban households, who generally buy all their food on the market and spend a large share of their income on it will suffer most, about 50-65% for Latin America and Asia to 67-86% in Africa (IFPRI, 2007). Those were also the groups that protested most loudly, particularly in low and middle income countries where publicly funded social safety nets could not cushion the shock. However, the hardship extends beyond the cities as a significant part of the low-income households in rural areas are net food buyers as well. For example, in Bangladesh over 85% of poor households are net food buyers (Table 1) with among them a large share of landless households. In countries such as Cambodia, Vietnam, and also Madagascar, about 50% of poor households are net food buyers.

Distribution of poor (%)	Bolivia 2002	Ethiopia 2000	Bangladesh 2001	Zambia 1998	Cambodia 1999	Madagascar 2001	Vietnam 1998
Urban (buyers)	50.9	22.3	14.9	30.0	8.4	17.9	6.1
Rural landless (buyers)	7.2	-	53.3	7.4	11.5	14.8	5.8
Smallholders net buyers	29.1	30.1	18.8	28.8	25.8	18.9	35.1
Smallholders self-sufficient	7.1	39.5	4.6	20.8	18.0	27.3	19.4
Smallholders net sellers	5.6	8.0	8.4	13.0	36.3	21.1	33.6

Table 1. Net buyers and net sellers of food staples within a country  
(Source: World Development Report 2008, Box 4.7. Country selection follows World Bank)

At the recent Food Summit, the Secretary General of the UN, referring to a preliminary estimate by the World Bank (Ivanic and Martin, 2008) indicated that the rising food prices were expected to push 100 million people below the poverty line of 1 USD/day.

At national level, the impact depends on the net trade position of a country: net food importers lose while the gains are with net exporters: The United States, Canada and Australia, for wheat, Thailand and Vietnam, for rice, Argentina for meat. The EU also stands to gain. Even though it is a net importer of agricultural products, once tropical

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products, for which prices have not gone up significantly, are subtracted, it becomes a net exporter in value terms, despite its large imports of animal feeds (EU, 2008)

Some of the definite net importers, say, the large oil producers in the Middle-East, can easily afford the higher prices but food deficit countries with low income such as Senegal, Mauritania, Mozambique and Guinea-Bissau, have seen their food import bill almost triple over the past five years (FAO, 2008a). In addition, the population groups relying on international food aid run the danger of being affected as food aid pledges by donor countries tend to be made in monetary terms. Since mid-2007, the World Food Programme has repeatedly urged donors to raise their contributions so as to avoid cutbacks in operations.

### 3. Explanations

The debate on what explains the rise in food prices is still raging, and whereas most participants concur on the list of factors at play, strong disagreement persists on their relative weights. Indeed, several of these factors did not occur in the same combinations in the recent past. Hence, it may take quite a few years until the necessary information becomes available and consensus emerges.

Upcoming food scarcity had been announced for many years by food analysts in academic and policy circles, e.g. Keyzer et al., 2005; IFPRI, 1999, stating in various ways that the question was not whether but when prices would start rising. Yet, the harshness of the transition as it became apparent in 2007 was difficult to predict, in retrospect because the coincidence of a series of short-term effects could not be foreseen. We review these here, but only after listing some well-known trends that predict a tense market situation but cannot by themselves explain the current turmoil.

For about forty years, it has been common knowledge that population growth, the shrinking reserve of unused potentially arable land, and loss of land to urbanization, presented a challenge for world food production, particularly because yields seemed to stagnate especially in Africa, where the Green Revolution of Asia in the 1960's never materialized.



Of a more recent date is the dominant role of animal feeds and to a lesser extent meat on the international food markets as driver of demand, mainly due to the sustained rapid economic growth in China and India as well as in several energy exporting countries. Furthermore, in Asia - besides raising per capita incomes - economic growth is also associated with rural to urban migration, which impacts on meat and feed demand as urban people tend to eat more meat and dairy products (Huang and Bouis, 1996) and to obtain their meat from the intensive livestock sector, rather than from traditional farming that largely feeds on household waste and crop residuals.

To illustrate the magnitude of the meat transition in China, we note that the large increase in meat consumption from approximately 29 kg per person per year in 1995 to 44 kg per person per year in 2005 would in calorie terms have been sufficient to feed an additional 300 million people above the 100 million increase that the country realized during this period. This phenomenal achievement was largely due through an increase in domestic production: cereal imports remained small and even surpluses were generated in some years, while imports of oilseeds for protein feed production and carbohydrates increased but remained modest as compared to domestic demand. Also in India, food demand has been rising over the past years, but the increase is less pronounced and more evenly spread across products (milk, fish, dairy, meat, fruits and vegetables) than in China.

These trends can, however, not explain the "rift" between supply and demand that occurred in 2007. Neither are there any sudden supply shifts to put the blame on. Whereas cereal production had faced relatively lean years in 2005 and 2006 slightly below the long term trend, 2007 was a good crop, except that Australia had a second year of failure (Table 2). Cereal stocks, however, have declined steadily and might be a factor of explanation. The ratio of world cereal ending stocks in 2007/08 to the trend world cereal utilization in the following season is forecast to fall to 18.8 percent, the lowest in three decades. This may have reduced their cushioning capacity, albeit that the figures are not very reliable and cover only a fraction of all food in the processing and

transportation pipeline until final consumption. Yet, also when these low opening stocks are being accounted for, they are, like production, fixed in the short run. The food price is what buyers are, right or wrong, willing to pay.

Million tons	2005	2006	2007	2008 (forecast)
World	2049	2009	2111	2191
China	372	387	392	397
India	195	194	207	207
Indonesia	47	46	48	49
Pakistan	32	31	32	31
Argentina	39	34	43	41
Brazil	52	55	66	73
Canada	53	49	48	51
USA	363	336	414	397
EU	260	247	260	297
Russ Fed	76	77	80	82
Ukraine	38	34	28	38
Australia	40	18	22	40
Stocks	467	461	428	427

Table 2. Cereals production of major producing countries, and global stocks, 2005-2008  
(Source: FAO (2006a,b, 2008c))

Hence the explanation of the price hike has, possibly after correction with a few percentage points for world inflation, to be searched for on the demand side, on the account of a low buyers' responsiveness to prices in the face of a short-term upward shift in demand on top of the long term trend. This low responsiveness can have causes of two kinds: limited price transmission from the international market to domestic buyers, and lack of responsiveness of these buyers themselves, which may vary across market segments. We consider the effects in this order.

### **3.1. Limited price transmission**

One cause of low buyers' response to international prices may be limited price transmission from international markets to major domestic markets, primarily as a result of protectionist intervention at the border through variable import levies, export tariffs and export bans, and also due to transport and transaction costs that isolate particular regions. In 2007 both factors played a role. In the developed countries existing agricultural policies such as the Common Agricultural Policy of the EU, or the rice policies in Japan, shield consumers from international food price fluctuations.

At the same time, in many parts of the developing world infrastructural limitations and trade policies also slow down the price transmission. A recent survey over 2007 held by IFAD (2008) finds that in China producer prices for staples increased by about 10% only, in Kenya by about 10-50%, in Cameroon and Mali by 15-22%, and in Jordan by 30%, all in domestic currency, hence much less than the changes recorded on international markets. Finally, in some instances traders and trading companies in the developing as well as the developed world, absorbed a large part of the price change in their margins, leaving farmers with virtually unchanged prices, witness the surge in operating profits of grain traders Monsanto and Cargill reporting a doubling of their net profits in 2007, whereas Archer Daniels Midland even enjoyed a 16-fold increase.

While price transmission to remote rural areas is often slow, if noticeable at all, this is not the case to urban areas, especially in coastal regions of poor countries that cannot afford subsidies or have committed not to provide these under structural adjustment programs.

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In such areas the international community, IMF and World Bank in particular, is increasingly being blamed for current hardship.

To avoid civil unrest, several countries have started procuring food via state procurement, buying at whatever price the market will ask so as to maintain stability domestically. Naturally, the larger the share of state procurement and the more domestic markets are being cut off, the larger the price adjustments needed to restore balance on international markets.

For given price transmission, further explanations will be looked for in the buyer's response, which will vary by type of use. Here we discuss three categories of demand: food, stocks and biofuel.

### **3.2. Inelastic food demand**

As is well known, consumers' responses to price change differ strongly between rich and poor. Food is obviously a necessity for all. No one easily scales down food consumption, but whereas a poor family has no choice but to adjust its diet to available income, a rich consumer only spends about 10-15 per cent on food. Hence the income effect of a change in food price is less for the rich. Also, the rich tend to eat more highly processed foods, in the production cost of which the raw material price plays a secondary role. This further cushions the effect of a change in raw material prices and leaves consumer demand virtually unaffected. At the same time for the food industry and retailers supplying these processed foods, the primary concern is to keep the factory in operation, and the supermarket well supplied. They will instruct their agents at auctions accordingly, even if this occasionally requires acquiring raw material at outrageous prices.

### **3.3. Stocks**

Major internationally traded food crops such as cereals and oilseeds are seasonal and require stock operations to meet a consumer demand that is evenly spread over the year. Since harvests are not as large in the Southern hemisphere as in the Northern hemisphere, world food stocks tend to reach their low by early May, before the new crop is collected in the North. When owners of food stocks expect prices to rise, they may choose to withhold, rather than maintain their usual flow of deliveries to auctions and final users. To avoid this eventuality, the users might have entered futures contracts in the past that assure them of delivery when they need it at a previously agreed price. This establishes the link between the spot market, where food supply actually meets food demand, to the futures market, where bets are being made on the spot prices in the seasons to come. Ideally, the joint operation of both markets should maintain a high price responsiveness of stockholders and hence improve the shock absorption capacity of the food market. However, once price expectations of a large portion of stockholders concentrate on a single value, price responsiveness will disappear, irrespective of the level of opening stocks. High expectations will for instance elicit hoarding everywhere in the pipeline that tends to escape the statistics. When large numbers of consumers fearing price rises buy only a few days earlier than they are used to, while traders and processors seek to hold to stocks just a few days longer, a substantial rise in stock demand may come about, that no annual supply utilization statistic at national or regional level will detect. These pressures can mount particularly high towards the end of the season before the new harvest comes in, especially under conditions of limited price transmission and inelastic demand. However, as food is perishable and its storage expensive, this is a temporary contraction. After a while products have to reach their final users, and goods will flow.

Are the sustained price rises then due to influences from the futures markets themselves? The authorities overseeing futures have been monitoring this process, distinguishing traders of two kinds, the commercial traders who intend to buy or sell the physical good on the spot market and use the futures to hedge their price risk versus the non-commercial traders who adopt speculative positions without the intention to acquire or deliver the physical product. Non-commercial traders have to pay transaction fees and maintain solvency positions, both set by the authorities. It is reported that non-commercial traders have become more active in recent years and that commodity futures have regained a strong position in asset portfolios of investors worldwide as vehicle for risk diversification. The credit crisis in the US and the depreciation of the US dollar only



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strengthened an already established tendency in this respect. Some have argued that the resulting increased trading volumes and speculation in futures have destabilized world food markets. Indeed, the size of the daily transactions in and out of these futures is so large that this is bound to create some unrest.

However, according to the CFTC, the supervisor in the US, there is so far little statistical evidence to that effect in the recent price boom for major raw materials (CFTC, 2008) – but then again many of the statistics are still to be released and they will only provide incomplete evidence. Non-commercial traders in futures are rather seen to follow price developments on the spot and futures markets, hence reducing the hedging premium and through this the wedge between present and future prices. This would suggest that inelastic demand on the spot market has generated expectations of high prices to persist that in turn attracted funds on the futures market, rather than futures creating havoc on the spot market.

At the same time, for futures contracts in maize, soybean and wheat there is also evidence (Irwin et al., 2008) that futures prices currently fail to converge at their date of delivery to the spot prices, and that their volatility is rising. Such turmoil makes the hedging premium more uncertain, inhibiting, much like rigid high futures expectations would do, the price stabilization function of stocks since it lowers the responsiveness of stockholding to the spot price.

It is clear that the interactions between the spot market and the futures markets can be very complex, and no attempt is made here to unravel this issue. What emerges, however, is that current prices on the spot markets are primarily a reflection of physical scarcity on these markets, whether induced by hoarding behavior in anticipation of future scarcity or by sharp increases in a “new” demand category: biofuel.

### **3.4. Biofuel**



In recent years, biofuel has emerged as a new component in the food equation. With the intention to reduce dependency on fossil fuels as well as CO<sub>2</sub>-emissions many programs have been implemented. This is actually a come-back: the first Diesel engine developed in 1898 ran on peanut oil; the famous T-Ford, introduced in 1908 ran on ethanol, and in the 1920s, 25% of oil sales were non-petroleum related. It was only to disappear in the late 1940s. The oil crises in the 1970s led to a revival: Brazil engaged in this technology immediately after the oil crisis of 1978 and now avails of highly cost effective cane sugar refineries producing bioethanol as a joint product. Also in Europe and the US, research was taken up again, but large-scale production of biofuel (bioethanol from sugar and maize, and biodiesel from vegetable oil) took off only in the 1990s, and other feedstocks for biofuels emerged, such as soybean and palm oil in warmer humid climates and *Jatropha* shrubs in semi-arid zones.

In 2007, the US issued the Energy Independence and Security Act (EISA), a long term program to boost its biofuel production, in the short-term mainly bioethanol from maize, eventually to replace 30% of the 2004 gasoline consumption in the US by 2030.

The EU has on its part issued a biofuel guideline that member states are to turn into legislation. In many countries the main instrument for intervention is on the demand side, with the mandatory mixing with fossil fuels according to preset percentages, for the EU currently 3-5% with the aim to reach 10% by 2020. The Netherlands' aims of 20% are even more ambitious, especially since the biofuels are to be certified as sustainable, which in practice means that they have to be produced on better lands and with more inputs. Other countries, Argentina with soybeans, Thailand with ethanol, several Indian states with various crops, have also expressed their ambitions in regulations or will do so shortly. In addition to mandatory mixing, biofuel programs offer a variety of tax exemptions, tax credits to blenders, production subsidies, support to energy crops, and import protection. So far, biofuel from food crops is commercially profitable only in Brazil, which also produces it in the most CO<sub>2</sub>-effective way, hence the key importance of the mandatory mixing, which amounts to cross subsidization from fossil fuels, supplemented by these additional subsidies.

Currently, most biofuels are of first generation, using plant oils and sugars/starches from regular arable crops. Despite many statements to the contrary in the media, their impact

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on land use is substantial already: the US currently turns more than 30% of its maize production into ethanol, and the EU 60% of its rapeseed production into biodiesel. For many years, significant R&D efforts were spent on second generation biofuels, that seek to obtain liquids from wood, crop residues and industrial waste, essentially to find enzymes or pressing technologies that can break the cellulose into useful components ('green chemistry'). Major breakthroughs were frequently announced but it appears that the scaling up of experiments to commercially attractive applications proves to be quite difficult, and unlikely to succeed within a few years (The Royal Society, 2008). At the same time, it may be mentioned that small to medium scale biogas plants that also process human excrements have already proved successful for many years, and that the technology is readily available for using biomass as feedstock in electricity plants, and hence in electric vehicles.

Also, for most of the current biofuel processes the claim of a major contribution to CO<sub>2</sub>-reduction is increasingly put to question, mainly because they appear to require at present significant volumes of fossil fuel for agro-chemicals, storage, processing and transportation (UN-Energy, 2007). Naturally, this also diminishes the role of biofuel in reducing import dependence. Increasingly, the impact of biofuel on the food market gives rise to major discords (Rosegrant, 2008). Food prices started rising in 2006 and went on soaring in the course of 2007 well into 2008, while harvests were on average rather favorable.

Next to rising demand for animal feeds, mainly from China, possible inflammatory effects of speculation, bans on food exports, and increased state procurement in response to the price rise, the rising demand for biofuels is being denounced as one of the causes of the crisis.

China over the years 2003-2005 has also stepped up its biofuel production, largely from food stocks that had built up in the 1990's and had become unsuitable for human consumption, but in 2007, as these stocks had been processed, and world prices started rising steeply worldwide, it imposed a ban on the use of maize for this purpose, signaling mounting concerns about competition with food. Model computations by IFPRI (Rosegrant, 2008) suggest that about one-third of the 2008 price rise is due to biofuel; Merrill Lynch (2008), in a report that ironically stresses the benefits from ethanol production for the US consumer through lower oil prices than would have prevailed otherwise, estimates that the increased ethanol production from maize pushed up prices by 21% since 2004, but major users Brazil, US and EU vehemently refute this claim. For instance, USDA (2008) claims that only 3% of the recent increases in food prices can be attributed to the global increase in corn-based ethanol production, bypassing among others the fact that many countries take actions in parallel.



Be this as it may, the basic mechanism of mandatory mixing is highly questionable in an international setting where free trade is the agreed principle. Mandatory mixing creates a subsidized demand which is by design non-responsive to food prices, since the fraction of biofuel in gasoline is regulated by the state, and moreover, relatively low, while in most countries more than half of the gasoline price consists of nominally fixed excise. This dualism is quite remarkable. While most developing countries are being urged by their donors to liberalize trade and to eliminate subsidies and export bans so as to build on prevailing comparative advantages between nations and improve international specialization, the largest economies are now introducing extreme forms of subsidization, without being challenged on this in the WTO or elsewhere, protected as they are by commitments to the higher cause of fighting climate change and reducing import dependence on fossil fuels.

The persistent quarrels about the relative importance of various factors to the current food crisis should not detract from the fact that some of these factors are hard to change, while others are purely attributable to developed country policies. Judging by the time path of fast rising percentages of biofuel in gasoline set out in prevailing regulations, the transition to biofuels has only just begun. It is hard to imagine how food supply could adjust at that pace.

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## 4. Prospects

If one looks beyond the short-term instabilities, scarcity of raw materials, especially fuels, emerges as the central driving force explaining the price rise for food. The sustained and almost miraculous growth in Asia and the persistent rise in energy demand by developed countries, combined with setbacks in oil deliveries in some parts of the world and the gradual depletion of the most easily accessible reserves prominently figure on the lists of explanations. In addition, non-fuel related plant nutrients may become scarce as well. Demand for potassium and phosphorus has been rising fast, especially in China, and already led to substantial price rises, tripling the costs of certain fertilizer mixes.

In short, it would seem that after decades of growth in service sectors, the biophysical world now makes itself felt, well before long announced problems of climate change or ageing have set in. Virtual reality is out as markets signal: "back-to-basics".

With a price level of fossil fuels that, since the last oil crisis of 1978, was set for about thirty years on the basis of a political understanding between major producers and consumers, occasionally disturbed by political unrest (Iraq, Nigeria), and with gasoline taxes making up to 75 per cent of the price and kept at levels to help finance government budgets rather than contain demand, the energy market can hardly be characterized as having had a free hand in signaling scarcity, despite all emphasis on economic reform and structural adjustment worldwide.

Similarly, the world food economy has been dominated for about forty years by concerns in developed countries to avoid surpluses. Technical progress, low energy prices and satiation in demand dispelled any worries about shortages, while the need to contain the per capita income gap between farmers and the other segments of the population elicited agricultural policies to keep prices well above world market level, by constraining production through production quotas (dairy and sugar) and by keeping land fallow or returning it to nature, not to mention its irreversible conversion under urbanization. Even biofuel production originally entered agricultural policy for this purpose. Options to expand output through genetic modification or intensified land use were frowned upon, primarily for fear of environmental impacts but also to prevent further surpluses and subsidy outlays. In short, in developed countries all brakes were on, and they largely still are. It seems advisable to relax these before opening the throttle.

### *i) How to strengthen agriculture*

In developing countries, poor people faced hunger, nonetheless, a large portion of them in rural areas that development policies of national governments and donors for decades tried to lift from poverty, in Asia with impressive success. Never in history did so many people escape poverty as in the past fifteen years, and this with a world population that has doubled since the 1950's. Going one step further, the UN in its Millennium Development Goals (MDG) expressed in its first goal the world community's firm commitment to halve poverty and hunger from 1990 to 2015. In 2007 a review was held. It showed that although progress in Africa was insufficient to reach this goal, the success in Asia, China in particular, would on average amply compensate for this. Progress in Latin America was important as well, and African economies had started growing at significant rates, partly thanks to the recent commodity boom. In short, after so many years the recipe for economic success seemed to have been discovered, even though its implementation outside Asia was still to be improved. One lesson from Asia was that the spectacular growth in Asian incomes could only be achieved through urbanization that made rural populations less dependent on agriculture, enabling those left behind to make a better living on the land available and letting them benefit from remittances in bad years.

Not surprisingly, with rising food prices and crowds protesting, proponents of strategies that failed in the past now return in the public arena to assert that the new strategies led to ruin as well. Currently, the claim is again voiced that neglect of agriculture is an important cause of current scarcity and some ask for the rural-based strategies to return. Indeed, the 2008 World Development Report of the World Bank also called for a strengthening of investments in rural areas, particularly in Africa, to fight poverty, to prepare a young generation of migrant labor force for industry and services, and to make efficient use of the national resource base, but the report also emphasizes that this should not be done in isolation, and that all efforts should be made to avoid errors from

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the past. Within rural areas, farmers will not see their incomes rise unless they find market outlets. For farmers there hardly is a frustration comparable to that of farm prices falling as a result of demand shortfalls following rises in farm yields, for which they in turn need external inputs and a good marketing chain to sell to. Agriculture will not grow on its own, definitely not in Africa whose lands have a lower carrying capacity and can, therefore, less easily sustain isolated urban concentrations. Rural development should be part of a stable and patient long term strategy that aims to improve physical and social infrastructure. A policy swing on the donors' part toward agriculture carries almost as many dangers for the sector as one away from it.

*ii) Energy and food*

Be this as it may, the spectacular changes on world agricultural markets call for reflection and reorientation but presumably more on raw material demand than on raw material supply. Underlying the rise in gasoline prices are the great difficulties for road transport in substituting away from liquid fuel. These are partly technological and partly economic. Technologically, the fossil fuel that was so easily available for a long time is quite hard for an alternative medium to compete with: it has extremely high calorie content per liter, it is easily transported and distributed to users, and has more than a century of technological experience invested into it, while alternatives such as battery or hydrogen powered cars are at their infancy (or rather, second infancy; as with biofuel-operated cars, electrically powered cars also were very popular at the beginning of the 20<sup>th</sup> century; in the US, they outsold all other types of cars in the years 1899-1900). Car manufacturers and fuel distributors have enormous sunk costs locked in current factories and delivery infrastructure, which their investment in next generation technologies naturally seek to capitalize upon, making all efforts to preserve a liquid fuel based technology.

Policy support to biofuels fits quite well within such a perspective. Biofuels are liquid and mix easily with fossil fuels. They can be used to increase the octane number of gasoline, and car manufacturers have designed engines to be marketed (e.g. see NEVIS, 2008) that promise almost to double fuel efficiency of combustion. Of course, biofuel also helps reducing dependence on fossil fuel imports. Yet, it is currently facing opposition, because of the price rises it may generate but possibly even more because its contribution to reduction of CO<sub>2</sub> emissions is increasingly put to question (UN-Energy, 2007). In a nutshell, biofuel crops produced with fertilizers, pesticides, transport and processing that rely on fossil fuels themselves will offer little gain, while biofuels produced from biofuels require such large stretches of land that insufficient arable surface would be left for food production (Pacala and Socolow, 2004), and even if currently unused marginal lands were brought under cultivation, the needs for minerals such as phosphorus and potash would still be enormous (IFA, 2007), not to mention the greenhouse gas emissions associated to the clearing of such lands, which in terms of time required to repay the biofuel carbon debt can be as high as 423 years for peat land rainforest converted to palm oil plantations, and 319 years if soybeans are grown on these areas (Fargione et al., 2008).

*iii) Carbon taxations*

Mandatory mixing amounts to an implicit subsidization of biofuel. Its pitfalls highlight once more the importance of adequate pricing of scarce resources. Had such a pricing prevailed for the clean air resources in the atmosphere, then the current opposition to biofuels would lack ground, as private fuel suppliers would only opt for it when benefits exceed costs. Hence, abolishing mandatory mixing would have to go hand in hand with improved pricing, for instance via a flat carbon tax if reducing CO<sub>2</sub> emissions is the aim. For example, if biofuels require large amounts of fertilizer, then a carbon tax will make production too costly. Generally, it will lead throughout the production chain to a selection of technologies with low emissions.

The EU has expressed its intention to move in this direction. The carbon tax amounts to a sharpening of the existing system of trade in emission permits, whose implementation started recently (in The Netherlands in 2005) to effectuate the Kyoto Agreement. This trade is open to firms whose emissions exceed given norms, and makes it possible for heavily polluting firms that have no competitive alternative technology available to trade their obligations with firms that can more easily adapt, which in practice often means foreclosure. In parallel several technical requirements are imposed on smaller energy users such as private cars and heating-apparatus.

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The problem is, however, that the carbon tax as proposed by the EU will be an instrument that is implemented nationally, and import tariffs will be imposed to substitute for the taxing of carbon emissions at the source. This leaves significant room for discretion, as reliable measurement of underlying emissions is next to impossible.

Furthermore, the issue to whom the tax and tariff proceeds would have to be addressed. The answer is, naturally, that this should be to the rightful owners of the resource, in this case the atmosphere. This is a subject the Centre has been engaged in ever since its inception, stressing in particular the implications of different assignments of property rights over these resources for the world-wide income distribution and hence, the situation of the poor (e.g. SOW-VU, 1993). Ideally, awarding such rights to all, including representatives of future generations, would generate a flow of payments such that those who use less than they spend receive a net compensation (Gerlagh and Keyzer, 2001; Keyzer et al., 2007). The practice is rather different, however, as proceeds from environmental levies tend to accrue to be spent by the authority in the country levying them, on public services and on the sector contributing them. Even within this narrow perspective there is ample reason to return a carbon tax on imports of say, biofuels to the exporting country, if only because it is designed as a substitute for a producer tax (Lockwood and Whalley, 2008). In short, this brief sketch of ramifications in the sphere of taxation only highlights the need for policy coherence and integrated analysis.

Finally, the prevailing notion that the price rises in oil and food constitute a crisis, an evil that should be fought, eventually will have to be put in more realistic perspective. Markets are supposed to provide timely signals and incentives to help society address upcoming challenges. That is what they are for. High prices of fossil fuels create new opportunities for competing technologies to penetrate. High food prices make it easier for farmers to pay their bills for the fuel they need in pumping and mechanization, fertilizers and pesticides, as well as in transport, (cool) storage and processing, hopefully leaving sufficient margins for them to invest and raise their output. Therefore, what undeniably is a crisis for the poor who have to “pay the price” at present, a lastingly higher food price level could also be a blessing for rural populations, and, through higher natural resource values, for the environment as well.

## 5. Implications for the research agenda

Now that the international community has agreed to call the price rise and its consequences a crisis, there is a danger that the debate will be captured by vested interests trying to avert to attribute blame, to keep current policies unchanged or to attract new subsidies, in endless controversies about the relative importance of the contributing factors. Our discussion suggests that many of these factors call for measures that would have been effectuated anyway, irrespective of the outcome of the debate and that also define questions for research, which will have to be attended to anyway. We mention three fields where new research priorities emerge.

### 5.1. Social security and humanitarian assistance



The policy reaction to the food crisis has brought to the fore that many countries lacked the social safety nets to address increased exposure of vulnerable groups to international markets. The necessary arrangements could borrow from developed countries' experience but with the qualification that developing countries face severe budgetary and often also administrative constraints in providing assistance to the poor and, therefore, would need specially tailored financial instruments and regulations. Also whereas urban poor belonged to the affected groups, the rural areas, as was mentioned, also counted many with very limited means to make their voices heard. Whereas urban poor might be helped through food stamps or income allowances, in rural areas food aid in kind, food for work and index-based crop insurance might be the appropriate instruments. At all times, authorities will have to decide whether to provide aid in cash, which is warranted as long as the local economy can deliver in sufficient quantities, or in kind when it cannot. Providing aid in kind when it should be cash causes prices to deteriorate, while aid in cash when it should be in kind leads to inflation and worsens the condition of the poor that the cash transfers failed to reach. Research and support to policy are needed to help maintaining this precarious balance and to assure that the agencies in charge are available of adequate tools for targeting the needy and assisting with the appropriate instrument,

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overall with sufficient appreciation that price risks are to be taken as seriously as drought and pests.

Similarly, identifying objective criteria to choose the distributor of aid is an important subject for investigation. Too often the choice between central government, NGOs and WFP is based on past practices and political fortitudes. Major considerations should be expediency and the aim to strengthen local governance. Good governance in the first place builds on political leaders who are effective in managing food security and other collective risks the community is faced with but then these leaders also need to be given a fair opportunity to get the credit for this, rather than always seeing reputed foreign organizations wave their flags.

Finally, unlike for a drought or a tsunami, the cause of the income shortfall may now be attributable to policies abroad, say, regarding biofuel or regulations on futures markets. It follows that claims might be issued to compensate for the damages suffered. This is a new challenge for research that calls for objective damage assessments.

## ***5.2. Raising agricultural production while protecting the environment***

Food and energy issues will remain intertwined for decades to come. The world economy is now experiencing in practice the consequences of exponential growth that were predicted long ago. Across the board, demand for the Earth's resources will rise, and call for wiser use of minerals, soils and water. Sustainable management of these resources extends far beyond reduction of pollution and mitigation of and adaptation to CO<sub>2</sub>-emissions. Maintaining the Earth's productive capacity will now be the challenge, and the Club of Rome problematique is fully back on the agenda.

In fact, looking back over the period since the Club of Rome launched its first reports, many research issues have survived. However, although protection of the environment and the linkage of the environment with economic activity is a hotly debated and well-researched topic, it seems that the focus is on the search for minerals, water resources and contamination of the atmosphere, while attention for soils has been receding. If all resources are to be used to their full potential, curbing this trend seems of the utmost importance. Research strategies will have to consider climate, water and soils jointly, emphasizing amongst others the roles of hard-to-recycle nutrients such as phosphorus or zinc often procured from less than a dozen sources worldwide, and the dangers of soil erosion and of the irreversible losses of land to urbanization.

In fact, the pressure on the environment is bound to persist, also if it were decided not to use any liquid biofuels in transport, be it in first generation from food crops, or in second generation from grasses and forests. Mankind has been using "generation zero" biomass as fuel ever since it lighted its first fire. High energy prices and depletion of fossil fuel resources inevitably raise the demand for biomass – if not for liquid biofuel then for burning in household stoves or electricity plants – at the risk of overexploitation, much in the way intensified use of charcoal for furnaces in the first half of the nineteenth century caused deforestation in Central Europe.

The research challenges abound. Shrub land, jungles, forests, tundras and steppes cover more than three quarters of the land mass, which are characterized by a low density of population that may also have a migrant way of life. Consequently, local knowledge of the soils and groundwater availability in these areas is quite rudimentary, and the number of ground trials by scientists is very limited, while soil qualities vary strongly across space. Furthermore, the property rights over these lands, let alone the layers below the surface, are poorly established, and often attributed by default to central government. Various countries are currently handing out concessions for large-scale biofuel plantations but without being able or willing to impose the necessary safeguards for social and environmental sustainability. Thus, all ingredients for conflicts and tragedies of the commons seem to be present. Governance aspects need urgent attention.

Research can provide tools to help charting out the carrying capacities, the suitable mode of operation and the economic valuation of these so far undistributed resources, while protecting the indigenous populations, such as herdsmen seeing their customary trekking routes blocked by new *Jatropha* plantations producing biodiesel.

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In short, while economic logic can see no justification for mandatory mixing or lavish subsidization of biofuels in a world trade system that accepts free trade as guiding principle, the use of biomass for energy will keep on rising also if these distortions are abolished. Food will regain much of the ground it lost once biofuel subsidies are dismantled. Yet, with energy prices continuing to rise over time, the balance will shift, and already now biofuels from crops as well as from manure and farm residues can offer valuable savings on input costs for farmers in remote areas provided soil fertility and groundwater conservation are adequately taken care of.

For instance, in tropical zones commercial production of high-yielding biofuel crops, such as palm oil and sugar cane carry definite promise. Even Reijnders et al. (2008), while highly critical of current practice of palm oil production in Malaysia because of the greenhouse gas emissions, report an oil yield for well managed plantations of about 5 ton/ha, more than three times the yield from rapeseed in Europe, while less than a quarter of the energy obtained is needed for cropping, processing and local transport. On semi-marginal drylands, the yields of *Jatropha* are far less but this crop can, nonetheless, help save on fossil fuel purchases, and eventually, commercial sales to local markets may also become possible and provide additional employment, especially since it will be more profitable to perform fuel extraction locally, given the bulky nature of the raw material, the exclusive interest in the carbohydrate components of the biofuel crop, and the need to return the plant nutrients contained in it to the soil. Furthermore, commercial production of energy crops on marginal lands requires settling in new territories, possibly with reliance on GMOs, also raising multiple topics for research.

Yet, for such transitions to materialize fossil fuel has to remain expensive in relative terms, which is by no means certain. Collapse in fuel prices is not imaginary, as a repetition of what happened in the early eighties', due to the combined effect of new fields entering production to meet anticipated demand, the slowing down of economic growth worldwide that may result from the high raw material prices, and a backlash from past speculation. During such an episode, biofuel plants may be forced to shut down, particularly those using the then too expensive food crops as feedstocks (Schmidhuber, 2005). This evidently raises various questions about regulatory mechanisms, and resource pricing, including the reconsideration of energy taxes, depletion allowances on mineral resources and carbon taxes on emissions, and associated to these, for special bridging safeguards to avoid distress in new biofuel plantations.

### ***5.3. Improving the functioning of international markets***



The food crisis has revealed at least three weak spots in the international trading system, which deserve further investigation. First, mandatory mixing not being challenged as a trade distorting measure at the WTO by any country is quite surprising. The reasons could be many: lack of time, little confidence that a WTO-panel would be able to curb the plans of US and EU quickly enough, fear of stalling progress at the already laborious Doha-negotiations, and the fear of confronting the established image of biofuel as an environmentally friendly and politically expedient commodity. Moreover, many countries in reaction to the price hike imposed export quotas that go against WTO principles and destabilized international markets. Some also engaged in state trading. These elements signal a definite gap in the international regulatory architecture in that the WTO has no powers to uphold any action pending a review.

Second, policy coherence was seen to be lacking, at international level and below. At the international level, World Bank, IMF, WFP, WTO, FAO, IPCC, IEA and UNEP to name a few, all responded in their own way and from their own angle to the threats to food and energy security as they perceived these. Consequently, they communicated a rather diverse picture to the public that may have blurred the distinction between corrective measures to be taken without delay, and long run development actions that have been underway for decades and only need to be intensified or reoriented. As the message that agricultural net exporters were gaining and that concerns about climate change were causing food prices to increase got diluted in a sea of explanations, the momentum for concerted action could not build up. This would suggest a need for stronger coordination on such sensitive issues among the various international agencies.

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At the national level, in Europe comprising the EU, the same lack of orchestration would seem to have prevailed, despite many meetings and consultations. A case in point is the EU issuing a biofuel guideline that member states are to convert into legislation at their own pace and in their own way. This makes it difficult for the public to appreciate whom to address, as the country politicians refer to the EU and vice-versa.

Another example is the current preparation for the reform of the Common Agricultural Policy beyond 2013, which follows its own track and is also covered in the media. In the fall of 2007, the EU issued a Health Check review document on the subject that contains a variety of proposals to fine-tune the present arrangements, such as gradually making farm subsidies more strongly tied to provision of environmental services, and shifting somewhat from land tied subsidies to investments into regional development. It would seem that at a time that world agricultural prices are climbing as fast (even in Euros) as they do now, future spending on agriculture needs a better justification. There is an obvious need for harmonizing the global agricultural perspectives with the internal agenda in the EU and elsewhere, to which food policy research can contribute.

Finally, the increased price volatility on spot and futures markets, yet to be confirmed by further studies, needs attention. It is in part originating via the futures markets from factors external to the food economy itself that may require action in the financial sphere. Yet, the lack of price responsiveness of the spot market itself – limited price transmission to domestic markets, low price responsiveness of richer consumers, of the food processing and retail sectors serving these, and of biofuel users – is also a cause, as we have seen. It has been suggested (e.g. IFPRI, 2008) to maintain strategic food stocks for food aid to rely upon as well as to discourage speculation. However, whereas emergency reserves situated in remote areas (such as the Emergency Food Security Reserve in Ethiopia, DPPC, 2004) have proved quite effective in allowing for fast food aid delivery in the wake of a disaster, past experience is far from encouraging for buffer stock operations that aim to stabilize commodity prices. Public stockholding is costly, the nutritive quality of the stored food deteriorates rapidly, and stocks either get overfilled or depleted once speculators become active. This experience largely dates back to the 'eighties when funds available for speculation were much smaller, speculative actions much slower, and the share of processed foods in total much smaller. Nowadays, most of the stocks are privately held and not registered as such, because they belong to the commodity pipeline from farmer to consumer, and are kept in trucks, factories and supermarkets. Hence, to affect the market very large publicly controlled stocks would be required, they would be very cost ineffective as compared to holding financial assets, and obviously, the present situation of scarcity is not the time to build up such large strategic stocks quickly.

In this regard, biofuel could provide an interesting new instrument for price stabilization that deserves further investigation. Since fossil fuels are by their very nature more easily stored than food, also because keeping oil and gas in the ground is an option, the interconnection between food and fuel offers new opportunities for food price stabilization. The G8 could for instance put a cap on the use of biofuel in gasoline when they find that food prices rise too much. Since the number of oil companies in the world is small, implementation would not have to be difficult. It would surely temper price expectations in the market and could do without any food reserves.

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Established in 1977, the Centre for World Food Studies (Dutch acronym SOW-VU) is a research institute at the VU University in Amsterdam that studies a broad range of development-oriented issues. Current public debate on the “food crisis” calls for a thorough scientific analysis of the underlying causes and the impact on the poor. The Centre’s multidisciplinary approach, where economics, soil science, hydrology and nutritional science are combined, is better suited than ever to address present issues.

In addition, the Centre operates within a wide international network of counterparts that includes the Chinese Academy of Science, the International Food Policy Research Institute, Joint Research Centre of the EU, and several UN organizations, under which the World Food Programme in Rome. The Centre has also provided policy advice to several Ministries in The Netherlands as well as to international organizations such as the World Bank, the International Fund for Agricultural Development (IFAD) and the European Commission.

SOW-VU’s research record consists of a series of staff working papers (mainly for internal use), research reports (refereed, prepared through team work), publications in peer-reviewed journals and briefs. The Annual Reports of the Centre discuss the world food situation and present an overview of the research highlights.

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