Biofuels and the underlying causes of high food prices

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October 2008

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The views expressed in this report reflect those of the author and do not necessarily reflect the views of the Global Bioenergy Partnership.

ACRONYMS

ADB Asian Development Bank
DDG Dried distillers grains
DEFRA Department for Environment Food and Rural Affairs
EU European Union
FAO Food and Agriculture Organization of the United Nations
GHG Greenhouse Gas
OECD Organization for Economic Co-operation and Development
PRC People's Republic of China
UAE United Arab Emirates
US United States of America
USDA Department of Agriculture of the United States
WFP World Food Programme of the United Nations
WTO World Trade Organization

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EXECUTIVE SUMMARY

International consensus indicates that a number of long-term, slowly-evolving trends are affecting the global supply and demand of food commodities. These trends reflect slower growth in production and more rapid growth in demand contributing to the tightening of world balances. The result is reduced supplies and higher prices.

The main drivers of increasing prices are structural and on the demand side, but this alone cannot justify the recent hikes in food prices. Different studies have concluded that the emerging economies have increased demand for food as *per capita* income has risen. However, there is little hard evidence of significant acceleration during the past two years.

For the most part, recent increases in food commodity prices have been due to reduced harvest levels during 2007 as the result of adverse climatic conditions, and flow-on effects of demands placed upon strategic reserve stocks. Increased oil prices and the weakness of the US dollar have also exacerbated these effects, including by pushing hedge funds to buy food commodities which, in turn, have increased prices in what can best be termed a 'catch-22 situation'.

The uncertainty of the adjustment of global supply (also due to natural constraints i.e. the natural cycles for harvesting) to the growing demand could contribute to the persistence of tensions in the global market of raw food materials and to increased sensitivity of prices to global shocks.

A closer look at both recent price spikes and the relationship between commodity and food prices is of value in order to evaluate commentary that recent price rises are due to the higher demand of food-derived biofuels. There are a number of factors that have affected cereal prices during the last year, some of which are cyclical or short-term and induce volatility into the market; others are long-term and structural in nature, such as the expansion of the biofuels industry or increased demand from emerging economies. Feed and food uses continue to dominate cereals, sugar and oilseed markets, and there are simply too many factors affecting agricultural and soft commodities to make a close relationship between fuel and food.

The persistent critique of biofuels' impact upon global food price increases (notwithstanding an inability to quantify the extent of this impact) depends upon a number of factors and not least natural constraints, markets and policies development and, importantly, upcoming pipeline technologies.

Natural constraints include the potential impact of climate change and desertification on agricultural yields in different parts of the world. Land availability also plays an important role in a number of countries, and particularly given the certification schemes that are in development in different parts of the world – to help ensure the sustainable exploitation of natural resources.

Market development implies the eventual removal of subsidies and feed-in tariffs. A growing number of market-oriented policies such as export bans and increased export taxes are used by governments to foster bioenergy development and to protect the agricultural sector. This directly affects the cost-competitiveness of bioenergy production when compared to traditional energy sources, while indirectly it affects the viability of biofuel markets.

Subsidies for biofuels that use agricultural production resources implicitly act as a tax upon basic foods. The WTO Doha Round still is to be completed. Failure to reach this goal will continue to have damaging implications for the well-being of global trade long-term, and effort needs to be made to counter short-term damage created by the current crisis with security of food supplies. To help counter this, a number of qualification tools, methods and systems need to be

introduced to provide for sustainability, environmental care and social equity – including life cycle analysis, certification of origin, labelling and similar. Qualifications need to be agreed internationally and introduced with skill into global markets so that barriers to trade are not encouraged. Classification of *"sustainable bioenergy"* could be introduced within WTO rules in order to reduce or, as appropriate, eliminate tariff and non-tariff barriers according to the Doha Development Agenda, paragraph 31 (iii).

Policy interventions such as food grain support prices, input subsidies, involvement of public agencies in food grain imports, marketing and distribution tend to be ineffective over the medium-term and to inhibit increases in supply. The industrial countries should act to facilitate flexible responses to drastic price changes by eliminating trade barriers and all non-essential programmes that set aside agriculture resources[1]. A world confronted with increased scarcity of food needs to trade more – not less – in order to spread trading opportunities more fairly.

Moreover, the derivation and adoption of advanced technologies could significantly change existing overall scenarios. New production technologies are drastically increasing yields of agricultural goods, reducing the need for land, water and fertilizers. Technologies such as biofuel production from micro-algae and 'second generation' production technologies using ligno-cellulosic feedstock (which will not compete for agricultural resources if sourced from wastes or residues) are expected to circumvent the food-fuel debate.

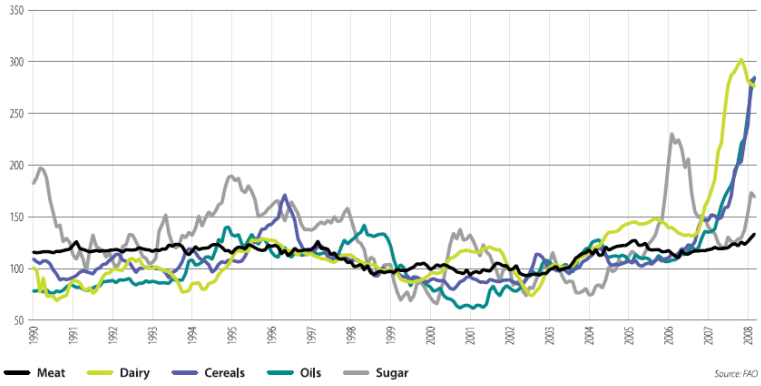
The leaders of international institutions have exhorted governments to use the current food crisis to reform policies that distort agricultural production and trade. Policies such as export restrictions, price controls, price support, optional food grain reserves and input subsidies need to be revised in the light of the higher food prices which may continue to persist into the next period. Hence, policy dialogue is critical to consider what options may be more effective in the short- to medium-term that will help address the immediate impact of food shortages and to restore food price stability.

[1] In EU, set-aside was introduced in 1992 to remove land from production to reduce the grain mountains. It was abandoned for a year in September 2007 to increase food production. In July 2008, the European Commission announced its intention that set-aside is to be abolished permanently.

BACKGROUND

The soaring of international food commodities prices started in the beginning of the 21st century after a long period of real price decrease. Prices of commodities such as grains and vegetable oils have risen more than 60 percent above 2006 levels. The world's food import bill rose in 2007 to $745 billion (up 21% from the previous year), 233 billion of which in developing countries (FAO 2007), whereas, according to the World Food Programme (WFP), one in six in the world already doesn't have enough eat.

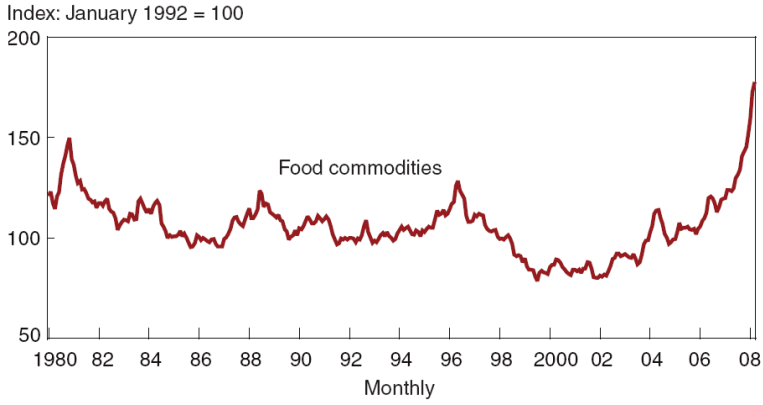
Monthly price indices for basic food commodity groups



Source: FAO

From the November 2001 minimum, the increase of the FAO overall index of food prices (in US dollars) has almost reached 120 percent, about 60 percent only in the last biennium, while the World Bank index of food crop prices increased 86 percent between September 2006 to March 2008. Agricultural commodity prices rose sharply in 2006 and 2007 and continued to rise even more sharply in the first three months of 2008 (FAO 2008). The World Bank reports a 181 percent increase in global wheat prices over the 36 months leading up to February 2008 (World Bank 2008), and a 83 percent increase in overall global food prices over the same period (Martin 2008).

Food commodity prices rose more than 60 percent in the last 2 years



Source: International Monetary Fund - International Financial Statistics

However, despite these figures, historical data shows that world wheat prices were at levels similar to present levels in 1995 and 1996, less than the 2007 peak in nominal terms but 15 percent higher in real terms (UK DEFRA 2008).

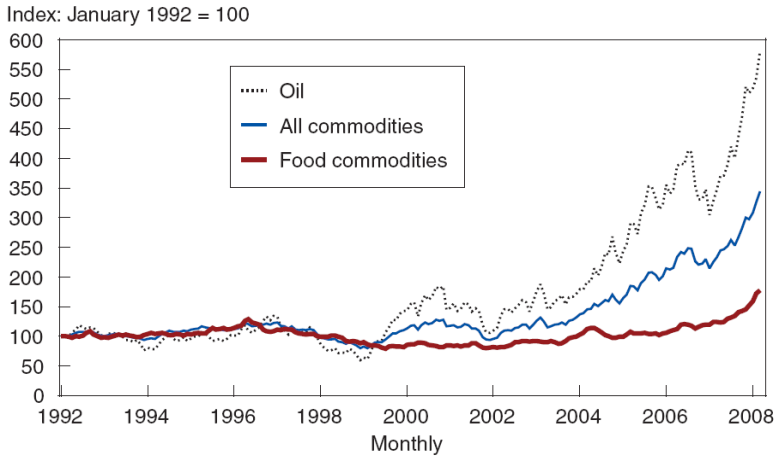
Periods of high commodity prices as well as low prices are natural in the agricultural markets, although often high prices tend to be short-lived compared with low prices which persist for longer periods. Furthermore the current price hike involves all the major food and feed commodities and not just a few, as normally happens.

Although the food commodity index has risen more than 60 percent in the last two years, the index for all commodities has also risen 60 percent and the index for crude oil has risen even more. Since mid-1999, when all three indices were at about the same level and were about where they had been 10 years earlier, food commodity prices have risen 98 percent (as of March 2008); the index for

all commodities has risen 286 percent; and the index for crude oil has risen 547 percent (USDA 2008) as shown in the figure below.

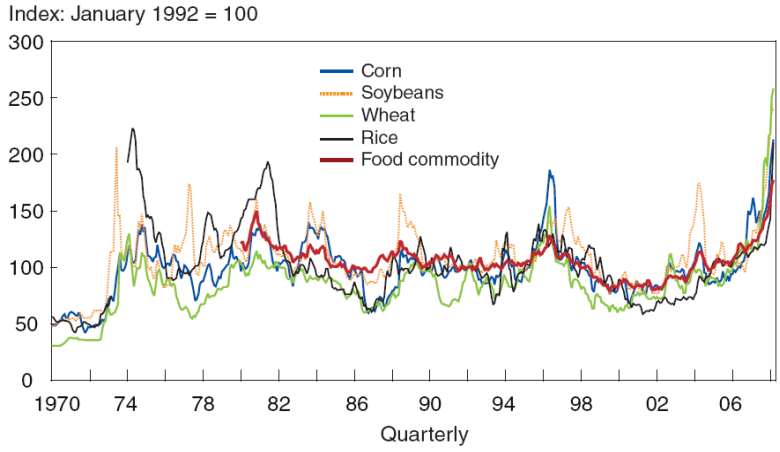
According to FAO standards, a price spike is identified as an annual percentage change that is above two standard deviations of the five years preceding the year from which the percentage change is calculated. Using this definition, it is possible to identify the years in which high price events for basic food commodities occurred. Four distinct periods can be identified when prices exhibited significant increases: 1972-74, 1988, 1995, and the current period (2007-2008). The only price events in consecutive years are those that occurred in the first and the last period (three years in a row in the first, during the oil crisis and two years at the moment) (FAO 2008).

Prices of many commodities rose



Source: International Monetary Fund - International Financial Statistics

Food commodity price spikes since 1970



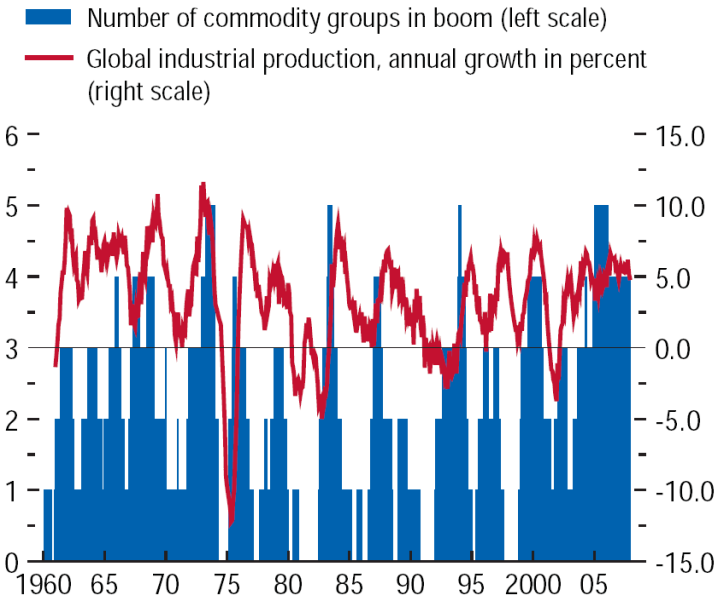
Source: International Monetary Fund - International Financial Statistics

This highlights a strong correspondence between a high insecurity of the global oil market and food commodity prices in general and not just a selected few of them. Especially in the cereals and in the oilseed sector, longer and higher price volatility has been observed during the price hike, confirming the extraordinary uncertainty of market trends and the tightness of supply. Broad-based booms[2] have typically been much shorter than the current one.

The pass-through of rising food prices does not translate into an immediate and proportionate rise in domestic price levels (World Bank 2008), due to various external factors and the different policies and trade options adopted by each country. Actually the effect of the sharply higher international prices would not have been fully transmitted to domestic prices yet (ADB 2008). In general, consumers in low-income countries are much more responsive to price changes (Von Braun 2007), although the current commodity price boom would prove more favourable to developing economies than previous booms, bringing rapid growth in exports, investment and output due to improvements in institutions

[2] According to the International Monetary Fund, at the general (global) market level, a commodity price boom is defined as a period of at least 12 months during which the spot price of a commodity or a group of similar commodities increases in real terms (IMF – World Economic Outlook, April 2008)

and policy frameworks (IMF 2008). Differentiation has to be made between subsistence and market producers in developing countries – while the former group will be largely unaffected by higher crop prices, net sellers of agricultural products will be able to benefit from higher prices to the degree they are connected to markets that are integrated with international trading systems. Better income opportunities might also derive for landless workers in developing countries' agriculture given the incentives to intensify agricultural production (OECD 2008).



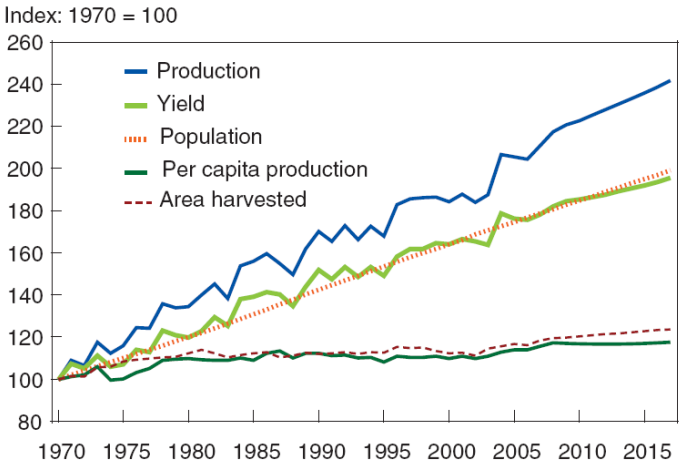
Sources: IMF, Commodity Price System; IMF, International Financial Statistics; and IMF staff calculations

The annual growth rate in the production of aggregate grains and oilseeds has been slowing according to the USDA. Between 1970 and 1990, production rose an average 2.2 percent per year. Since 1990, the growth rate has declined to about 1.3 percent (USDA's 10-year agricultural projections for US and world agriculture see the rate declining to 1.2 percent per year between 2009 and 2017).

In the last decades, the most part of global production growth for cereals was the effect of an increased land productivity rather than cultivated area.

Global aggregate yield growth averaged 2.0 percent per year between 1970-1990, but declined to 1.1 percent between 1990 and 2007 while growth rate for area harvested has averaged only about 0.15 percent per year during the last 38 years (USDA 2008). Productivity levels are low and food grain yields have stagnated and the growth slowed significantly since the 1990s (ADB 2008).

Total world grain & oilseeds[1] - Production, yield, area harvested, population & per capita production



Source: USDA Agricultural Projections to 2017

Without massive investment in technology it is most likely that a response to the increased demand will come from an increased harvested area in the short-medium term.

This is also due to the fact that stable food prices during the last two decades have led to some complacency about global food concerns and to a reduction in R&D funding levels (USDA 2008).

THE CAUSES

There are several explanations to the sharp price increase. One of the first rules of economics is that prices are determined by supply and demand, but the classical ideal market assumption and the fall of commodity prices in tough times seem to have lost validity. This could be attributed to the increased use of financial instruments (influencing not only the cost of production but also the demand for them through the derivatives market) but also to the current market structure, much more interlinked than in the past. Agricultural commodities are much more dependent on other markets (such as the oil market) and the direct competition with fossil fuel on the demand side add complexity to the current scenario and signal a structural change in the agricultural commodity market.

At present, the main drivers of increasing prices are on the demand side (Evans 2008) but this cannot alone justify the recent effects on food prices. Historically, demand growth for food has been about 1.5 percent each year; now, however, it has risen to 2 percent and Goldman Sachs estimate that it will be as high as 2.6 percent within a decade (Currie 2007).

There is, by now, an international consensus that a number of long-term, slowly-evolving trends have affected the global supply and demand for food commodities. These trends reflect a slower growth in production and more rapid growth in demand contributing to tightening the world balances.

A number of factors that contribute to the increase of food prices are further investigated in the following pages.

THE CLIMATE ISSUE

Although many extraordinary factors influenced the cereals production increase of the last biennium, among them adverse climate events that damaged the harvests and reduced global stocks, the accelerated price increases observed in the decennium are mainly caused by structural changes in the market that gradually put upward pressure on agricultural food prices.

According to FAO recent estimates, the production of cereals in major exporting countries declined by 4 percent in 2005 and 7 percent in 2006 due to adverse climate conditions. Consequently, food import dependency is projected to rise in many regions of the developing world (IPCC 2007).

Yields in Australia, hit by a 60 percent wheat output reduction in 2006 (ADB 2008) that, alone, translated to a decrease of 4 percent in the global grain export. Yields also fell in Canada by about one fifth in aggregate, and were at or below trend in many countries like South Africa, Southeast Europe, Turkey, Argentina. Poor crop harvests that occurred in EU, Russia and Ukraine in 2006 and 2007, were largely offset by increased exports in other countries (two sequential years of lower global yields occurred only three other times in the last 37 years) (USDA 2008).

To protect against climate threats, some countries that usually imported sufficient quantities of grain to meet their needs for the following 3-4 months began to contract for imports for the following 5-10 months and, as a result, world wheat prices began their sharp upward trend in August 2007 as did rice in the autumn of the same year. (USDA 2008). Additionally, flooding in parts of

South Asia and pest infestation and cold weather in Vietnam reduced harvests in 2007 (ADB 2008).

The OECD-FAO Agricultural Outlook 2007-2016 noted that, for example, the combined cereal supply shortfall of North America, Europe and Australia was over 60 million tonnes (nearly four times larger than the 17 million tonnes increase in cereal use for ethanol in these countries).

These effects would not, on their own, have had a significant impact on prices according to the World Bank (World Bank 2008) although would be cited as the main cause of cereal price increase according to a number of other studies.

Events like the recent cyclone damage in Burma have drastically contributed to the reduction of agricultural productions (Clini 2008) and to its rice price increase of 76 percent in 2008. However, the Asian Development Bank says that Indonesian harvest is going to be very good and if the monsoons are normal, rice prices should stabilize or even decrease. The same situation applies for Cambodia, Bangladesh and a number of other countries (Minder, Flood 2008). Recent increases in cereal prices appear to have more in common with poor harvests and consequently lower stocks than they do with structural change in demand (UK DEFRA 2008), which means that supply recently decreased sharply due to contingent factors, while demand continue to increase slowly due to structural factors.

According to recent studies, the effect of carbon fertilization[3] due to the increase of CO2 concentration (considered as a possible unexpected benefit for agricultural land fertility) could limit the severity of climate change effects to only 3 percent (Von Braun 2007).

Climate change is also putting more stress on water resources for agricultural purposes, changing water flows and its availability more quickly than usual. Water is becoming more difficult to access and therefore expensive: global demand for water has tripled in the last 50 years (Singh) and a particular issue for concern is the depletion of limited groundwater resources.

The FAO estimates that there is at most 12 percent more land available that is not already forested or subject to erosion or desertification, and that 16 percent of arable land is already degraded (Bidwells 2007).

The effects of climate change, although a long-term concern, are likely to adversely impact agricultural output and cause supply disruptions both in the short and longer term (ADB 2008) and many studies all over the world consider climate change one of the most fundamental factors.

Furthermore, in the short term, supply of cereals and oilseeds cannot adjust to unexpected changes in supply or demand because in general there is only one harvest per year. Price is the main instrument available to balance the market in the short term. In the medium-long term, supply is fairly responsive which can lead to large price swings following shortages. In this regard, expected (long-term) changes in supply and demand have much smaller impacts on prices than unexpected events such as bad harvests (UK DEFRA 2008).

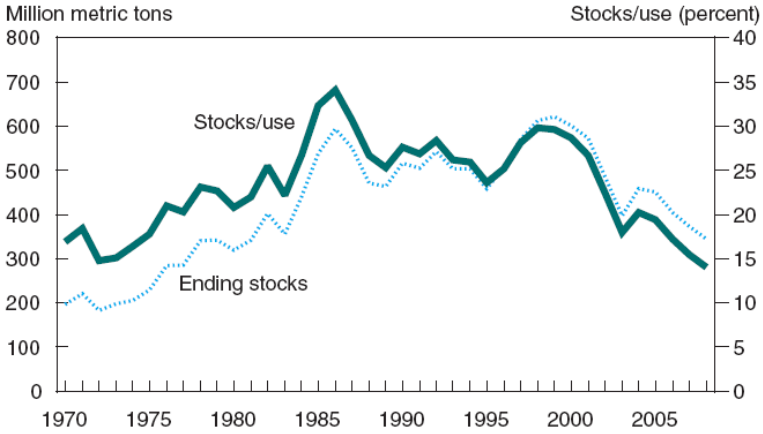
INTERNATIONAL STOCK LEVELS

The level of stocks, mainly of cereals, gradually reduced since mid-1990s, is another supply side factor that has had a significant impact on markets recently.

[3] Carbon fertilization refers to the influence of higher atmospheric concentrations of carbon dioxide on crop yields.

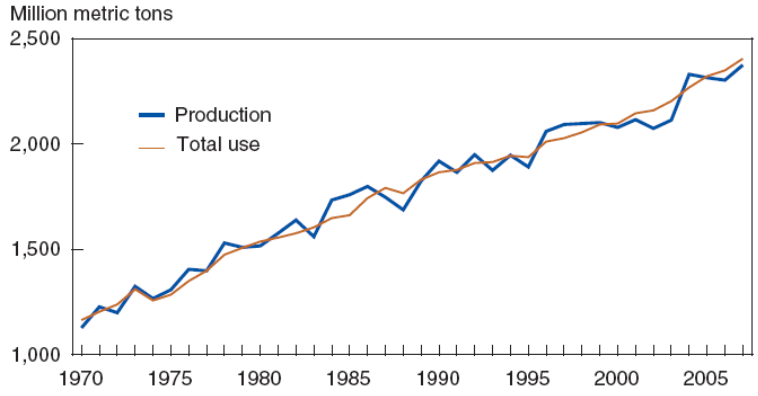
Worldwide food reserves are currently at their lowest in 35 years (Kingsbury 2007). Indeed, since the previous high-price event in 1995, global stock levels have declined, on average, by 3.4 percent per year as demand growth has outstripped supply. Production shocks at recent low stock levels helped set the stage for rapid price hikes (FAO 2008).

Total world grain & oilseeds - Stocks and stocks-to-use ratio



Source: USDA PS&D Database

Total world grain & oilseeds - Production and total use



Source: USDA PS&D Database

The development of other financial instruments for national risk hedging made the necessity of stocks less essential, avoiding useless immobilization of goods and capital. Policy decisions in China as well as in other countries to reduce grain stocks in favour of "just-in-time" inventory management are aimed to reduce holding costs. As a drawback, the low level of national stocks makes the commodity prices much more sensitive to shocks in the demand or supply market.

Additionally, grain reserves are used to prevent speculative attacks and correct for the misalignment between the underlying physical market and the futures market (Von Braun et al. 2008).

FAO recently reported (FAO 2008) that 'the stock situation for oils/fats and meals began to deteriorate in mid-2007 because of spillover effects from developments in the cereals markets, especially of wheat and coarse grains, with the stock-to-utilization ratio expected to fall from 13 to 11 percent for oils/fats and from 17 to 11 percent for meals by the end of the 2007-08 season'. As reported by USDA, global consumption of aggregate grains exceeded production in seven of the eight years since 2000 and US wheat stocks, for instance, fell by half in the 2007-08 crop year to its lowest level in 60 years.

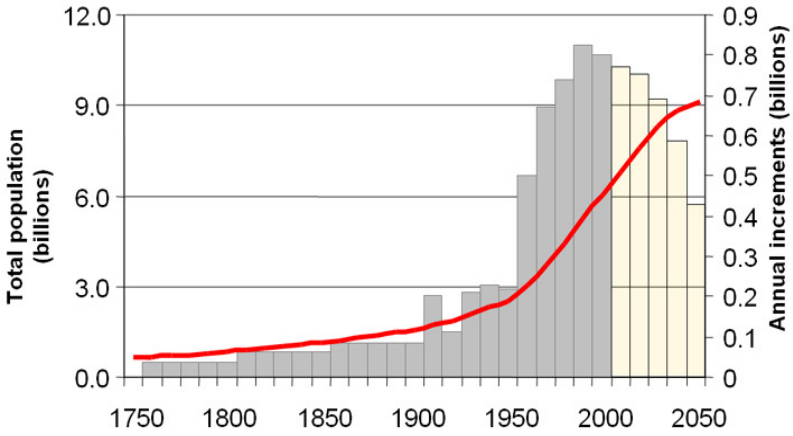
Also the ADB agrees that 'this decline in stocks is a result of both cyclical and structural factors and has been an acute source of volatility in world market prices' and currently, public food grain agencies and private traders in many countries are replenishing their depleted stocks in the wake of the surge in international prices (ADB 2008).

INCREASED GLOBAL FOOD DEMAND

From the demand side, a strong global economic growth combined with rising population is increasing the demand for food.

Although the world's population growth rate has been trending downwards since before the 1970s, the number of people on earth is still rising by about 75 million (1.1 percent) per year. This rising population adds to the global demand for agricultural products and energy (USDA 2008).

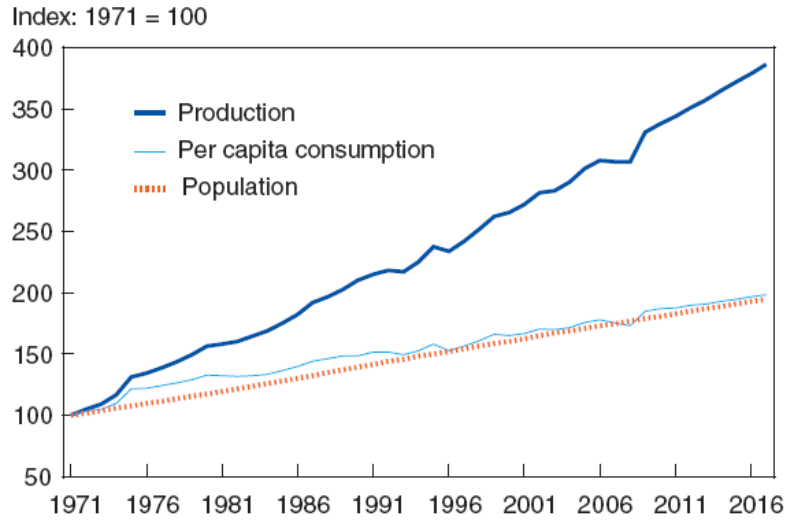
Total population and annual increments



Source: FAO

South-East Asia's real gross domestic product (GDP) increased by more than 9 percent a year between 2005 and 2007. Sub-Saharan Africa also experienced rapid economic growth of more than 6 percent in the same period. Even countries with high incidences and prevalences of hunger reported strong growth rates (Von Braun et al. 2008).

Global meat - Production, per capita consumption, and population



Source: USDA Agricultural Projections to 2017

Developing countries are moving from starchy foods towards meat and diary products and this implies an increased demand for feed and strengthens linkages between these and other food commodities. Increased animal protein consumption in developing countries led to an increased demand for meat, milk, fodder and feed of cereal origin. The composition of food budgets is shifting from the direct consumption of grains and other staple crops to vegetables, fruits, meat, dairy and fish (Von Braun 2007) (leading to a an increased demand for more grain as feedstock) and to higher prices of a number of products like milk and butter that tripled from 2000. China alone consumed about 250% more meat in 2007 than in 1990; India consumed 20% more meat, fish and eggs than in 1990 (ADB 2008).

Feed-to-product conversion rates vary significantly depending on crops and meat type. For instance, about 7 kg of corn are estimated to produce 1 kg of beef, 6.5

kg of corn to produce 1 kg of pork, and 2.6 kg of corn to produce 1 kg of chicken (Leibtag 2008).

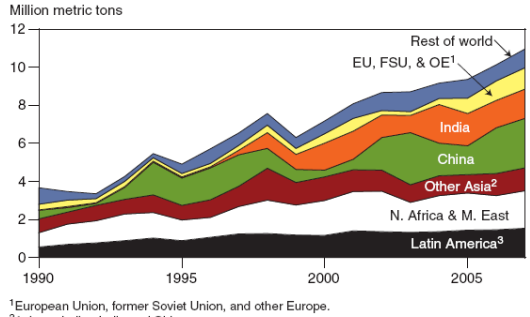
The World Bank estimates that food production will need to grow by another 50 percent by 2030 and meat production by 85 percent to fulfil projected demand (Wiggins, Blas 2007).

The demand for food grain consumption of poor and low-income quintiles of the population increases more than the growth of income and this trend is projected to continue in the foreseeable future (ADB 2008). These imbalances are important but effects are relatively long-term and it is difficult to regard them alone as the main reason for the recent quick price increase. At the same time these are structural causes that have little to do with the relatively small amount of grain used for biofuels.

China and India are often cited as examples of booms from the demand side of food commodities with a new diet pattern, although there are other national realities that are experiencing a similar boom on a smaller scale. Although this is contributing to the increased complexity of the food system, it can not be regarded as the main factor responsible for the recent soaring food prices. For sure, the current boom seems to have contributed to the increased demand for commodities on the part of some fast-growing economies in Asia, which is outpacing the increases in supply, including those from Russia and other countries of the former Soviet bloc (IMF 2008) as a medium-term slowly evolving factor. A number of other sources actually consider the high income growth in emerging economies the single most significant [structural] factor (Evans 2008). The Director General of the International Food Policy Research Institute (IFPRI) argues that high income growth accounts for perhaps half of the recent increases in food prices (Borger 2008).

Regarding China and India, FAO highlights how "since 1980, the imports of cereals in these two countries have been trending down, on average by 4 percent per year, from an average of 14.4 million tonnes in the early 1980s to 6.3 million tonnes average of the past three years. Moreover, mainland China has been a net exporter of cereals since the late-1990s, with one exception in the 2004-05 season. Similarly, India has been a net importer of these commodities only once, in the 2006-07 season, since the beginning of the twenty-first century". These two exporting countries gradually increased the import of oil crops since 1996 and this can hardly justify the current global food price increase.

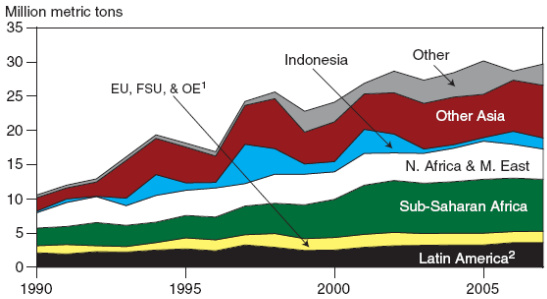
Global soybean oil imports



[1]European Union, former Soviet Union, and other Europe.
[2]Asia excluding India and China.
[3]Includes Mexico.

Source: USDA Agricultural Projections to 2017

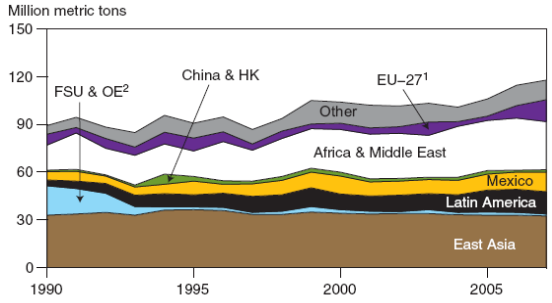
Global rice imports



[1]European Union, former Soviet Union, and other Europe.
[2]Includes Mexico.

Source: USDA Agricultural Projections to 2017

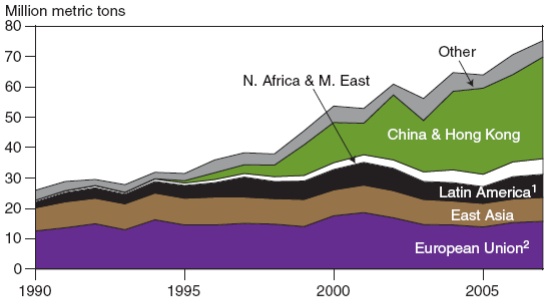
Global coarse grain imports



[1]EU-27 excludes intra-trade after 2002, EU-15 intra-trade before 2003, Slovenia before 1992.
[2]Former Soviet Union and other Europe; prior to 1999, includes Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia.

Source: USDA Agricultural Projections to 2017

Global soybean imports



[1]Includes Mexico.
[2]EU-27 excludes intra-trade after 2002, EU-15 intra-trade before 2003, Slovenia before 1992.

Source: USDA Agricultural Projections to 2017

INCREASED OIL PRICE

The sharp increase in energy prices began in 2003 (up 15 percent compared to 2002) and is now at an all-time high, more than 125 USD a barrel in June 2008. A large spike occurred in 2004 (37 percent increase), about two years before the hike in grains prices (20 percent increase in 2006 compared to 2005, and 43 and 60 percent in the following two years). The associated increase in petroleum use in developing countries has contributed to gradually rising oil prices since 1999 and the oil imports of China alone grew 20 percent per year from 166 million barrels in 1996 to 1.06 billion barrels in 2006 (USDA 2008).

The hikes in fuel and energy prices are structural in nature because they reflect a long-term imbalance between rising incremental oil demand (estimated 1.7 million barrels of oil equivalent a day in 2008 over 2007) and stagnating production and supply (ADB 2008).

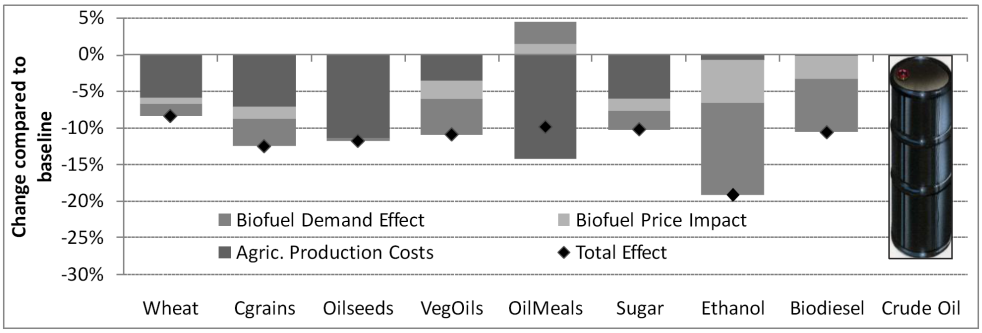
Higher oil prices have an impact on the agricultural industry and the sensitivity has increased with the emergence of biofuels. The Sustainable Development Commission suggests that an increase in oil price from $50 to $100 a barrel could cause an increase in production costs of 13 percent in commodity prices for crops and 3-5 percent for livestock products (UK DEFRA 2008). Agriculture has become more energy intensive in the past decades. Both irrigation and fertilizers are critical inputs to production of high-yielding varieties of food grains, and these are energy intensive (ADB 2008).

The increase in the price of oil puts more pressure on both the production cost (through the fuels used in tractors and transports as well as pesticides and fertilizers used in agriculture) and demand (by stimulating biofuel production) of agricultural commodities such as grains and oilseeds.

The cost of fertilizer, fuel and pesticides began to rise already in 2004 (USDA 2008). Fertilizer, irrigation and transport costs have increased by 30-50 percent and the cost of urea has almost tripled since 2003 (ADB 2008, FT Lex Column 2008). The US dollar prices of some fertilizers increased by more than 160 percent in the first months of 2008 compared to the same period of 2007 (FAO 2008). Also freight costs increased on the basis of soaring fossil fuel prices, increasing by about 100 percent from 2006 to 2007.

With oil prices being some 28 percent lower than in the baseline on average, and energy costs in agricultural production moving with oil price changes to some degree, world crop prices would decline between 6 and 12 percent on average. The consequent downward response in biofuel prices further reduces the crop use in biofuel production and hence commodity prices. Further biofuel use would decline with lower crude oil prices, putting further pressure on agricultural commodity prices (OECD 2008).

Impact of lower oil prices on world crop and biofuel prices, 2013-2017 average effect relative to baseline



Source: Aglink/Cosimo simulation results, OECD Secretariat

A relatively small share of that could be estimated in about 15 percent of the recent increase in food commodity production price is directly due to higher energy and fertilizer costs in countries where intensive production practices are in place, and slightly less in other countries. For example, according with the USDA, the combined energy, chemical and fertilizer costs accounted for 16 percent of the US soybean production costs, 27 percent of US wheat production costs and 34 percent of US corn production costs in 2007 and these costs increased by an average of 50 percent from 2000 to 2007 (USDA ERS 2008) as the US agricultural sector is one of the most fertilizer-intensive.

On the demand side, the existence of biofuel industries in various countries tends to increase the responsiveness of crop markets to changes in energy costs (about 20-30 percent of the price change in cereal and sugar markets results from the demand for these crops as a fuel energy source). This effect is more limited for oilseeds due to the opposite effect that biodiesel production has on the markets for vegetable oils and for oilseed meals (OECD 2008).

THE BIOFUEL FACTOR

Biofuels have been produced and used in small amounts in several countries in recent decades although only in recent years venture capitalists are strongly investing into start-ups trying to create new fuels or energy sources and some politicians are looking to the industry for ways to fight climate change without wrecking the world's economy. Thus, global biofuel production has seen a three-fold increase over the last 20 years.

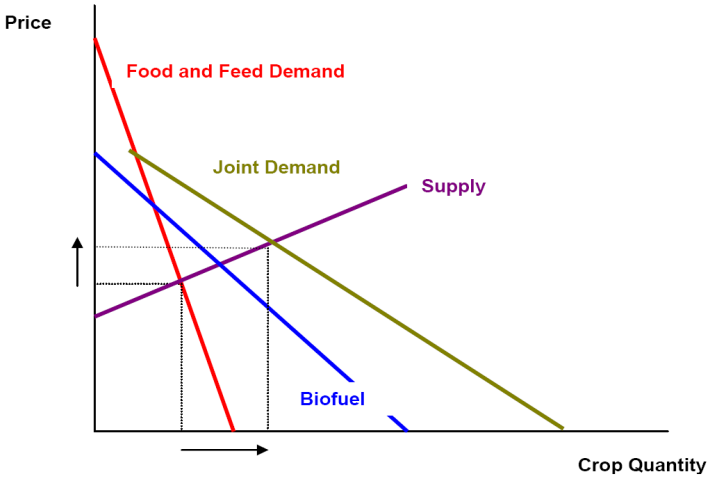
The public policy debate about biofuels has become increasingly polarised. Some point towards the potential impact of biofuels on food security and it has been suggested that biofuels expansion could result in significant implications for world hunger (UK DEFRA 2008). "Great uncertainty remains about which of the new technologies will work to assure the sustainability of energy production and biofuels, one of the industry's main obsessions, have come under fierce attack lately as a possible cause of food shortage" (V. Khosla on SFGate 2008).

Biofuel production generally grew slowly until after the turn of the century. US ethanol production began to rise more rapidly in 2003; EU biodiesel production began to increase more rapidly in 2005 (USDA 2008). About 7 percent of global vegetable oil supplies were used for biodiesel production in 2007. Currently about 84 percent of total biofuel production in the world is ethanol and 16 percent biodiesel (OECD 2008).

In mid-2007, biodiesel produced from soybean oil cost about US$3.25 per gallon but costs have increased to US$4.64 per gallon in January 2008, kicking in this way some producers out of business.

The figure below, provided by UK DEFRA, describes how new biofuel demand will shift the food and feed demand curve outwards, resulting not only in higher feedstock output but also higher prices. The scale of the change in both price and output will depend on the shape of the supply curve, which will shift over time as land availability and other factors of productions become available.

Food crops' demand and supply

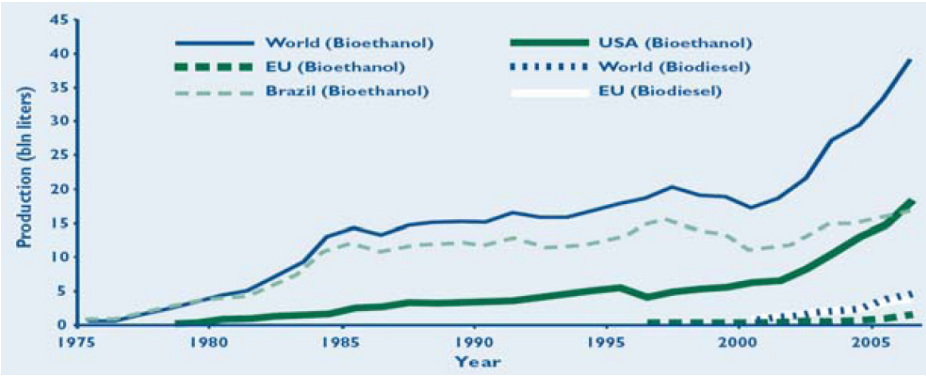


Source: UK DEFRA

According to FAO, demand for cereals for industrial purpose, including biofuels, rose by 25 percent from 2000, against an increase of 5 percent in global food consumption.

While in Brazil biofuel production benefits from particularly favourable cost conditions, in the United States and EU countries, where costs are higher, the recent biofuel production increase is due mainly to the introduction of substantial fiscal incentives. Ethanol produced from sugar cane does not seem however to contribute to the rise in food prices. The increase in cane production has been large enough to allow sugar production to increase from 17.1 million tons in 2000 to 32.1 tons in 2007 while Brazil's share of global exports increased from 20 percent in 2000 to 40 percent in 2007, sufficient to keep sugar price increases small except for 2005 when Brazil and Thailand had poor crops due to drought. Ethanol produced from sugarcane or molasses has a competitive advantage over other ethanol feedstocks because the sugars in the cane or molasses can be directly fermented into ethanol without the need to first convert starch into sugar as is the case with ethanol produced from starch crops such as corn or wheat. Sugarcane

World Biofuel Production

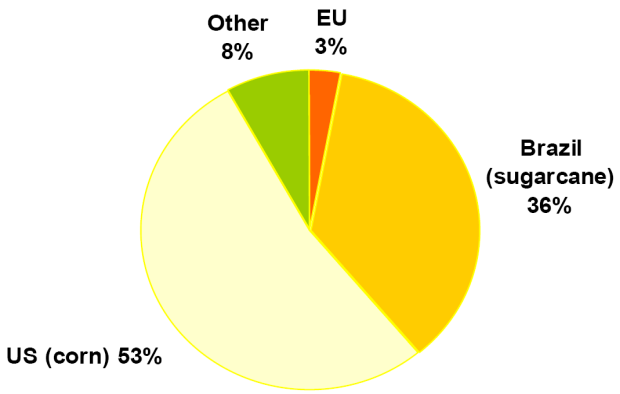


Source: F.O. Licht's World Ethanol and Biofuel Report. Vol.4 No. 16 and Vol.4 No. 17 (Tunbridge Wells, UK: F. O. Licht 2006)

also produces high biomass yield per hectare compared to other energy crops.

Cost-competitiveness with fossil fuel is highly dependent upon the type of feedstock used and ultimately on the region of origin. Ethanol from sugarcane could be already competitive with oil at US$40/barrel in Brazil, while US corn ethanol could compete with oil at around US$60/barrel[4] (Schmidhuber 2006). The estimated cost of ethanol from sugarcane in Brazil in 2007 was US$0.90 per gallon, compared to US$1.70 per gallon for ethanol from corn in the United States. Most types of biofuels are not currently economically competitive with the relative fossil fuel they replace, although technology significantly reduced the costs that are still decreasing although at a slow pace.

Global fuel ethanol production (2007)



Source: F.O. Licht

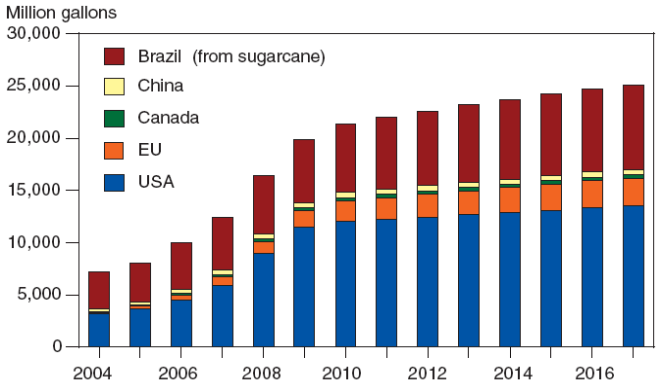
The case of Brazilian industry with the use of sugar cane is an example of economic redemption for developing countries and this could be easily imitated by others tropical countries (Clini 2008).

The United States, the world's largest bioethanol producer, strengthened public support for corn ethanol production after approval of the Renewable Fuel Standard in 2005. In 2007 one-fourth of corn harvest was diverted towards biofuel production (Kingsbury 2007) to meet the proposed target of 36 billion gallons of renewable fuel by 2022. In Europe projects to increase the production capacity of biodiesel from rapeseed are underway and China is currently focusing on cassava and sweet potatoes as feedstock for bioethanol production. Other major players in the bioenergy market are Canada that is expanding its biodiesel production from rapeseed as well as Russia and Ukraine, who may play a significant part in helping the EU to meet its envisaged minimum blending target of 10 percent by 2020. Also Brazil and Argentina are currently planning to expand their biodiesel production capacity within next years.

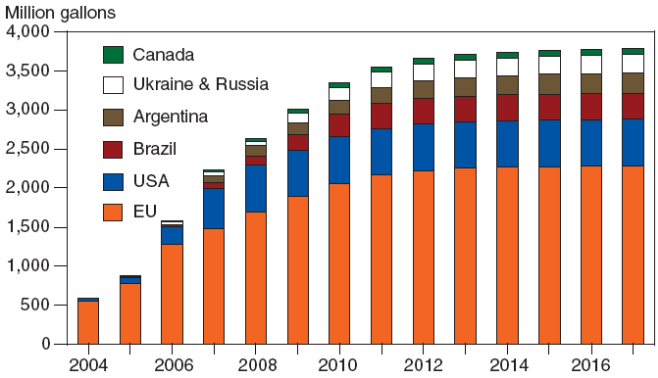
US processors and growers received support worth about US$6.7 billion in 2006, and those in the European Union received about US$4.7 billion. Ethanol subsidies range from about US$0.30 to US$1.00 per litre, while the range of biodiesel subsidies is somewhat wider (FAO 2008). In OECD Countries support reached a cost of about 13 to 15 billion USD (11 to 13 billion USD just in the US (Von Braun et al. 2008)) a year, but this sum generates less than 3 percent of the overall supply of liquid transport fuel. Thus, the subsidy to biofuels is often greater than the cost of the fossil fuel equivalent (Wolf 2007) and has for years distorted markets and undercut the competitive advantage of developing-country farmers (Von Braun et al. 2008). Although [globally] farmers have not profited from higher food prices, many with access to large markets have certainly gained (USDA forecasts farm sector income to increase again this year on top of big jumps in previous year, up 4.1 percent to a level of 51 percent above the 10-year average) (Beattie 2008) as the case of Brazil demonstrates.

[4] The cost competitiveness of biofuels with fossil fuels is continuously changing due to technological improvements and cost of the feedstock. In this regard Clini and Caltagirone report a cost competitiveness of Brazilian ethanol from sugarcane with an oil price per barrel of US$30 while US ethanol from corn would be competitive with an oil price of US$80 per barrel (Clini, Caltagirone 2008).

Ethanol production - Mostly from grain feedstocks except for Brazil

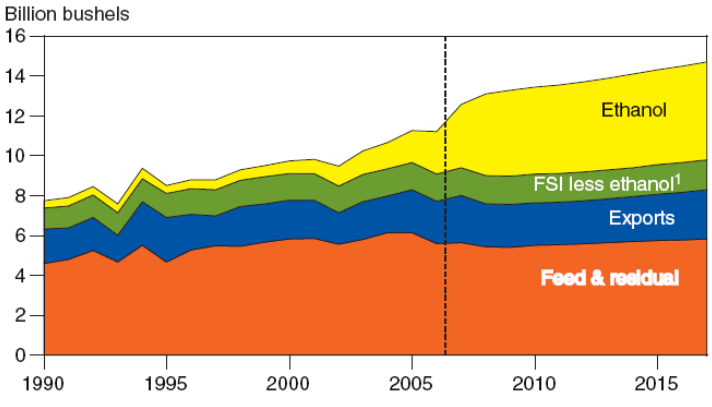


Source: USDA Agricultural Projections to 2017



Source: USDA Agricultural Projections to 2017

US corn use



[1]Food, seed, and industrial less ethanol.

Source: USDA Agricultural Projections to 2017

Soaring corn markets during the last year contributed to maintaining high oilseed prices because of expanding corn plantations replacing oilseed. Increased biofuel production contributed to increasing the price of vegetable oils (these increased by 97 percent in the first three months of 2008 compared to the same period in 2007) (FAO 2008), wheat, and corn, which registered the highest increase in the last 3 years, ranging from 130 to 200 percent. The price boom has also been accompanied by higher price volatility for these feedstocks. Also due to the high replaceability in the demand of some food products and to the relative simplicity of interchanging crop cultivation, these price increases transmitted to other agricultural commodity products.

To what extent the competition for agricultural products for production of biofuel contributed to the price increase of food commodities is now one of the main issues and recent reports issued by reliable organizations show figures ranging from a distressing 75 percent to 5 percent but often they are based on different baselines[5]. "On the supply side, when the marginal value product in the biofuel market (net of crop feedstock costs, including by-product revenues) exceeds that in the food market, the crop will be diverted to the production of the biofuel. When larger quantities of the feedstock are absorbed by the energy sector, price determination will tend to mirror that in the energy sector and an 'energy floor price' effect will be created. As energy crops compete for other agricultural resources, greater cultivation intensity of energy crops can lead to reduced supplies of other competing crops, thus pushing up their prices. On the demand side, the degree of substitutability by which biofuels can be blended in large proportions with their fossil-fuel counterparts (e.g. flex-fuel vehicles) determines how much biofuel and petroleum prices may depart from one another. If this substitutability is high,

[5] As of May 2008 IFPRI estimates a 30 percent of the weighted average increase of cereal prices due to increased biofuel demand in 2000-2007

with biofuel competitive at the pump and large quantities of feedstock subsumed by the energy sector, consumers ensure equilibrium between prices of petroleum and biofuel, and producers between prices of biofuel and the feedstock" (Schmidhuber, 2007).

According to FAO, in the case of US, the world's largest producer and exporter of corn, high corn prices since mid-2006 encouraged farmers in the US to plant more corn in 2007. Corn plantings increased by nearly 18 percent in 2007 and this increase was only possible because of reduced land areas for other feedstocks like soybean and, to a lesser extent, wheat production.

The expansion in corn plantings combined with favourable weather resulted in a bumper harvest in 2007 which made it possible for the US to meet domestic demand. Corn production rose both in response to increased demand (not only for biofuels) and prices. According to the USDA, the total increase in the US demand for wheat and coarse grains (corn, barley, sorghum, rye and oats) between 1980 and 2002, ethanol accounted for 7 percent, feed use for 44, and food and other non-feed use, except for US ethanol, for 49 percent. Between 2002 and 2007, the quantity of US corn used to produce ethanol rose by 53 million metric tons. This accounted for 30 percent of the global growth in wheat and feed grains use. Feed use grew by 48 million tons and accounted for 27 percent of the increase in total. Food and other non-feed uses climbed up to 79 million tons and accounted for 44 percent of the global increase in wheat and coarse grains use (USDA 2008).

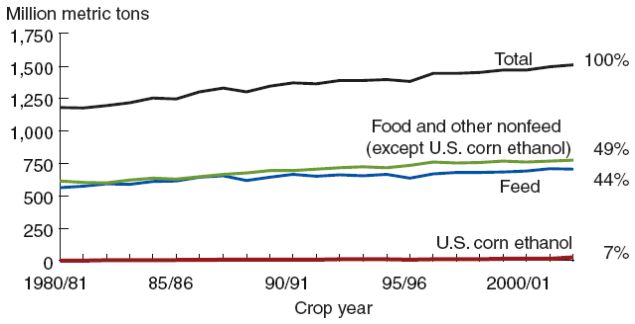
US planted acreage

	2005	2006	2007	2008
Corn	81.8	78.3	93.6	90
Sorghum	6.5	6.5	7.7	8.3
Oats	4.2	4.2	3.8	3.7
Barley	3.9	3.5	4	4
Feed Grains	96.4	92.5	109.1	106
Winter Wheat	40.4	40.6	45	46.6
Spring Wheat	14	14.9	13.3	12.6
Durum	2.8	1.9	2.1	2.6
All Wheat	57.2	57.3	60.4	61.8
Rice	3.4	2.8	2.8	2.7
Soybeans	72	75.5	63.6	69
All Cotton	14.2	15.3	10.8	9.1
Sunflowers	2.7	2	2.1	2.1

Source: Informa Economics

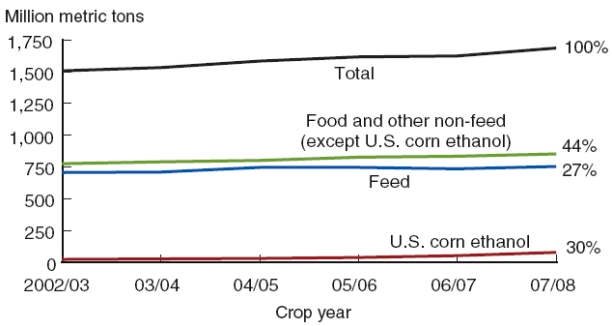
Historically, the amount of grain globally used to produce ethanol has been a small percentage of the global total used for all purposes as shown in the graphs below.

Global wheat and coarse grains use, 1980/81– 2002/03 - US ethanol accounted for 7 percent of historical global growth



Note: Category's share of the change in total use from 1980/81to 2002/03 shown at the right. Source: USDA PS&D Database

Global wheat and coarse grains use, 2002/03 – 2007/08 - US ethanol has accounted for 30 percent of recent global growth



Note: Category's share of the change in total use from 2002/03 to 2007/08 shown at the right. Source: USDA PS&D Database

It is notable that whereas wheat prices have seen the most dramatic rise amongst all the cereals, the use of wheat for biofuels production is modest (in 2007 1.4 percent of wheat was used for biofuels in the EU and 0.6 percent globally). It is therefore unlikely that biofuel demand for cereals in the EU has contributed to price increases (UK DEFRA 2008). At the same time, out of the nearly 40 million tonne increase in global corn utilization in 2007, 30 million tonnes were absorbed by ethanol plants alone. It could be argued that if corn ethanol greatly contributed to the worldwide food crisis, corn exports from US would have declined; on the contrary, in 2006 and 2007 an increase was seen. (SFGate 2008).

Also the recent rise in palm oil production has been associated with the boom in biofuel production, however at present only one percent of palm oil is used for biofuels. There will have been some indirect impact as more rapeseed is used for biodiesel but overall, the use of vegetable oils for biodiesel remains small compared to other uses (UK DEFRA 2008).

According to FAO, inter-linkages between fossil fuels prices and biofuels prices do not seem to be very strong in general. This can be due to the still embryonic stage of the biofuel market in most countries and the difficulty to switch between fuels for the end-user due to the lack of infrastructure. Also in the US, where the biofuel market is rather developed the independence of corn prices in the energy nexus is surprising, despite the price of feedstock being the dominant component in ethanol's cost schedule. The evidence suggests that over the last couple of years, other "fundamentals", including policies and policy changes in grain and biofuel markets in the country, were more important in the evolution of the grain prices (FAO 2008).

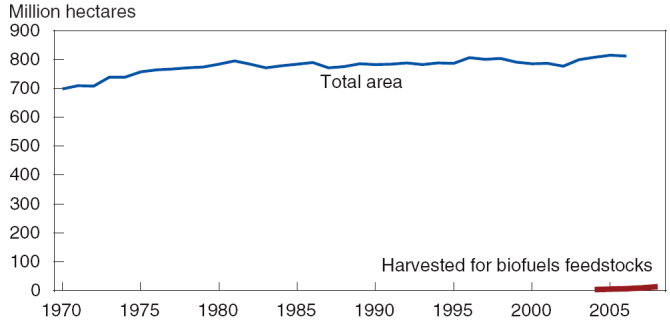
Ethanol trade (million gallons)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Brazil	928	647	719	779	856	940	1,007	1,072	1,137	1,198	1,255
China	42	8	5	-8	-33	-52	-72	-90	-106	-121	-133
EU-25	-71	-124	-129	-145	-154	-182	-193	-205	-219	-232	-244
India	-118	-152	-147	-152	-164	-171	-179	-185	-189	-193	-195
Japan	-171	-196	-209	-222	-235	-246	-258	-269	-281	-292	-302
S. Korea	-75	-84	-90	-96	-103	-110	-116	-123	-129	-135	-142
U.S	-679	-237	-286	-288	-295	-300	-306	-311	-316	-322	-327
ROW	23	17	15	11	6	1	-5	-11	-18	-25	-33

Source: FAPRI Agricultural Outlook 2007

At present, the international trade in biofuels is somewhat limited. Some of these limitations can be explained by trade distortion in both the importing and the home producing countries. Brazil is the largest world exporter of ethanol and the US and Japan the largest importers. The projections seem to suggest that the flow of biofuels should increase in the coming years as countries engage in policies aiming to diversify their energy sources (UK DEFRA 2008).

Global area harvested



Source: USDA Agricultural Projections to 2017

Another important aspect to consider for assessment of the impact of biofuels on food prices is the quantity of land used to grow energy crops. A rough estimate suggests that about 21 million acres were used world wide to produce feedstocks for biofuel production in 2007. This would account for about 1.3 percent of all cropland used to produce grains, annual oilseeds, and cotton. (Notice the line for biofuels in the lower, right-hand corner of the

graph.) However, at the margin, the 11-million acre increase in the area of biofuels feedstocks harvested between 2004 and 2007 accounted for about 24 percent of the 45 million acre-increase in total area harvested during the same period (USDA 2008). As shown in the previous graph, global area used for biofuel production is small.

Therefore biofuels do appear to have an impact on global commodity price in the light of the current contingencies in the agricultural market.

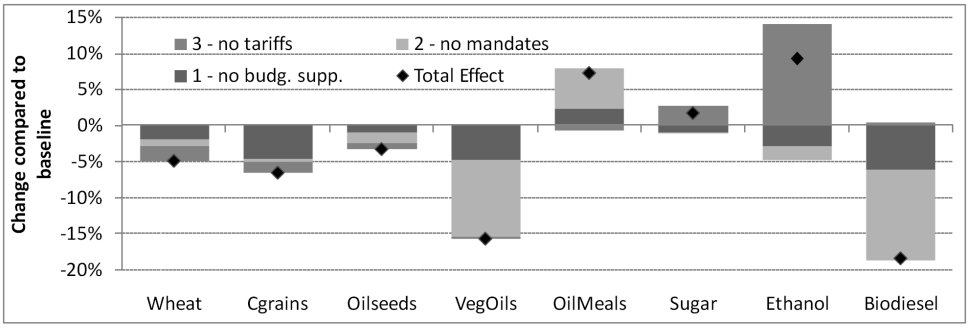
TARIFFS AND POLICIES

Increases in commodity export prices have historically been associated with increased trade barriers (IMF 2008). A growing number of market-oriented policies such as export bans and increased export taxes are used by governments to assure food self-sufficiency and to foster bioenergy development, affecting the cost-competitiveness of bioenergy as compared to its substitutes and therefore bioenergy viability in the marketplace. Subsidies for biofuels that use agricultural production resources implicitly act as a tax on basic food (Von Braun 2007). Under the US laws for example, biodiesel receives a tax credit of US$1.00 per gallon but also qualifies for tax incentives in the EU in a case of unintended consequences (Brasher 2008).

Price controls and export tariffs make production less profitable, which discourages increased supply and can make shortages worse (FT 2007). For the last decade, countries like India and Brazil have been trying to get higher food prices, as the subsidies to food in these countries reduce the price of food to the point where their farmers cannot stay in business (SFGate 2008).

The combined impact of current and new policies specific to biofuels on projected commodity markets is relatively pronounced. According to the OECD, compared with a situation without biofuel support, international prices for wheat, coarse grains and oilseeds would be by about 8, 13 and 7 percent higher on average for the 2013-2017 period while sugar prices would be little affected in the medium term and, despite the importance of support policies for biofuel markets, the analysis shows that the medium-term impact on crop markets should not be overestimated (OECD 2008).

Impact of biofuel support removal on world commodity prices, 2013-2017 average



Source: Aglink/Cosimo simulation results, OECD Secretariat

At the same time, in response to rising food prices, some countries began to take protective policy measures designed to reduce the impact of rising world food commodity prices on their own consumers (e.g. eliminated export subsidies, export taxes, export quantitative restrictions, export bans for export countries and reduced import tariffs, consumer subsidies for import countries). As of April

2008, 15 countries, including major producers, had imposed export restrictions on agricultural commodities. These restrictions have harmful effects on import-dependent trading patterns, stimulating the formation of cartels, undermining trust in trade and encouraging protectionism (Von Braun et al. 2008). In Asia, policy responses (export bans, price floors) of key rice-exporting countries including the People's Republic of China (PRC), Pakistan, Vietnam and India have increased price volatility and uncertainty in the international markets. Export bans and price controls imposed by some countries (PRC, India, Vietnam and Pakistan) have reduced supplies in the world rice markets and increased uncertainty about future supplies, contributing significantly to the surge especially of rice since the end of 2007 (ADB 2008).

Price fluctuations have, in general, direct effects on the values of commodity exports and imports and can also encourage changes in the volume of such trade (IMF 2008).

The approach taken by most countries so far (Azerbaijan, Bangladesh, Bosnia, China, Egypt, the EU, Ghana, India, Indonesia, Mexico, Morocco, Nigeria, Peru, the Philippines, Russia, Taiwan and Turkey) has been to reduce or eliminate import tariffs (Evans 2008). However, at least some of these reductions in import tariffs have been offset by the imposition of additional export tariffs or quotas by other countries – some of them major producers – in order to reduce domestic prices (Argentina – where the move has led to major unrest among farmers – China, India, Kazakhstan, Ukraine and Vietnam) (Evans 2008).

Other approaches currently being tested are importing commodities to establish or replenish stockpiles and strategic reserves – which in turn increases pressure on prices (Iraq, Malaysia, Turkey and the UAE); increasing subsidy levels (Egypt, India and Oman); capping prices (China, Russia and Thailand); and examining the possibility of introducing rationing (Malaysia and Pakistan) (Evans 2008).

Policy options, such as export restrictions and minimum export prices, intended to protect domestic consumers reduce incentives to producers and increase uncertainty thereby weakening the supply response. Lower than expected production during a food crisis like the present one could keep supplies tight and prolong the crisis (ADB 2008).

Such measures typically force greater adjustments and higher prices onto global markets, changing price relationships in world markets (USDA 2008).

According to the ADB, "the spike in world prices of cereals, particularly for rice and wheat is eliciting policy responses that exacerbate rather than cushion price volatility as governments rush to restrict exports, control domestic prices, and attempt to rebuild stocks in the face of the price increases" (ADB 2008).

Trade barriers alter consumption and production decisions and are leading to a misallocation of resources. Therefore, liberalization will generally raise real incomes, except perhaps in cases in which externalities or pre-existing distortions are present or a terms-of-trade deterioration outweighs efficiency gains. The results from simulation models of the International Monetary Fund suggest that, with few exceptions, trade liberalization raises the level of a country's real income (IMF 2008).

The food aid system also benefited from the food price increase and it would also need an important reform. The US is the biggest donor of food aid in the world by far, with much of its help being channelled through the UN WFP. American aid bears the marks of agricultural lobbying and for this reason proposals such as the proposal of the White House that a quarter of US food aid be converted to cash met fierce opposition from the farm lobby and the Congress (Beattie 2008).

THE FINANCIAL MARKET

Markets are still reflecting supply and demand, since the short-term effects of a looming recession are being hedged by longer-term threats to supply, and hedging instruments.

Historically, every time the dollar has weakened, hedge funds have bought commodities. Commodities are often priced in dollars and when US currency is falling, producers outside America raise prices to compensate.

Financial markets, which have become increasingly attractive as a new type of asset at a time when the dollar and stock markets are weak and US interest rates are low, are boosting asset allocation and attracting speculators. Another probable cause of price increases is that the correlation of oil prices with those of corn, rice and other commodities pushes hedge funds to buy these and the subsequent wave of buying increases the price in a catch-22 situation.

Although commercial traders mainly enter into future markets for hedging purposes, non-commercial traders mainly speculate in search of financial profits[6] (Von Braun et al. 2008). The latter is not necessarily harmful because it indicates some investment opportunities in the agricultural sector. An estimated US$42 billion (F.O. Licht 2008) have been moved into the US commodity markets in general, during the first quarter of 2008. These measures, while gradually making agricultural markets more transparent, are somehow distorting the natural equilibrium of trade.

The strong involvement of financial instruments like hedge funds, index funds and sovereign wealth in agricultural commodities is a relatively recent factor starting in 2005 (this is also the year of the US Energy Policy Act requesting a minimum mandatory blending target for renewable fuel in the US). Between 2000 and 2006, world demand for cereals increased by 8 percent while cereal prices increased by about 50 percent and the volume of traded global agricultural futures and options rose by almost 30 percent in 2006 (Von Braun 2007). In the first quarter of 2008 the volume of globally traded grain futures and options increased even more, by 32 percent compared with the same period in 2007 (CBOT 2008). The large increase in speculative and investment activity in commodities is reflected by the quadrupling of wheat futures contracts on the Chicago Board of Trade (CBOT).

"Declining stocks are likely to have triggered the initial spur of speculative demand in recent years along with the turmoil in global financial markets that has reduced expected returns on bonds, equities, and other financial assets relative to commodities. The flow of funds into commodities has also been exacerbated by the weakness in property and housing markets in several industries economies" (ADB 2008).

In this respect, the influx of liquidity and the disorder that financial markets create seem to influence the underlying spot markets to the extent that they affected the decisions of farmers, traders and processors of agricultural commodities (FAO 2008). High spot prices could have therefore influenced investor participation.

Although prices are soaring, supply is very inelastic and does not respond quickly to price change (typically aggregate agriculture supply increases by 1 or 2

[6] In the past six months, the total number of long positions (that is, obligations to buy) by non-commercial traders as a fraction of the total reportable long positions by commercial and non-commercial traders for corn, wheat, soybeans, and rice has significantly increased, suggesting the possibility of a price bubble above what is justifiable by market fundamentals (Von Braun et al. 2008)

percent when price increases by 10 percent). The response decreases further when farm prices are more volatile (Von Braun 2007). Income elasticity of food products in emerging economies (which measures the responsiveness of the quantity demanded of a good to the change in income) is normally higher than in developed economies (UK DEFRA 2008).

Already in 2005, the outcome document of the UN world summit called for a need to address the impact of weak and volatile commodity prices (UN World Summit 2005).

Biofuel production is responsible for only part of the changing world food equation (Von Braun 2007) and this is reflected on the "energy" commodities price volatility.

WEAKNESS OF US DOLLAR

Another factor influencing the usual trade pattern is the exchange rate of the US dollar that has been following a negative trend from October 2006 against the other currencies (especially Euro).

Commodities priced in dollars have become cheaper for many import countries and this has increased demand for US production by import countries twisting trade flows.

Further, since the world price of major crops are typically denominated in US dollars, the depreciation of the dollar also raises prices (measured in dollars) (USDA 2008).

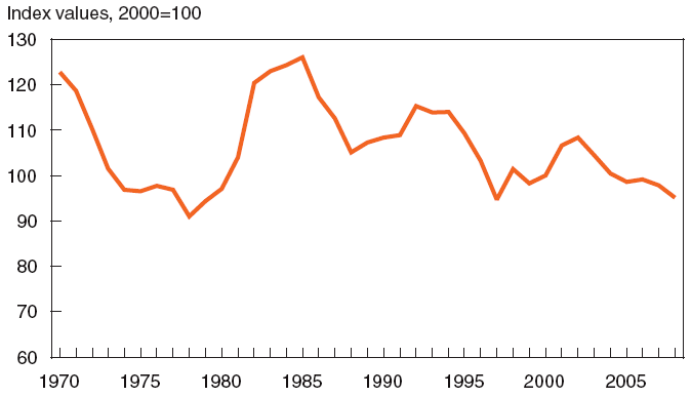
In the 1973 boom, for example, commodity prices were pushed up by the combination of strong global growth and US dollar depreciation. However, the current boom is characterized by the extended period during which these factors have interacted. As a result, the prospects for global commodity markets depend importantly on how long these underlying, mutually reinforcing forces continue to prevail (IMF 2008).

According to a recent draft paper of the World Bank, the recent decline of the dollar contributed alone about 20 percentage points to the rise in food prices.

Higher food prices also mean higher global inflation. The international soaring of agricultural raw material prices, reflected later on consumption inflation in the Euro area, rose sharply in the last months of 2007, due to the rise of processed food products prices. In this area, in spite of the delay, consumption price reactivity for a number of food products (dairy products and cereals) is currently increasing (Banca d'Italia 2008).

Also in other regions (e.g. Central Asia) food price inflation is higher than aggregate inflation and contributing to underlying inflationary pressures (World Bank 2008).

Value of US dollar declines after 2002



Source: ERS International Macroeconomics Dataset

FURTHER DISCUSSION AND CONCLUSIONS

In general, "the market developments observed since 2006 ... seem to have been the result of short-term imbalances in some commodity markets that spilled over to markets with which they had close linkages, as well as of some [structural] factors that may continue to influence the markets for longer periods" (FAO 2008). The adjustment of consumer prices to the input price increase suggests how these have been acknowledged by producers as a stable variation of cost conditions and as such transferred to the consumer market. According to a draft World Bank paper, the combination of higher fertilizer prices and dollar weakness alone caused an increase of 35 percent in food prices from January 2002 until March 2008. The uncertainty of the adjustment of global supply to the growing demand of developing countries could contribute to the persistence of tensions in the global market of raw food materials and to increase the sensitivity of prices to global shocks. Expectations about the increase of cereal and oilseed use in future might have already had an impact on prices though and might have inflated commodity prices (UK DEFRA 2008).

Different studies conclude that emerging economies have increased their food demand as per capita income has increased. However, there is little evidence of a significant acceleration in recent years. Indeed, for China and India overall food demand seems to be rising somewhat more slowly than in the mid-1990s (UBS 2007). What can be easily registered is that supply from traditional exporters decreased while demand from importers was increasing at the same time.

World rice prices are forecast to remain high in 2008, in spite of a record crop, because of export restrictions and rising consumption (Minder, Flood 2008), although commodity market models are not yet designed to model biofuels as endogenous factors. Some of the difficulties relate to the fact that they mostly rely on historic data while biofuel production and trade are a relatively new phenomenon and as such the market for both biofuels and feedstocks has not yet been developed (UK DEFRA 2008).

The most recent figures on future food price, using the AGLINK/COSIMO modelling framework (OECD/FAO), estimate that by 2017, when compared to the average of the observed prices during the period 2005-2007, the real price of wheat is expected to have increased by 2 percent; rice by 1 percent; corn by 15 percent; oilseeds by 33 percent; vegetable oils by 51 percent; and sugar by 11 percent. The World Bank estimates that demand for food will rise by 50 percent by 2030 (Evans 2008) and it will take several years for supplies to increase and reach sufficient stock levels and allow prices to fall (World Bank 2008). Additionally, the IFPRI's International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) envisages a similar scenario of persistent high food prices, with real prices of corn and oilseed 26 and 18 percent higher in 2020 compared with a scenario that keeps biofuel production at 2007 levels (Von Braun et al. 2008). In this regard, the Economic Intelligence Unit predicts an increase of 11 percent in the price of grains in 2009 and 5 percent in the price of oilseeds compared to current levels (EIU 2007). A significant price increase is predicted for palm oil. Another interesting result comes from a set of simulations carried out by the European Commission in order to analyse the impact of increased biofuel demand. The results suggest that half of the projected biofuel demand of the EU25 in 2010 could be served by domestically grown feedstocks: through increased production driven by price increases for cereals (6 to 11 percent) and oilseeds (5 percent to 15 percent), shifts in consumption and reductions in exports. The second simulation assumes a 5.75 percent market share as well as a deregulated market where all tariffs on

biofuels and feedstocks are phased out. The analysis suggests that 27 percent of EU biofuel demand will be served by domestic production, mainly due to increased oilseed production caused by higher oilseed prices (5 to 12 percent). The phasing out of tariffs on biofuels and feedstocks would cause cereal prices to decline (-15 to -20 percent) due to the substantial increase in imports (EC 2006).

Other positive assessments estimate that biofuels could supply 20-30 percent of global fuel demand in an environmentally responsible manner without affecting food production (Koonin 2006).

The OECD suggests that effects of global demand for biofuels are likely to be more significant for vegetable oil (and sugar as consequence of increased mandates for 2nd generation biofuels). However, recent decreases in world sugar prices despite increasing oil prices and bioethanol production, suggests that the relationship is not straightforward. While such studies provide a useful benchmark they assume that all biofuels are produced from food-crops, no trade in biofuels and constant technology (UK DEFRA).

It could be useful to point out how the last OECD estimates highlight that while prices for vegetable oils are projected to increase by 35 percent due to current and new biofuel support policies, those for oilmeals would be reduced by 11 percent due to the higher crush and DDG supplies (OECD 2008).

According to the USDA, if a significant shortfall occurs this year due to weather or disease, food prices might continue to rise sharply from the current high level and although trade flows can mitigate some of these effects, new or existing trade restrictions or barriers can exacerbate price impacts.

In the case of cereals like wheat (already in 2000 its real price was widely exceeded by the international quotation), the recent acceleration in production prices can be related to the shortage of harvests in the area during the summer 2007, due to adverse climate conditions, in an international context of limited stocks.

A closer look at both the recent price spikes and the relationship between commodity and food prices is needed before drawing conclusions about the extent to which recent price increases have been driven by higher biofuel demand. There are a number of factors that have affected cereal prices over the last year, some of which are cyclical or short term and induce volatility into the market and others that are long term and structural in nature (such as the expansion of the biofuels industry or increased demand from emerging economies). Feed and food uses still dominate cereals, sugar and oilseed markets and there are too many factors affecting agricultural and soft commodities to make this a close relationship (UK DEFRA 2008).

The impact of the persistent demand for biofuels on global food prices, would depend on a number of elements including natural constraints, market and policies development, and upcoming breakthrough technologies.

Natural constraints include the impact that climate change and desertification could play on agricultural yields in different parts of the world. Land availability also plays an important role in a number of countries, especially in view of the certification schemes that are being developed globally (although still at regional and scattered level) in order to safeguard natural resources.

Market development implies the removal of subsidies and feed-in tariffs. Of the various types of subsidies, direct payments [not related to production levels] are the most compatible with WTO rules since they do the least to distort production (Beattie 2008) and these should be used as a safety net rather than as a barrier to trade. The WTO Doha Round still needs to be completed, and it would be a damaging side effect if the current crisis were to divert attention from that goal (Von Braun et al. 2008). In this regard, life cycle analysis, labelling and

certification of origin of biofuels should be agreed internationally and introduced into the global market in order to be used to ensure sustainable development, environmental gains and to promote social equity but not to introduce barriers to trade (Clini, Müller 2007). Classification of "sustainable bioenergy" could be likely introduced in the WTO rules in order to reduce or, as appropriate, eliminate tariff and non tariff barriers according to the Doha Development Agenda, paragraph 31 (iii) (Clini 2007). Policy intervention such as food grain support prices, input subsidies, involvement of public agencies in food grain imports, marketing, and distribution tend to be ineffective over the medium term and inhibit supply increases (ADB 2008). Developed countries should facilitate flexible responses to drastic price changes by eliminating trade barriers and programmes that set aside agriculture resources, except in conservation areas. A world confronted with more scarcity of food needs to trade more – not less – in order to spread opportunities fairly (Von Braun 2007). Along several dimensions, the current commodity price boom is proving more favourable to developing economies than previous booms and one key reason developing economies have performed relatively well during the current commodity price boom has been the general improvement in their institutional and policy environments, including greater financial development, trade liberalization, and fiscal restraint (IMF 2008).

Last but not least, technologies could significantly change the overall scenario. New cultivation technologies are drastically increasing the yields of agricultural products, reducing the need for land and above all for water and fertilizers. The South Asian Green Revolution experience shows that farm yields can double or even triple in a few years if modern seeds, irrigation, and fertilizers are combined with assured output prices (Von Braun et al. 2008). A recent OECD study suggests that the three OECD regions, the US, Canada and EU15, would require between 30 percent to 70 percent of their respective current crop area if they were to replace 10 percent of their transport fuel consumption by biofuels, assuming unchanged production technologies, feedstock shares and crop yields, and in the absence of international trade of biofuels or use of marginal fallow land. Brazil on the other hand, would only require 3 percent of its land in order to replace 10 percent of its transport fuel. For the world as a whole, 9 percent of cereals, oilseeds and sugar land would be required in order to achieve a 10 percent biofuels share of transport fuel. FAO reports how as "an illustrative example to indicate that a great deal can be done to increase yields using known technologies in developing countries, the Government of India notes that the actual yields of wheat, rice and sugar cane in selected states are on average 23, 26 and 31 percent, respectively, below the yields obtained by applying the best practices of farmers in those states and 80, 205 and 117 percent, respectively, below the yields obtained by applying improved practices. This indicates that developing countries have potential to increase production, without expanding area planted or using new technologies" (FAO 2008).

To intelligently address the biofuel issue, it is necessary to see the full picture. Calling everything biofuels and asking "Are they good or bad?" is like asking "Are drugs good or bad?" In this case it should be asked if we are talking about cocaine or aspirin. Since biofuels can be produced from a range of feedstocks, and the type of biofuel being produced, the feedstock used and the market value of the by-products are all important determinant costs, a more rational policy would be to phase out production subsidies in a selective way.

The move from the use of edible products to non-food crops as feedstock for the production of biofuel is happening fast, mainly because of higher food prices and volatility (food commodities are strongly linked to other markets and policies) and because of the critical views in the international community concerning the drawbacks that biofuels could have on poor communities. Second generation production technologies are supposed to circumvent the food-fuel debate using lignocellulosic feedstocks that do not compete with agricultural products.

Through a more complex process, the quantity of biofuel that can be obtained from a certain quantity of raw biological material can be increased (per unit area of land) and also less valuable biomass can be used. In this way also other not specifically dedicated cultures can be exploited, widening the type of biomass that can be used, including industrial scrap material and a part of urban and agricultural waste. Whilst growing dedicated perennial energy crops on land that could be used for food production will still lead to competition for land, water and other resources with food production, OECD suggests that the impact of this practice on food prices would be much less than that from using food crops grown on the same land as feedstock (OECD 2008). Nonetheless, it is clearly important that policies to encourage use of biofuel produced from wastes, residues, and other feedstocks that require little land or land that is otherwise of low ecological and socio-economic value (including unsuitable for food production) are developed. In this context, the alternative options for use of such wastes and residues should also be considered. The most promising feedstock at this time, in terms of cost effectiveness and efficiency of the overall process seems to be algae. The enormous increase of available feedstock should in this way augment the quantity of biofuels produced with a consequent decrease of costs. Second-generation technologies are already available and technically viable, although processing costs are still high and further research is needed to make these technologies economically sustainable. It is important to stress that second-generation technologies cannot solve the food-fuel debate in the short term and, although the feedstock to be processed is largely available (with a very low or even negative cost), it is hard to predict that the overall cost including processing cost will be economically competitive with first generation biofuels. In the future, a sound policy implementation could solve the problem of sustainability between first and second generation technologies.

The leaders of international institutions including the World Bank and the WTO have exhorted governments to use the current food crisis to reform policies that distort agricultural production and trade (Beattie 2008). Policies such as export restrictions, price controls, price supports, optional food grain reserves and input subsidies need to be revised in light of the higher food prices which could persist. Hence, policy dialogue is critical to consider effective options to address the immediate impacts of the crisis and to restore food price stability. Prudent macroeconomic management to contain inflation is also critical in the mix of available policy options (ADB 2008).

Divergence between economic and financial returns needs to be narrowed otherwise farmers will continue to operate sub-optimally and return on investment will continue to be low in the sector (ADB 2008). There is a need for an innovative response to the age-old policy problem of how to safeguard smallholders against weather-related income shocks – one example is the new generation of weather insurance systems (Von Braun et al. 2008).

Although biofuel prices are usually higher than fossil fuel prices, the added social benefit might justify some subsidies and regulations taking into account that the externalities are not currently included in fossil fuel markets. Clear environment-related efficiency criteria and sound process standards need to be established that internalize the positive (and negative) externalities of biofuels and ensure that the energy output from biofuel production is greater than the amount of energy used in the process (Von Braun 2007). In a similar way, GHG emissions deriving from different feedstocks and processes should be internalized in the final price. Objectives and instruments of policy should be defined precisely, in terms of the overall goals of energy security and reductions in emissions of GHGs, for instance, creating a single global price of carbon that governs all activities, making producers compete for any support that is offered, letting the markets decide on sales of flexible-fuel vehicles and, above all, moving to free trade of biofuels (Wolf 2007).

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