Agricultural Markets *Brief*

Brief nº 1

June 2011

European Commission
Agriculture and
Rural Development

High commodity prices and volatility

...what lies behind the roller coaster ride?

1. Is agricultural price volatility on the rise?
2. Is increased price volatility driven by higher yield variability?
3. Are higher prices and increased price volatility driven by growing demand for agricultural products?
4. Have prices become more sensitive to stock changes in recent years?
5. Is there a spillover effect from other markets?
6. What conclusions can be drawn?

This *Brief* looks at recent factors driving price developments in agricultural markets over the long term. Changes to the fundamentals of agricultural markets have contributed to upward pressure on prices and rising volatility but they do not give the full picture. Factors outside of agriculture including the increasing linkage with energy markets and the co-movement across commodity markets also strongly influence the volatility observed in agricultural markets.

Agricultural market prices have been increasing sharply for many months, reminiscent of the price surge of 2007 and 2008. At the same time there is mounting international concern about price volatility, with growing calls for policy responses to dampen the negative impact of disproportionate price fluctuations on both producers and consumers, especially the most vulnerable.

Markets by their nature have always been volatile. A consensus now seems to be emerging that volatility in agricultural markets is on the rise and that the underlying causes are wide-ranging. But even among experts there is still uncertainty as to the weight that should be attached to the contributions of these individual factors. In addition, price volatility has not been confined to agricultural markets and there are rising concerns about volatility transmission across commodity markets due to increasingly correlated price movements.

This *Brief* sifts through the evidence provided by in-house analysis of price developments in agricultural markets, in an attempt to identify the key drivers. It focuses on a number of key questions. Firstly are we experiencing higher price volatility than previously? How much can be explained by changes to the fundamentals, e.g. higher yield variability, rising demand and growing sensitivity to stock changes? And how much can be explained by new factors such as increasing financial investment in commodity derivatives and the spill-over effects arising from increased linkages between agricultural and other commodity markets; i.e. energy, metals and minerals? Our aim is to draw a distinction between fact and fiction, amidst all the hype that surrounds the issue of volatility.

Contact: DG Agriculture and Rural Development, Agricultural Trade Policy Analysis Unit
Tel: +32-2-29 91111 / E-mail: Agri-L5@ec.europa.eu

http://ec.europa.eu/agriculture/analysis/tradepol/index_en.htm

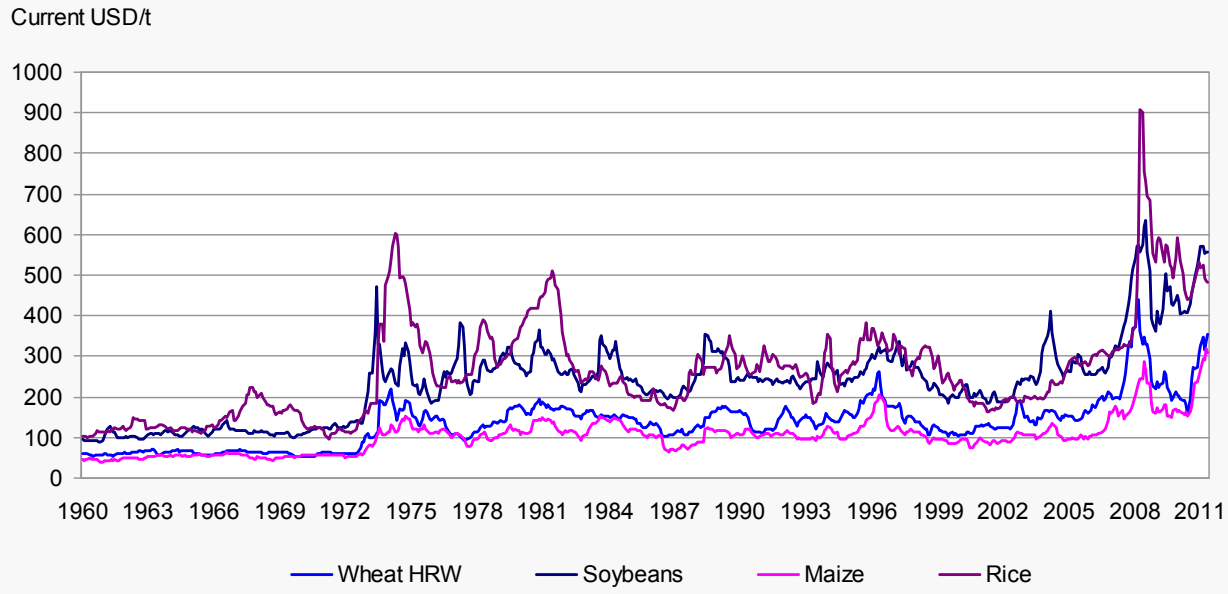
1. Is agricultural price volatility on the rise?

Price variability is an intrinsic part of all markets, as prices adjust to changing market conditions. While demand for agricultural commodities tends to be continuous and steady, on the other hand supply, especially crop production, is less predictable due to seasonality, weather and other natural factors. Farmers, processors and consumers are used to this normal market feature.

Figure 1 below shows price developments for key agricultural commodities since the 1960s, highlighting the high levels of volatility in the 1970s and especially over the past decade.

Markets have always been volatile as prices adjust to changing market conditions

Figure 1: Long term price developments for key agricultural commodities.



Source: World Bank.

The recent volatility has generated a debate on whether agricultural price volatility has become 'excessive'. This refers to price changes whose frequency or magnitude goes beyond that justified by fundamental changes in demand or supply and is strongly associated with uncertainty. Excessive volatility benefits neither producer nor consumer, blurring market signals for producers and potentially threatening the most vulnerable consumers. The current spell of volatility is of concern to business operators and consumers alike.

As a contribution to the search for evidence as to whether price volatility[1] has actually increased over time, we conducted our own analysis for the main agricultural products at world level over the past 50 years. Measuring volatility is not straightforward and results vary depending on the time intervals and frequency selected.

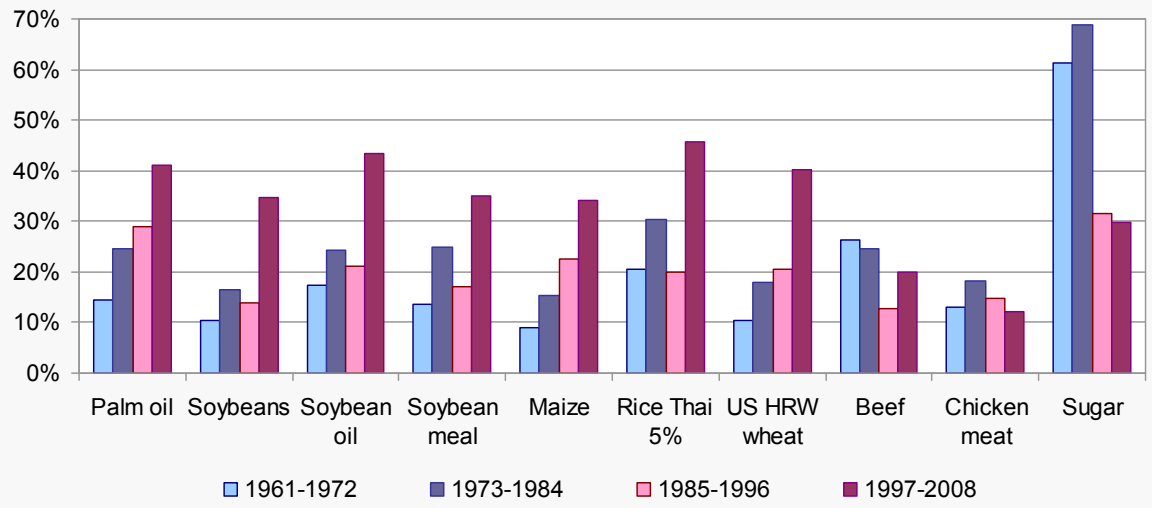
Four equal 12-year time periods were examined. These correspond to broadly different economic periods: 1961-1972 (green revolution), 1973-1984 (aftermath of the two energy shocks and stagflation), 1985-1996 (recovery of agricultural prices until their mid-1990s spike), and 1997-2008 (the parallel boom in agricultural and other markets and agricultural price spikes of 2007-2008).

[1] Volatility is measured in terms of a coefficient of variation of monthly nominal price series (not seasonally adjusted). The coefficient is a ratio of the standard deviation to the mean and measures a dispersion of the series. The higher the coefficient of variation, the higher the volatility.

This analysis concluded that, for most agricultural products analysed[2] price volatility was higher during the latest period 1997-2008, than at any other time since the 1960s. The exceptions were beef, chicken and sugar which had higher volatility from 1973 to 1984. A summary of the results is displayed in figure 2.

For most agricultural products, price volatility in 1997-2008 was the highest since the 1960s

Figure 2: Coefficient of price variation for selected products, 1961-2008.



Source: Own calculations, based on World Bank data.

Analysis undertaken elsewhere (e.g. OECD and FAO) using different time intervals also confirms that recent price volatility is high compared to the past two decades. The G-20 Report on Price Volatility in Food and Agricultural Markets[3] points out that whatever conclusions are drawn about long term trends, 'there is no doubt that the period since 2006 has been one of extraordinary volatility'.

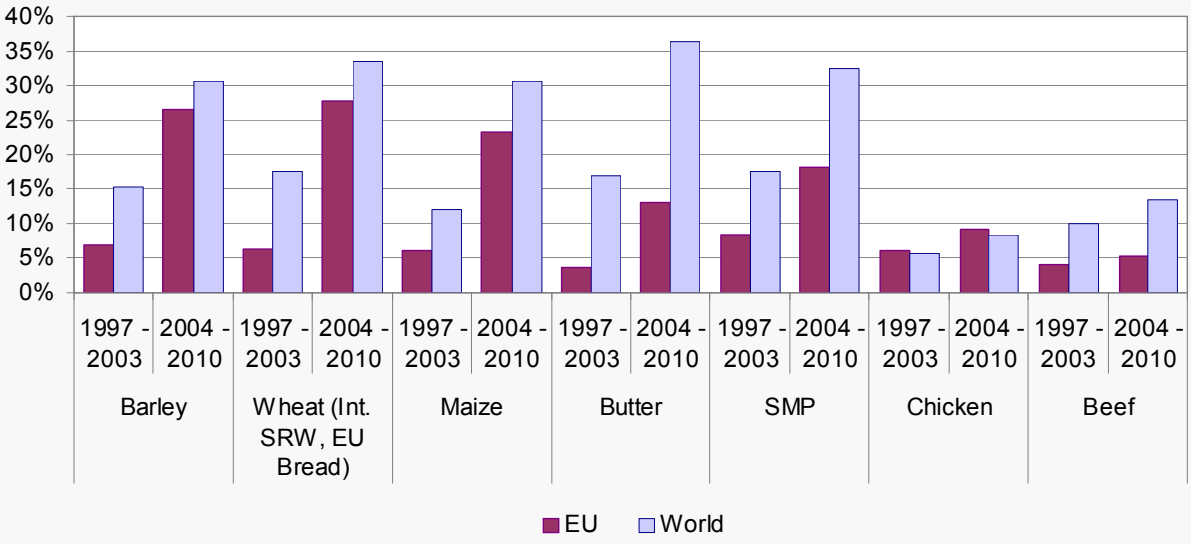
The G-20 Report points out that 'there is no doubt that the period since 2006 has been one of extraordinary volatility'

In order to understand this extraordinary volatility, we took a closer look at the period from 1997 to 2010, comparing recent developments in volatility in the EU with international markets. The time interval was split into two periods; 1997-2003 and 2004-2010. Volatility increased for most commodities in both the EU and international markets from 1997 to 2010, as shown in figure 3 overleaf, the exceptions being beef and eggs (not shown in the graph) in the EU. However, compared to crops and dairy, volatility of meat prices is relatively low, both in the EU and on world markets.

The relative increase in volatility for many products was greater in the EU following successive policy changes towards enhanced market orientation of EU agriculture. However in absolute terms volatility remains higher on the world than on the EU markets for all products (except chicken where levels are comparable and relatively low).

[2] Grains (barley, maize, sorghum, rice and wheat), soybeans, soybean meals, oils (soybean, coconut, groundnut and palm), meats (beef and chicken), and sugar.
[3] G-20 Policy Report, June 2011 – http://www.oecd.org/dataoecd/40/34/48152638.pdf

Figure 3: Coefficient of variation for comparable products, 1997-2003 vs. 2004-2010, EU and world.



Source: Own calculations, based on DG Agriculture and Rural Development and World Bank data.

2. Is increased price volatility driven by higher yield variability?

While changes in harvested area can usually be factored into production expectations, crop yields can be highly variable as they are dependant on weather and phytosanitary conditions. Given that demand for agricultural commodities tends to be relatively inelastic and stable or displays a gradual development, a sharp shift in yields can lead to a strong movement in prices. With a more frequent occurrence of droughts, floods and other weather-related events which negatively affect production, the question is whether yields have become more variable in recent years.

In an attempt to shed some light on this question, we analysed average yields and yield variability for major crops in the main producing countries over the same period from 1961-2008[4], divided into the same four twelve-year long intervals as before.

Average yields are increasing across countries and commodities albeit at different rates of growth. In many cases average yields more than doubled between 1961-1973 and 1997-2008.

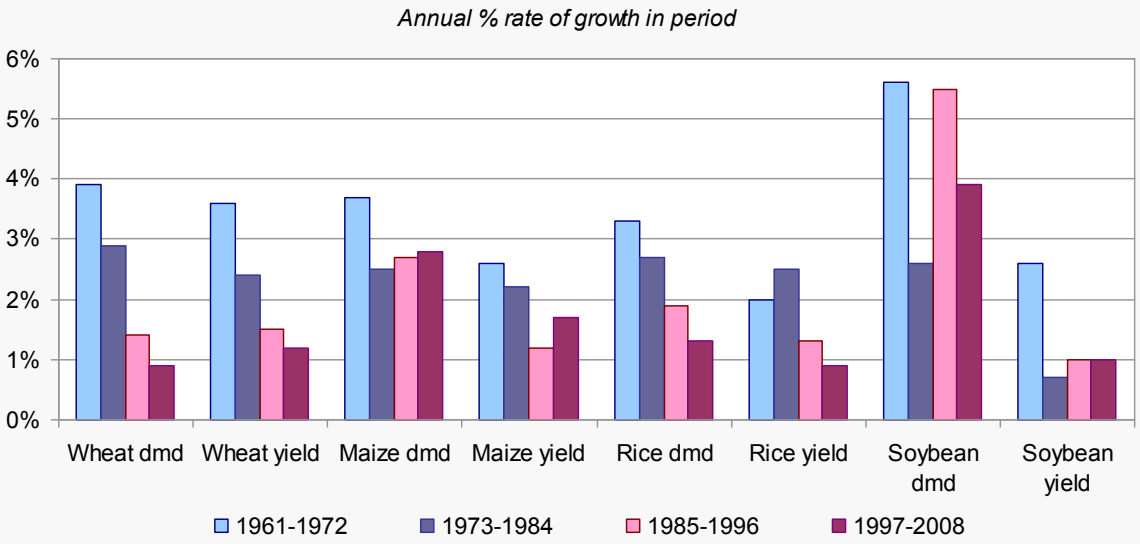
Nevertheless crop yield growth is on the decline (wheat and rice) or static (soybeans) apart from maize which has seen an increase in yield growth from 1997-2008 (figure 4), linked to GMO development.

Furthermore yield growth has failed to keep pace with increasing demand for maize, rice and soybeans, increasing upward pressure on prices. Only wheat yield growth remains slightly ahead of the growth in consumption from 1997-2008, but the impact on production was mitigated by the decline in wheat area.

Crop yield growth is slowing down

[4] Where pertinent, annual data from the USDA were used for Argentina, Australia, Brazil, China, EU (EU-15 until 1996, EU-27 from 1997), USSR-FSU (USSR until 1991, Former Soviet Union (Russia + 11 countries) from 1992), USA and India for wheat, maize, barley and rice. Data on soybeans and sugar (cane or beet, depending on the country) were taken from the FAO. Not all commodities were followed in all countries.

Figure 4: Comparison of consumption and yield growth at world level.

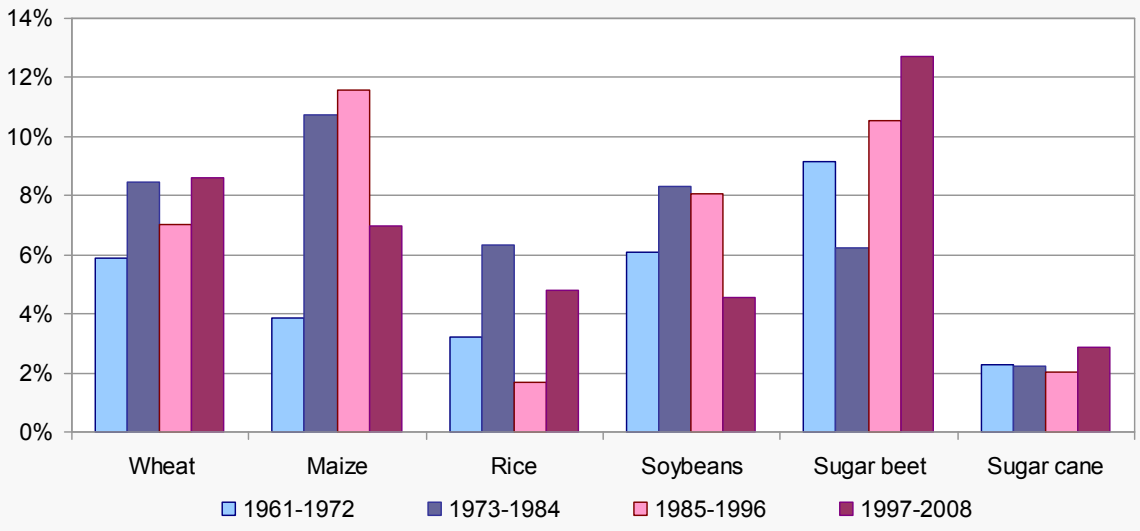


Source: Own calculations, based on FAO, Eurostat, DG Agriculture and Rural Development and USDA data.

In order to study yield variability, we removed the upward trend in yields due to improved seed varieties, fertiliser application, methods of production, etc. The evidence provided by our analysis is inconclusive. The level of variability differs across countries for the same crop. Indeed some countries systematically experience higher yield variability than others, e.g. wheat yield variability is much higher in Brazil and China than it is in the EU, India and the United States.

In some cases e.g. wheat, sugar cane and sugar beet, yield variability seems to have increased in the 1997-2008 period compared to earlier, as shown in figure 5. In other cases (maize and soybeans), yield variability was higher from the mid-1970s until the mid-1990s but declined more recently. In any case this limited evidence does not back up a claim of systematic increased yield variability.

Figure 5: Yield volatility over 12 years for crops at world level.



Source: Own calculations, based on FAO data.

3. Are higher prices and increased price volatility driven by growing demand for agricultural products?

To assess the extent to which developments in agricultural prices are demand driven, our analysis considered whether there has been acceleration in demand growth for agricultural products in recent years and how this growth compared with other raw materials, notably energy, metals and minerals. The analysis for agriculture focused on the past 50 years, ending 2008, based on the same four time periods outlined earlier.

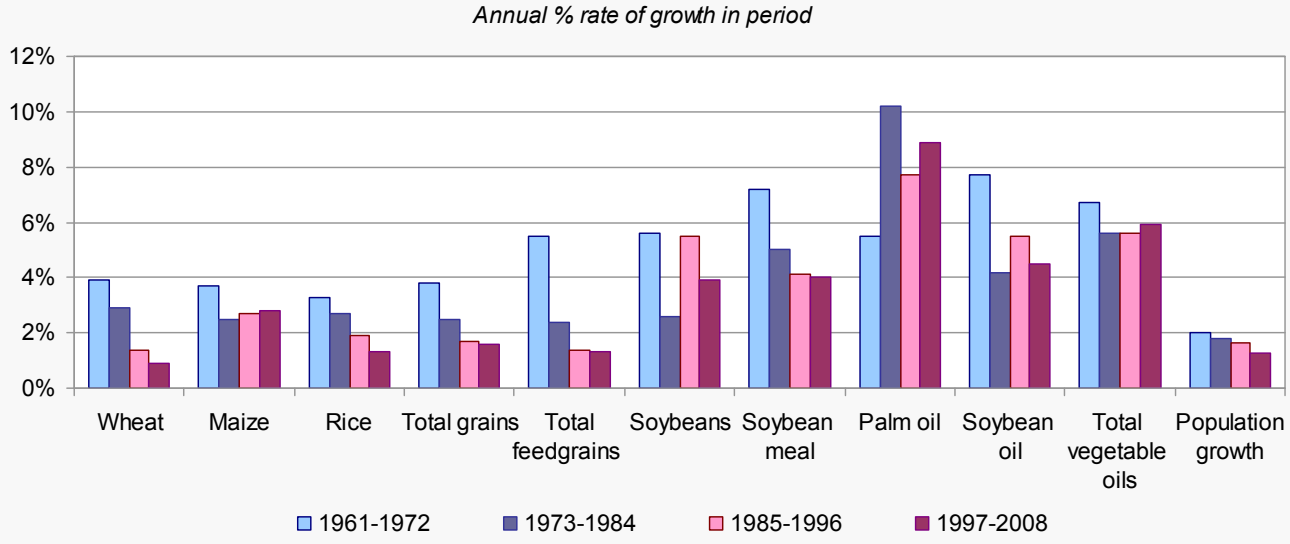
Global demand for agricultural products continues to rise in line with world population growth and changing consumption patterns linked to income developments, with annual growth rates for the main agricultural products ranging from 1.7% for dairy to 6.1% for vegetable oils, since the 1960s. However the rate of growth in demand is on the decline.

Contrary to popular belief, the analysis confirms that there is a global long-term trend of a slowdown in world consumption growth for agricultural products, in line with lower population growth. This is reflected in the decline for wheat, rice and total feedgrains (see figure 6). Even taking account of rising demand for biofuels, this does not reverse the overall trend of declining growth in consumption of feedgrains. Maize world consumption growth slightly accelerated in recent decades, long before the development of maize-based ethanol.

Vegetable oil is the only sector which bucks this trend, with demand growing at persistently high rates over the whole period, in particular palm oil at over 8% annual growth since the early 1970s.

Growth in demand for most agricultural products is also slowing down

Figure 6: World consumption growth rates for crops and population growth.

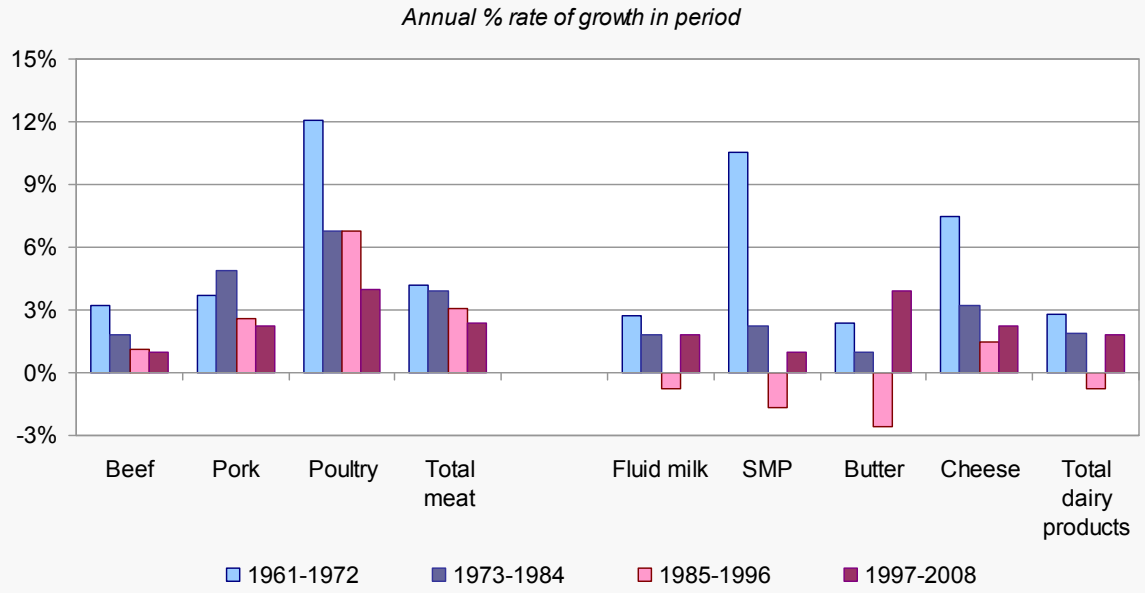


Source: Own calculations, based on USDA, FAO and UN data.

Turning to livestock, there is considerable variation in developments in consumption, depending on the specific product (see figure 7). Overall demand growth for meat, notably beef, has shown a steady decline since the 1960s. Pork demand growth is stronger and continued to increase until the mid-1980s. Poultry growth reached an impressive 12% per annum in the 1960s and is still more than double that of competing meats, but has slowed down more rapidly over the last decade.

Dairy products also saw a sharp decline in consumption growth from the 1960s to the mid-1990s, to the extent that demand declined for fluid milk, SMP and butter from 1985-1996 and only cheese showed positive growth. However growth has recovered for all dairy products over the past decade, especially for butter.

Figure 7: World consumption growth rates for animal products.



Source: Own calculations, based on USDA and FAO data.

We also conducted more detailed analysis by region, which confirmed these findings. Both the EU and the US experienced a slowdown in demand growth over time, apart from vegetable oils where demand has accelerated recently. The same broad trend can be seen for emerging countries, which are considered to be underpinning growing world food demand.

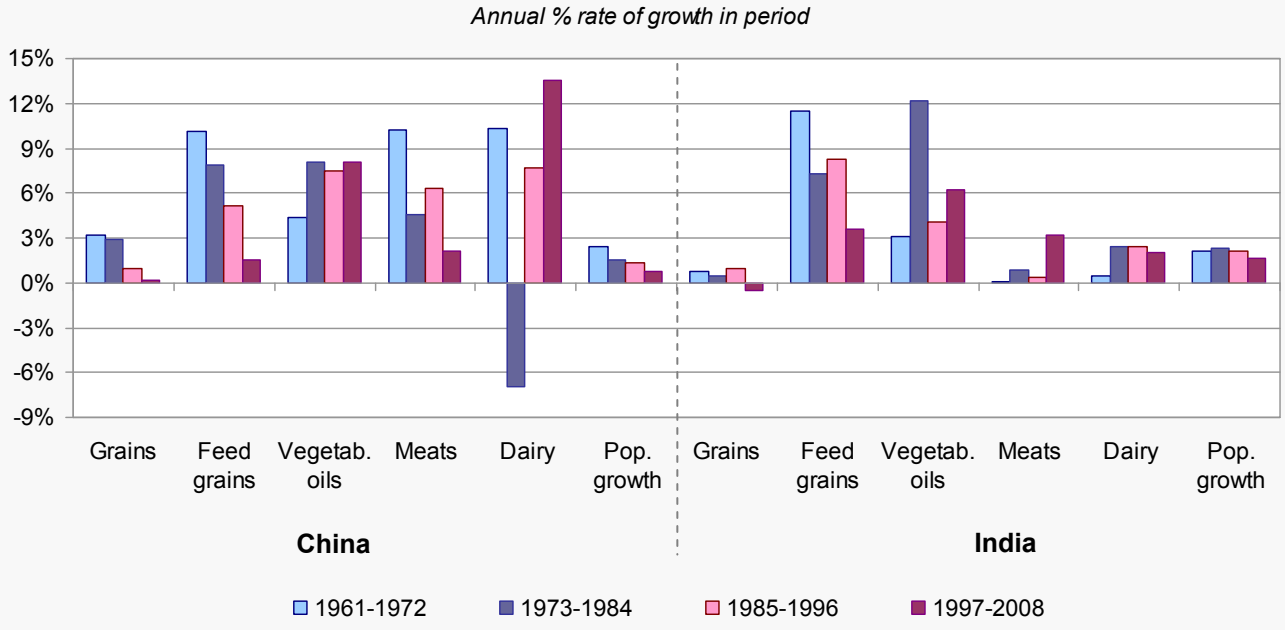
For China and India, although absolute levels of demand growth are higher for all products analysed, there is an increasing trend only for dairy products and vegetable oils, both of which are growing faster in China than in India (figure 8). China has seen the sharpest fall in demand growth for feed grains since the 1960s.

Chinese meat demand growth has also shown a sharp decline recently after recovering from the mid 1980s to mid 1990s.The situation is very different in India where meat demand has grown strongly over the past decade, albeit from a low base.

Meanwhile Brazil showed a declining trend for all commodities and Russian growth accelerated only in the past decade, as it recovered from the collapse of the Soviet Union and the contraction in demand for most commodities.

China and India show accelerating growth in demand for dairy and vegetable oils

Figure 8: China and India consumption growth rates per capita and population growth.

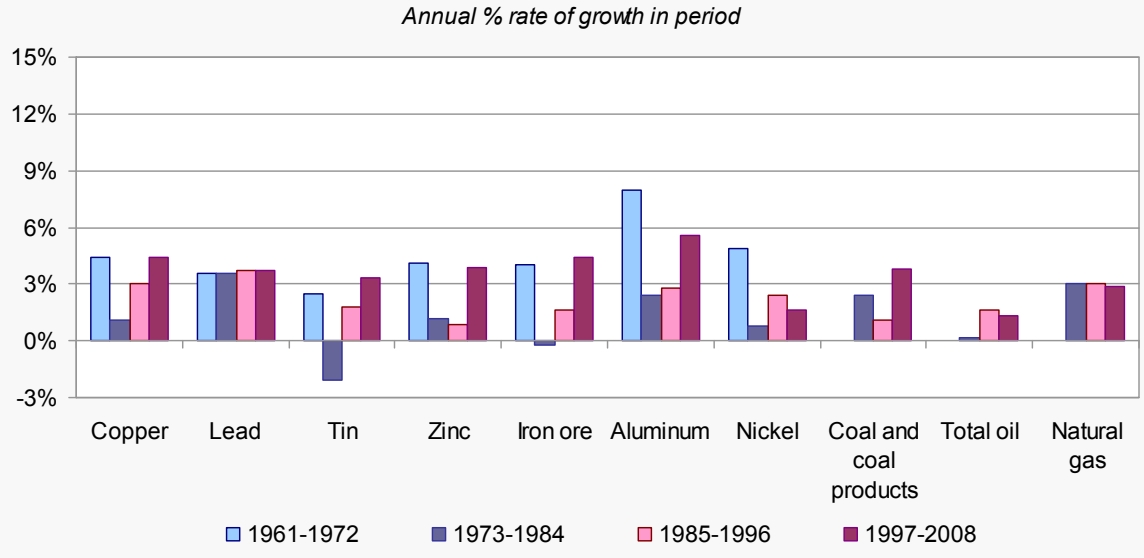


Source: Own calculation based in USDA, FAO and UN data.

The situation for energy, metals and minerals is very different (see figure 9), with an acceleration of demand growth since the mid eighties for the most important metals (iron, aluminium, tin and copper). Lead has remained steady while zinc has accelerated recently.

Turning to energy demand (based on data going back to 1973), oil demand grew strongly from 1985-1996 compared to the decade after the oil crises, though growth tailed off slightly in the period 1997-2008.

Figure 9: World consumption growth rates for minerals, metals and energy.

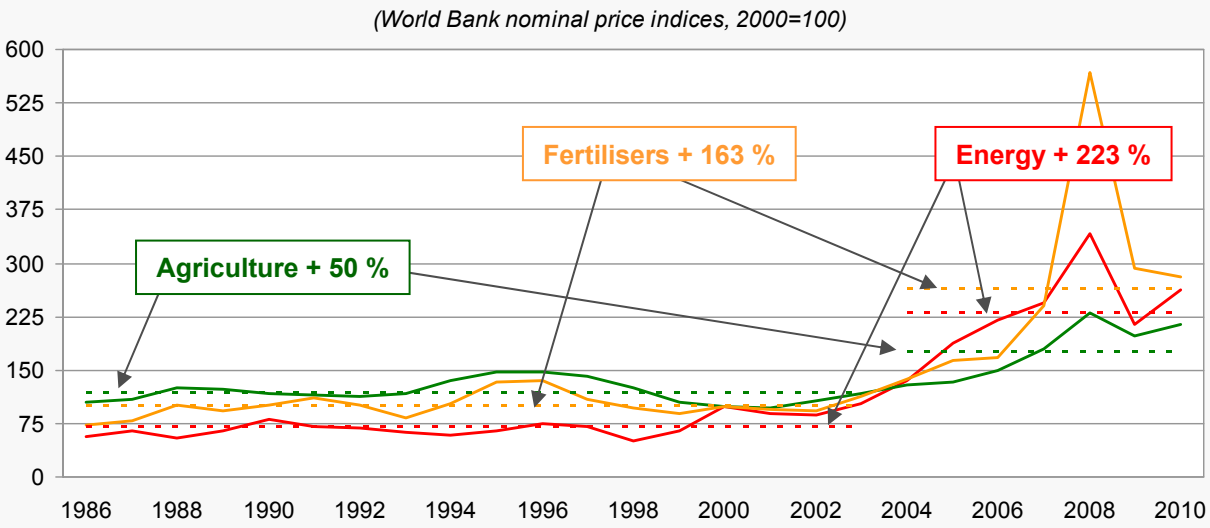


Source: Own calculations, based on International Energy Agency and US Geological Survey data.

In contrast demand growth for coal halved from 1985-1996 before recovering to nearly 4% per annum from the mid-1990s. Meanwhile demand for natural gas continues to grow steadily. The relative acceleration in demand for metals and energy contrasts with the slowdown in demand for most agricultural products over the past 50 years.

The impact of strong demand for oil on the cost of agricultural inputs, particularly fertilisers, is shown in figure 10. During 2004-2010, average world agricultural prices grew by 50% compared to the average of 1986-2003. By comparison energy prices jumped by 220% and fertiliser prices by 150 % over the period.

Figure 10: Recent trends in commodity prices.



Source: Own calculations, based on World Bank data.

4. Have prices become more sensitive to stock changes in recent years?

Since sudden variations in supply impact on the level of commodity stocks, we also explored the link between commodity prices and changes in stocks. We looked at the responsiveness of world prices to changes in the stocks-to-use ratio from 1961-2008 for wheat, soybeans, maize, sugar and rice to see whether this relationship changed over the same twelve year periods previously identified. This analysis points to differences in impact of stocks on prices, depending on the commodity.

Prices for the main food crops; maize and wheat, are strongly and inversely linked to changes in stocks-to-use ratios. When this ratio increases, for example as a consequence of strong supply and/or low demand, prices tend to decrease, while the opposite is true when the ratio drops.

For these food crops, there is evidence of increasing price elasticity in response to stock movements, more than doubling since the mid eighties. The correlation of prices to stocks-to-use for wheat in particular has grown strongly from just 2% price elasticity for a 10% change in the stocks-to-use ratio, until the mid-1980s, rising to 14% thereafter (see figure 11).

Prices for wheat and maize show increasing response to changes in stocks

Meanwhile soybean prices have a very low correlation with stock changes, for a number of reasons. Traditionally world stocks have been low (e.g. there is no public intervention in the EU). In addition thanks to production in both the northern and southern hemispheres, weather effects on supply are less pronounced than for some other commodities.

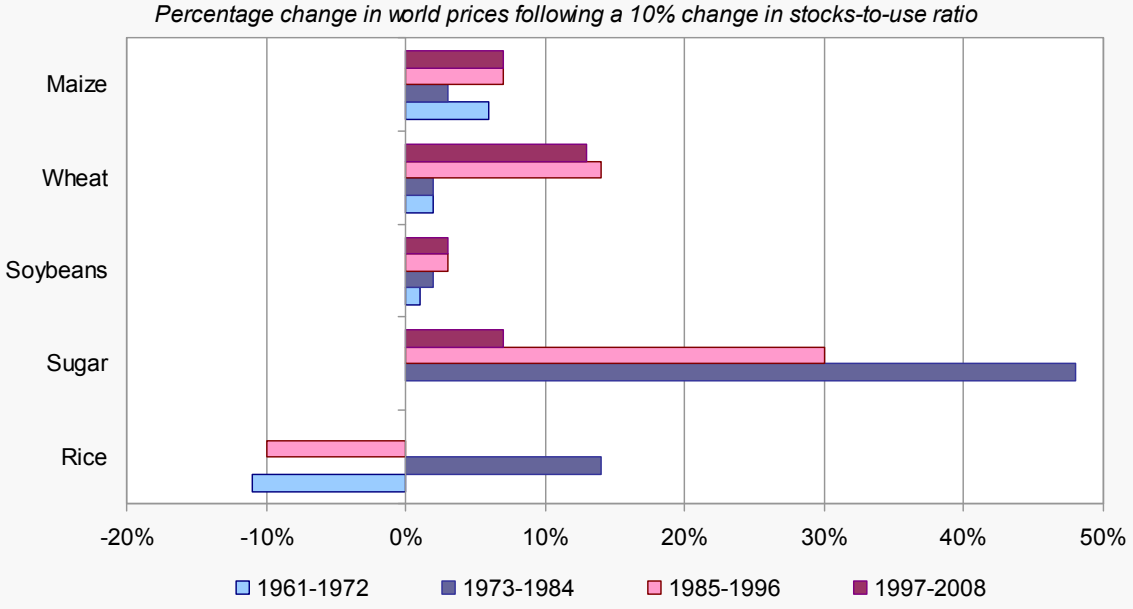
Sugar prices on the other hand, were more sensitive to stock changes in the 1970s and 1980s than recently[6]. From 1973-1984, in the aftermath of two energy shocks, they showed a correlation with oil prices, possibly linked to ethanol. During that period the sensitivity of sugar prices to stock changes was very high, with a 10% change in stocks-to-use leading to a 48% elasticity in prices. Sensitivity was still very high in the 1985-1996 period, but declined from 1997-2008. However analysis of more recent data from 1997-2010 shows a return to higher price elasticity.

Rice was also analysed but no significant linkage between stock-to-use ratio and prices has been found.

While some attribute the increased responsiveness in recent years to the fact that stock levels have fallen over time, to reach historically low levels recently, available data (averaged out over 12-year intervals) show that for most commodities, actual stocks-to-use ratios have remained around long-term averages and in some cases they have even increased over time (from 1997-2008).

[6] Data on stocks-to-use for sugar from the same source, was not available for 1961-1972.

Figure 11: Price elasticity in response to stock changes.



Source: Own calculations, based on FAO, International Sugar Organization and World Bank data.

Note: We conducted regression analysis of changes in world prices to changes in the stocks-to-use ratio for wheat, soybean, maize, sugar and rice from 1961-2010.

5. Is there a spillover effect from other markets?

Our analysis confirms that changes to the fundamentals of agricultural markets, e.g. higher yield variability, rising demand and growing sensitivity to stock changes are all factors which contribute to upward pressure on prices and explain to a large extent the increase in price volatility, but they do not tell the whole story.

Factors outside of agriculture strongly influence volatility in agricultural markets

Other factors outside of agriculture are at play and can contribute to explaining the volatility observed in agricultural markets. The G20 report on Price Volatility identifies a number of factors including fluctuations in demand for agricultural non-food commodities and the increasing correlation between oil and agricultural markets. Higher and more volatile oil prices filter through to agricultural prices (due to input costs and the biofuels outlet for agricultural commodities). This may also stem from a sharper linkage with financial investment in commodity markets.

6. What conclusions can be drawn?

There is a general consensus that both higher output and input prices in agriculture are here to stay. Price volatility has increased markedly and is also expected to remain high, at the same time as productivity growth has slowed down. Based on our analysis it is clear that changes to the fundamentals of agricultural markets have contributed to upward pressure on prices and go some way towards explaining the rise in price volatility but they do not give the full picture. The link to developments in other commodity sectors should be explored further.

Since the causes of price volatility are multiple and varied, this does not lend itself to simple solutions. Despite some common factors that appear to be at play across and beyond commodity markets, there are specific factors related to agricultural production (linkage to food security and the environment, dependency on life cycles, weather and seasons, sanitary conditions) which further complicate the potential impact of policy.

The scope for agricultural policy measures to address the causes of agricultural price volatility is further constrained by the presence of price co-movement across commodities. In the short term, efforts should be concentrated on improvement in market transparency particularly on public stocks and dissemination of relevant information throughout the food chain, which could play a significant role in reducing price fluctuations. In the longer term, the sustainability and competitiveness of agriculture depend upon innovation and agricultural productivity growth.

Efforts should be concentrated on improvement in market transparency and attempts to reverse the slowdown in agricultural productivity growth