Speculation and the Recent Agricultural Price Spikes

Executive Summary

High agricultural prices in recent years have prompted a lively debate. Why did prices spike? How should governments react? Some have pointed the finger at speculators. They argue that a 'wall of speculative money' has driven price increases. They argue that movements in supply and demand in food markets are simply insufficient to explain recent price spikes, and that something else (speculation) must have been a key driver, before arguing for limits on speculation.

This debate really matters because agricultural markets and food prices really matter. High and volatile agricultural prices fuel inflation and increase the cost of living. They also threaten food security in poor households, especially in the poorest countries, whilst higher food price volatility makes it riskier for farmers to invest to produce. But ill-informed regulation is generally counter-productive. Before debating whether or how to regulate markets in a certain way, we need to understand what has happened in those markets and why.

Agriculture relies on variable climatic and biological processes which result in yield variability and supply lags. At the same time, food is a basic human requirement and food demand is therefore relatively unresponsive to price movements. The result is a propensity for agricultural price variability. This means that farmers face a fundamental problem. High prices at planting time can turn into low prices by harvest. In parallel, many livestock farmers rely on grains and oilseeds to feed their animals. Together with food processors, they face the risk that grain prices may increase sharply and unexpectedly, squeezing margins.

If they are to invest in food production, farmers and others in the food chain need to manage their price risks. There is a range of ways of doing this (e.g. diversification, part-time farming, storage, forward contracts and the use of credit markets) but agricultural futures and options are some of the most flexible and important.

Agricultural futures markets and traders *do not* trade agricultural commodities. They *do* trade promises to sell or buy a certain quantity of commodities in the future at a particular agreed price. These markets provide a sort of price insurance. They allow farmers to have greater certainty about the price for some of their crop even as they are planting it.

Price movements in futures markets also send vital price signals, even if the message can be unwelcome. These help farmers to choose which commodities to produce, and to put the world's agricultural land to its most productive use. So for example, in early 2008, stocks in the big wheat exporters were tight, and the size of the next crop was going to be critical. High futures prices for wheat resulted in a big expansion in production. In the largest eight exporters (85-90% of the international market) the 2007-08 increase was 23.5%, equivalent to a 12% increase in the global crop (elsewhere, taken as a whole, production was flat). Better weather conditions played a part - but so too did the decisions of farmers, such as how big an area to plant.

Without well-functioning futures markets in 2007/8, the price signal to farmers would have been unclear. Farmers would have had less scope to insure against the risks they faced. Wheat production in 2008 would have been lower and prices subsequently higher than they were.

Against the backdrop of climate change and growing global demand for food commodities, international agricultural prices may become more volatile over time. So the role of agricultural futures and options markets becomes even more important. But these markets rely on speculation.

There can be an intuitive appeal in arguments that suggest that speculators are to blame for price rises and volatility. But speculators do not have privileged access to guaranteed profits. They take risks and will often experience losses. Furthermore, they perform a critical function. In common with the providers of, for example, life and home insurance (who seek a profit from providing cover against the risks of personal misfortune), commodity futures markets perform a vital service for society. They provide a mechanism for the transfer of risk in respect of fundamental aspects of our lives (food and energy prices) from those who cannot afford to bear it (farmers, food processors etc) to those who can (speculators).

Regulation of agricultural futures and options markets designed to limit speculation, rather than focusing on ensuring orderly markets, could have perverse impacts. It could leave EU farmers, processors and traders less able to manage their price risk, less efficient, and less productive. So how far did speculation play a significant causal role in recent price spikes?

There is a very technical debate amongst those using statistical methods to look at this question. The data and the nature of the tests available make it extremely difficult to definitively prove things one way or the other. But we can also sense-check claims about the role of speculation by looking at what has happened in financial and agricultural markets.

First, how far does the 'wall of money argument' stack up? *In theory*, under certain circumstances, it is possible for speculation to cause prices to move out of line with market fundamentals. This could happen if there were large inflows of money relative to the rest of the market. Or it could happen because of 'herding', where speculators take similar views to each other. But is this what happened *in practice*? The data suggests a sceptical view.

It is true that the *value* of speculative positions grew substantially as prices spiked. But rather than causing price movements, this increase in value has, to a significant degree, been caused by price movements. For wheat, the *volume* of key speculative positions at important parts of the 2006-08 price spike was essentially flat.

Furthermore, for there to be a 'wall of money effect', higher futures prices need a mechanism to drag current prices up – an increase in stocks. Higher prices in the futures market would make it profitable to buy up stocks and hold them back from the market. This would reduce availability in the present, pushing up current prices. But in fact, projected stocks in the big exporters were falling, not rising, as prices increased. This is not consistent with arguments that speculation in futures markets was a key driver.

Second, is it really true that fluctuations in the production of grain are simply insufficient to explain recent food price spikes? The focus by some campaigners on aggregate global production and consumption ignores the way world markets work and is misleading. It is open to a range of fundamental criticisms.

It doesn't consider what happens in those countries most important for determining the world price. In fact, movements in projected production, consumption, and end-stocks in *major exporters* of wheat and other grains are such that it is not at all surprising that prices spiked (see charts 18 and 19 in the body of the paper), especially in light of *ad hoc* export restrictions in key countries in 2007/8 and, to a lesser degree, 2010/11. In 2008, six countries responsible for 38% of world wheat production and 20.7% of world exports

imposed export restrictions. In the same year, seven countries responsible for 62% of world production of rice and 50% of global rice exports imposed export restrictions.

The causes of the food price spikes, and the operation and regulation of agricultural futures markets are complex issues. But there are good reasons to be sceptical that speculation in futures markets has been a significant cause of food price spikes.

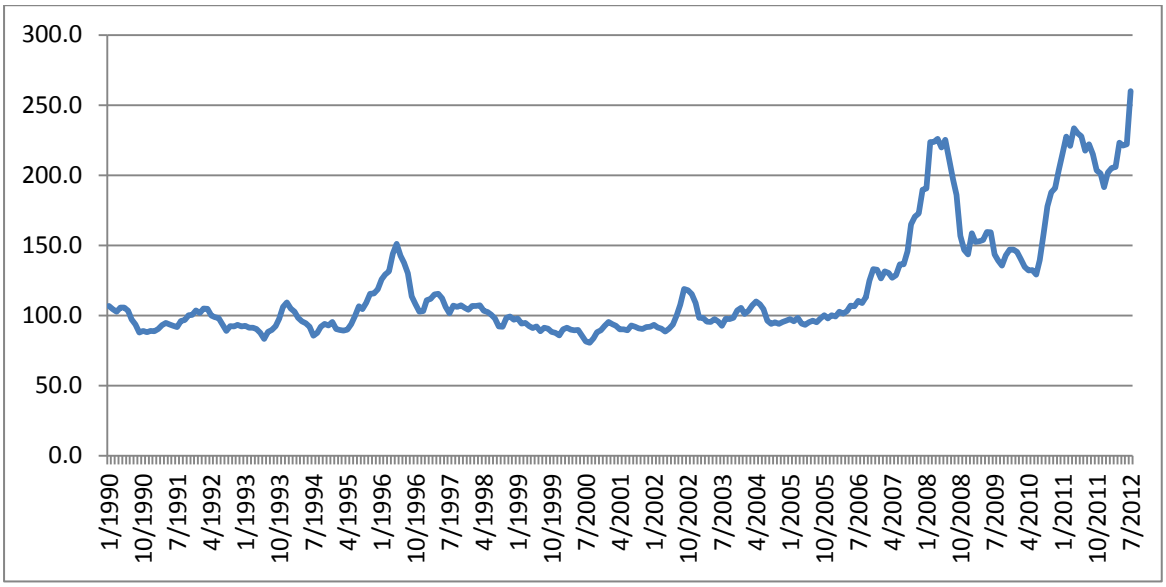
Some suggest that the precautionary principle points to pursuing limits on speculation. Such an approach risks complacency. It underplays the likely increased price risk in a world affected by climate change, and the critical role of speculation in allowing farmers and others to insure against the risks they face as they invest to respond to higher prices.

Finally, focusing on speculation distracts policy makers from the fundamental importance of increasing the efficiency, resilience, and responsiveness of the world's agricultural sector. It makes it easier to side-step important issues such as trade and subsidies, or the inflexibility of biofuel mandates.

1. Introduction

International grain prices have spiked three times in the last 5 years (see chart 1).

Chart 1. FAO Cereal Price Index (2002-2004=100)



Price volatility is intrinsic to agricultural markets. But high prices and volatility in agricultural markets present important macro-economic policy challenges. More fundamentally, they also threaten food security, especially in developing countries. Sudden, large, food price increases erode consumers' purchasing power, reducing calorie intake and nutrition, leaving more people hungry. The poor bear a disproportionate burden of adjustment to rising food prices. Higher food price volatility also lowers production responses to higher prices, especially in developing countries, with risk-averse behaviour leading to inefficient investment decisions.

Price spikes in international commodity markets have prompted an active debate in the G20 and other international *fora*, about the causes and the appropriate policy responses. In the EU, in the context of Commission proposals to reform the Markets in Financial Instruments Directive (known as "MiFID"), some have argued that the policy response should involve the introduction of *ex ante* position limits so as to restrict the share of open interest held by speculators in agricultural futures markets. Such proposals are based on two arguments:

- First, that speculation in commodity derivative markets has played a significant causal role in recent price spikes (and associated volatility) in international markets; and
- Second, that the introduction of position limits in these markets would prevent speculation from playing any such role in the future.

The first of these arguments is the subject of this paper.

Advocates of position limits express concern about speculators generally. But there has been a particular focus on so-called index funds which typically invest in long positions that are rolled forward before expiry of the futures contract.

Some commentators have argued that fluctuations in the production of grain are simply insufficient to explain international price volatility over the last few years (e.g. see Worthy, 2011[1], and Lagi et al, 2011[2]), and that a 'wall of speculative money' has had a distorting impact on agricultural commodity prices. Indeed, it is quite normal to see graphics similar to charts 2 and 17 presented prominently by those making such arguments.

But the 'insights' implied by these charts are extremely misleading. This paper considers a number of arguments commonly made by some of the most vociferous participants in the debate about the role of speculation.

Section 2 provides some background, explaining the importance of futures markets, how they function, and the role of speculators. Theory allows for the possibility, under certain circumstances, that speculation in futures markets could have an impact on prices in the physical market. Section 3 considers whether data from futures markets, and in respect of physical stocks, are consistent with suggestions that liquidity issues or herding may have had an impact. A further argument advanced, often the starting point for those arguing a significant causal role for speculation, is that supply and demand fundamentals in grain markets were simply insufficient to cause recent price spikes; the implication being that something else (speculation) must have been the cause. Such arguments are considered in section 4. Conclusions are drawn in section 5.

[1] Worthy M. *Broken Markets: How financial regulation can help prevent another global food crisis*, World Development Movement, 2011.

[2] M. Lagi, Yavni Bar-Yam, K.Z. Bertrand, Yaneer Bar-Yam, *The Food Crises: A Quantitative Model of Food Prices Including Speculators and Ethanol Conversion*, New England Complex Systems Institute, September 21, 2011.

2. Price risk and futures and options markets

Agriculture relies on variable climatic and biological processes which result in yield variability and supply lags. At the same time, food is a basic human requirement and food demand is therefore relatively unresponsive to price movements (see the discussion of elasticities in section 4). The result is a propensity for agricultural price variability. This means that farmers face a fundamental problem. High prices at planting time can turn into low prices by harvest. In parallel, many livestock farmers rely on grains and oilseeds to feed their animals. Together with food processors, they face the risk that grain prices may increase sharply and unexpectedly, squeezing margins.

If they are to invest in food production, farmers and others in the food chain need to manage their price risks. There is a range of ways of doing this (e.g. diversification, part-time farming, storage, forward contracts and the use of credit markets) but agricultural futures and options are some of the most flexible and important.

Futures contracts are similar to forward contracts except that they are standardised across the market. Any given futures contract will specify the type, grade and amount of commodity covered by the contract, and the location to which the contract relates. The only contract variable that changes over time is its price. Exchange traded futures contracts are subject to margin calls[3], and therefore substantially reduce counterparty risk compared to forward contracts. Futures are also more flexible than forward contracts. Because they are standardized, farmers, processors and traders can more easily adjust their positions after they have taken on the original position. But it is options markets that provide perhaps the most flexible and useful mechanisms for price risk management. The purchase of options is analogous to taking out insurance.[4]

Taking a simple example, farmers can sell July 2013 futures contracts amounting to one hundred tonnes of wheat - a legal promise to deliver that amount of wheat of a given quality at a given place in July 2013. Millers can buy these same contracts, promising to take delivery of this same quantity and quality of wheat at this time and in this place. By participating in the futures market, both buyers and sellers have limited ('hedged') their exposure to price movements in the future - they have committed to a particular price (the futures price) in respect of a proportion of their expected output or demands.

Both, however, forgo taking advantage of the possibility that the price subsequently moves to their benefit (a higher price benefiting the farmer, and a lower price benefiting the miller). To avoid such concerns, a more flexible approach would be to buy options. A ‘put’ option gives the farmer their own personal price floor for a specified tonnage of wheat, but allows them to sell elsewhere if prices in the physical market in July 2013 turn out to be above the price floor provided by the option. By the same token millers or livestock farmers could buy call options. They would be covered against the possibility of prices rising above a specified

[3] Those buying or selling futures will typically have to post a financial margin. If the futures price rises (falls) subsequently then those who sold (bought) futures contracts will be obliged to increase the size of the margin. This helps to reduce the risk of default and hence counter-party risk, but can have significant cash flow implications.

[4] Options give the purchaser the right but not the obligation to purchase (‘calls’) or sell (‘puts’) a specified amount of produce at the price set in the option on a certain date, so allowing processors to secure a price ceiling (via calls) and producers a price floor (via puts) for a given tonnage for an up-front full and final payment (there are no margin requirements for purchasers of options). The cost of the option will vary depending on how close the strike price is to prevailing futures prices, the level of price volatility, and the length of time before the option matures.

level but would be free to benefit if prices in the physical market turn out to be lower when the option expires.

Trades will take place on the futures market where there is a match between the price at which potential buyers are prepared to buy and potential sellers of futures are prepared to sell. Buyers of course have no interest in paying a price for futures that is higher than the price they expect to see in the physical market when the futures contract expires. Likewise, sellers have no interest in accepting a futures price that is lower than the price they expect to see in the physical market at contract expiry.

Over time, as more information becomes available (rain or drought in key production areas, changing exchange rates etc), expectations about where prices in the physical market will be in July 2013 will change. So trades of the July 2013 contract will take place at different prices reflecting these changes.

A well-functioning futures market needs participants to have confidence that the price at which the July 2013 futures contract expires is closely related to the price in the physical market in July 2013. This is achieved either by cash-settlement (based on prevailing physical market prices for wheat of the same quality and location) or by going to physical delivery (those who had been net sellers of an expiring contract will be expected to deliver the appropriate quantity of the right grade of wheat to specified locations in settlement of the 'short' position they took – those who had been net buyers of the July 2013 contract (holding 'long' positions) would take delivery.

In practice, especially in more mature futures markets, the vast majority of positions (open interest) is closed out (bought or sold back to cancel the original commitment – albeit the contract price will have moved in the interim) before the contract expires. Both cash settlement or physical delivery at contract expiry ensure that those trading the July 2013 wheat contract remain focused on changing expectations of the physical market value of wheat as of July 2013, even if only a very small proportion of such contracts are settled in this way.

A well-functioning futures market needs many potential buyers and sellers (the market needs to be 'liquid'), so that those wishing to hedge (or adjust their hedge) can do so quickly at prevailing prices. But if only farmers and millers were participating in the futures market it would not be sufficiently liquid. There would often be a mismatch between the size and timing of the hedges that farmers and millers might wish to undertake. So a key characteristic of a well-functioning futures market is the presence of speculators.

Speculators

A speculator can be defined as "an investor who purchases/sells a futures contract in order to sell/purchase it later (usually before expiry) for the purpose of profiting from the intervening price changes. By doing so the speculator frequently acts as a counter-party to hedgers (producers and buyers) and assumes risks."[5] The European Commission notes, for example, that "speculation is a feature of any efficiently functioning market and speculators are present in financial markets at all times".

[5] European Commission (2008). *Is there a speculative bubble in commodity markets?* Commission Staff Working Document. Task force on the role of speculation in agricultural commodities price movements.

The risk that one cannot hedge at prevailing futures prices because of insufficient (potential) buyers or sellers are reduced as the liquidity and depth of the market is increased; thus making it cheaper for farmers, commodity buyers and intermediaries to participate. Speculators are the main source of this liquidity.

Speculators involved in the commodity markets can be split into two broad categories; 'traditional speculators' who move in and out of the market, taking long or short positions depending on the level of market prices relative to their expectations of future price movements (this can be individuals or hedge funds), and 'index funds', through which investors/speculators typically take a long passive position in the commodity futures markets. Index funds have become popular vehicles for speculation and investment in commodity markets in recent years, and this 'new' class of index-investors in the futures markets has grown considerably in importance.[6]

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So, agricultural futures markets and traders *do not* trade agricultural commodities. They *do* trade promises to sell or buy a certain quantity of commodities at a specific time in the future at a particular agreed price. This has an important implication. If one futures market participant buys futures contracts so that he or she goes 'long', for example, by one hundred tonnes of wheat (and other participants go 'short' by the same amount), this creates more open interest (the volume of outstanding contracts), and implies increased hedging against (or increases speculative exposure to) the financial consequences of changing future valuations of one hundred tonnes of wheat. So there is a transfer of price risk. But crucially, such activity on the futures market does not create one hundred tonnes of wheat or remove it from the physical market. By the same token, if an individual takes out additional insurance on his or her home, it does not create more homes, or remove homes from the market. It simply signifies a transfer of risk from the person taking out insurance to the insurance provider.

Key benefits of futures markets

Agricultural futures and options markets play a number of important roles that go beyond allowing individual farmers and other businesses in the supply chain to manage price risk. They benefit the agricultural sector, and broader economy by:

- mediating the relative incentives to use or store 'old crop';
- spreading agricultural risk beyond agriculture and more evenly around the economy;
- generating more transparent price formation and discovery than might otherwise be available[7], and allowing farmers, processors and traders to plan, budget, raise money in capital markets, and invest with greater certainty; so

[6] Index-investors regard commodity futures as an "asset class" comparable to equities, bonds, real estate and emerging market assets and useful in diversifying their portfolio. They take positions on commodities based on the risk-return properties of portfolios containing commodity futures relative to those confined to traditional asset classes. The weight given to various categories of commodity can vary, but agricultural commodities generally account for about 15-45% of the value of an index with the rest going to energy and metals.

[7] For example, the establishment of the Johannesburg based SAFEX white maize contract in the mid 1990s (and now widely recognized as the key reference price for white maize) brought transparency to an international market that had, hitherto, been regarded as opaque.

- facilitating more efficient and flexible use of available agricultural resources.

These benefits are practical and tangible. For example, in late 2007, projected wheat end-stocks in key exporters were low and falling. The size of the next crop was going to be critical. High futures prices for wheat resulted in a big expansion in global production in 2008 (12% higher than in 2007). This increase was concentrated in the largest eight exporters (85-90% of the international market) where production rose by 23.5%. By contrast, in the rest of the world, taken as a whole, production was flat, often because farmers were not linked in to world markets. For example, China and India together account for 29% of the world's wheat production (over 50% of rice production), but their wheat and rice farmers are largely isolated from world price signals.

Better weather conditions played a part in the 2008 wheat harvest - but so too did the decisions of farmers, such as how big an area to plant. Without well-functioning futures markets, the price signal to farmers would have been unclear. Farmers would have had less scope to insure against the risks they faced. Wheat production in 2008 would have been lower and prices subsequently higher than they were.

This demonstrates the benefits of an agricultural sector that is market-oriented and well integrated with financial markets.

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Against the backdrop of climate change and growing global demand for food commodities, international agricultural prices *may* become more volatile over time. So the role of agricultural futures and options markets (and the speculators that keep them liquid) may become even more important than it is currently.

However, in recent years, in the face of a number of significant price spikes in international grain markets, there have been calls to limit the role of speculators in these markets, based in part on the view that speculation has been a significant cause of these spikes. This view, and related issues, is the subject of the rest of this paper.

3. Growing speculation and changing market structure in agricultural futures markets

Two key strands of the 'speculation debate' are suggestions that:

- Increased levels of speculation have damaged markets and distorted prices in both the futures and spot markets; and
- Supply and demand fundamentals in the physical market have been insufficient to explain the sort of spikes seen.

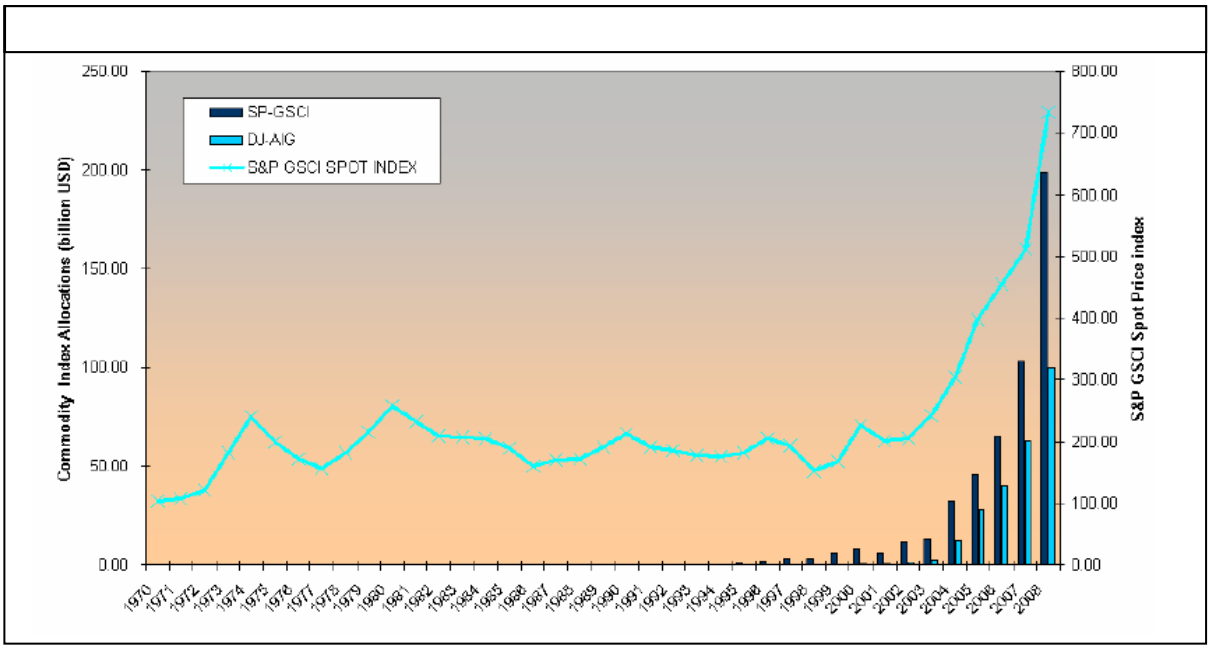
This section considers the first of these strands, and the following specific questions:

- What has happened to the *volume* (as distinct from the *value*) of index fund positions in key agricultural futures contracts?
- How far has the structure of these markets changed, and does this necessarily matter?
- How consistent are recent market developments with what we might expect to have seen if futures prices had had the negative effects on physical markets that have been alleged?

The growth in index fund positions – value vs volumes

Graphics similar to Chart 2 have been used to suggest that the increased value of positions held by index funds (represented by the vertical columns) has driven movements in international commodity prices (the blue line).

Chart 2: Commodity Price Movements (rhs) and Index Fund Asset Values (lhs)

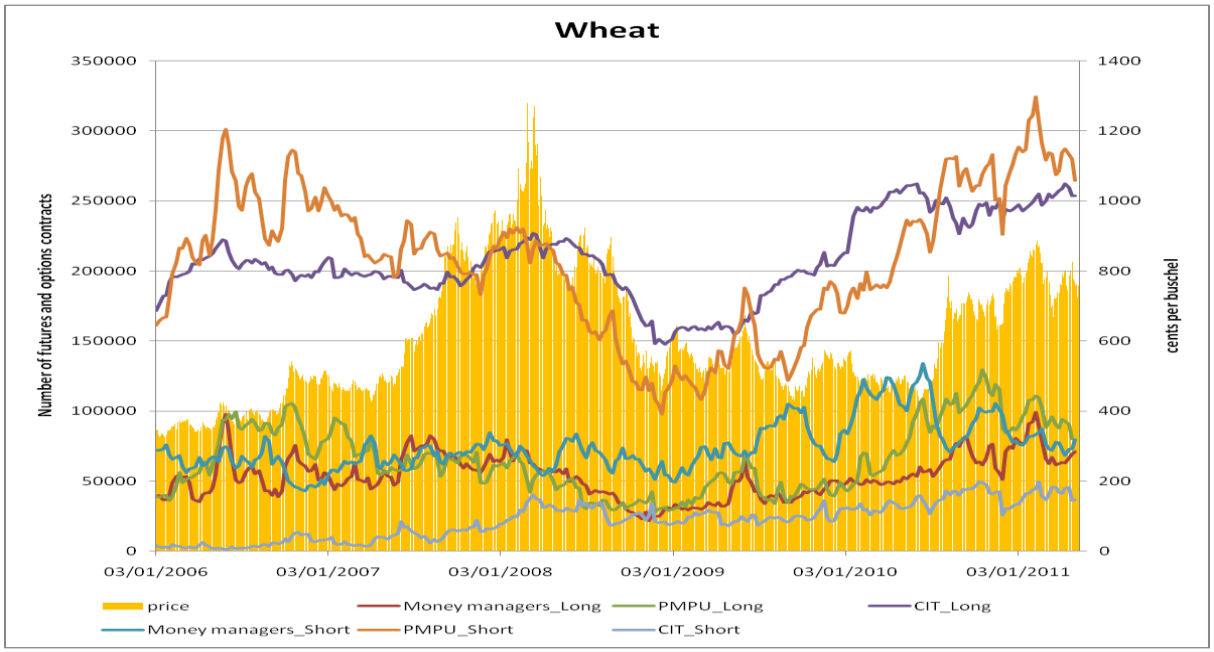


Source: HMG (2010)[8]

[8] HMG (2010). *The 2007/08 Agricultural Price Spikes: Causes and Policy Implications* (Annex 6 *Speculation and the food price spikes of 2007/08*).

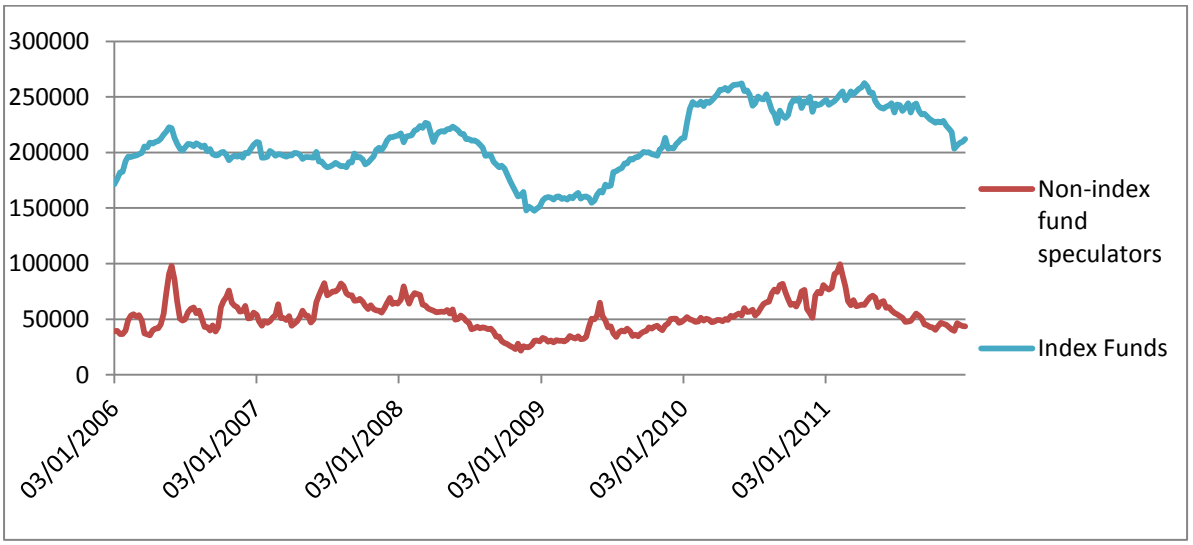
But such suggestions gloss over important issues about cause and effect. Just because two data series both increase over a number of years does not necessarily mean that one is causing the other. But if there is causation, in could run in the opposite direction. Prices rising to the extent shown in chart 2 will increase the value of long speculative positions even if the volume of contracts held by speculators is completely static.

Chart 3: CFTC data on CBoT wheat open interest by class of market participant[9]



Data source: CFTC COT supplemental reports

Chart 4. CBoT Wheat: Speculative Long Open Interest (contracts) excluding spreads



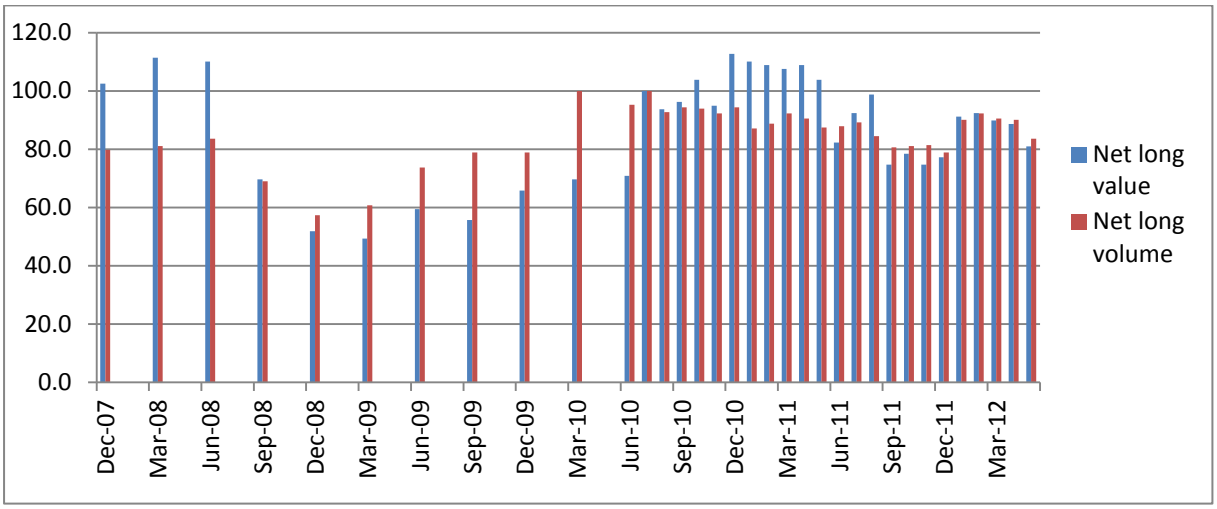
Data source: CFTC COT supplemental reports

[9] In the legend of Chart 3, 'CIT' refers to index funds, 'money managers' refers to speculators other than index funds, such as hedge funds and others at liberty to move swiftly between long and short positions, and 'PMPU' relates to commercial individuals and organisations participating in the supply chain (farmers, silo operators, processors etc) who need to hedge their exposure to price risk.

If index funds were responsible for a significant part of the grain price spikes, a necessary (but not sufficient) condition would be to see a clear rise in the *volume* of long 'open interest' held by index funds.[10] But the level of index fund open interest for wheat (dark blue line in chart 3), for example, was relatively stable between 2006 and 2008 even as wheat prices rose. For ease of reference chart 4 isolates data on speculative long open interest in CBoT to illustrate the same point.

However, as the CFTC points out, the data it presents on index funds in its COT supplemental reports, although an improvement on previous reports, are still subject to a number of caveats. In particular, if a preponderance of a trader's trading is index related, then all of the trader's positions get classified as index related for COT Supplemental purposes.[11] The CFTC has, therefore, required relevant organisations to provide more specific information (value and volume of index fund positions) on a monthly basis from mid 2010 (earlier such data is available on a quarterly basis from late 2007).[12]

Chart 5. CBoT Wheat Futures Index Fund Open Interest (July 2010=100).



Data source: CFTC index investment data

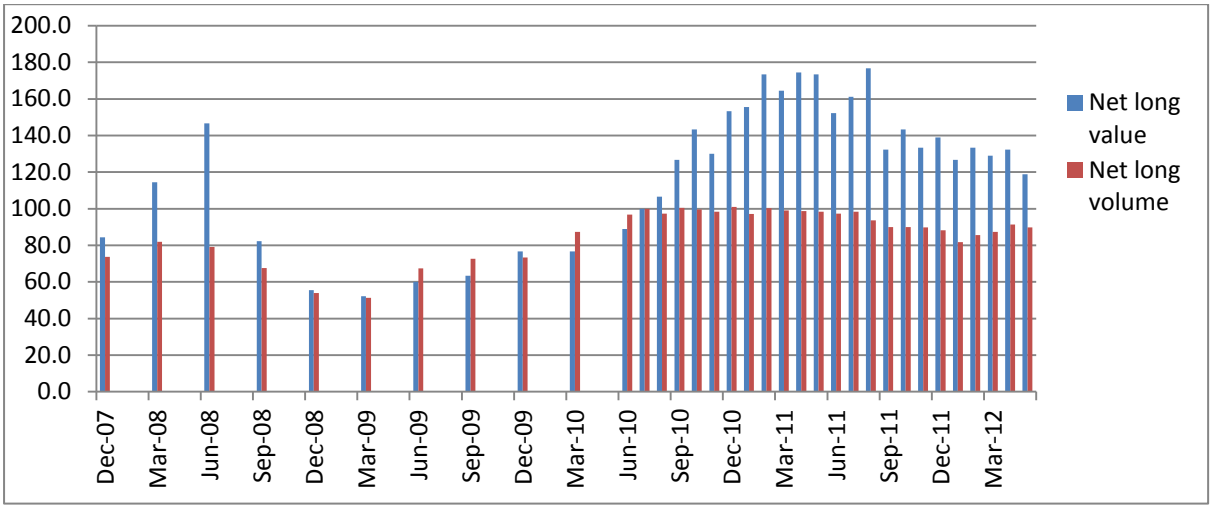
[10] Open interest is the total of all futures contracts entered into and not yet offset by a transaction or by delivery. The aggregate of all long open interest is equal to the aggregate of all short open interest.

[11] In January 2007, the US Commodity Futures Trading Commission (CFTC) began publishing Supplemental reports to its weekly Commitments of Traders report, which shows 'Index Trader' positions in selected agricultural markets. This data (the COT Supplemental) classifies all the positions of a trader engaged in commodity index trading based upon the preponderance of the trader's trading strategy. That is, if a preponderance of a trader's trading is index related, then all of the trader's positions get classified as index related for COT Supplemental purposes. As a result, the published aggregate figures may overstate or understate the actual amount of index trading (overstate to the extent that the positions also include other trading strategies, and understate it to the extent that index positions are internally netted off before the net position is brought to the futures markets). These shortcomings are explicitly acknowledged by the CFTC. They mean that the data should be treated as indicative.

[12] The monthly index investment data is more comprehensive than the COT Supplemental in that it covers more than just selected agricultural markets. However, it is published less frequently and less close to the 'as of' date than the COT Supplemental. The data is more precise than the COT-Supplemental data, but as the CFTC points out, it is still subject to a number of caveats. For example, CFTC staff did not independently examine the original books and records of each entity responding to the 'special call', and it is possible that entities with relevant information have not yet been identified by the CFTC staff and that some small traders may have relevant information not included. Nevertheless, the CFTC is clear that the index investment data represents its best effort to provide a one-day snapshot of the positions of swap dealers and index funds (the figures do not reflect trading activity or position changes taking place during each month).

Charts 5 and 6 present such data for CBoT wheat and maize respectively. The data is only available from December 2007 and so sheds relatively little light on the period 2006-07. Nevertheless, these charts illustrate that net volume positions held by index funds are generally much more stable than net value positions. In chart 6, for example, the net long volume of open interest accounted for by index funds in the year from July 2010 was effectively flat, even as the value of these positions increased with the price of maize.

Chart 6. CBoT Maize Futures Index Fund Open Interest (July 2010=100).



Data source: CFTC index investment data

All of this illustrates the problem with assertions that charts such as Chart 2 imply that higher values of open interest drove prices. Charts 3 to 6 suggest that any causation may well have run in the opposite direction.

The changing structure and composition of agricultural futures markets

Some commentators note the changing structure of commodity derivative markets (especially the increased role of index funds over the last 10-15 years), suggesting that this is necessarily a concern (Worthy, 2011, Finance Watch, 2012, Masters, 2010)[13] [14].

But the short side of the market is also important. Over the last six years, the balance between long open interest held by speculators and short open interest held by the commercial side of the market has been relatively stable. Indeed Table 1 (where footnote 11 is also relevant) shows that during the period 2006-2011, commercial hedgers on the sell side of the market accounted for 40%-50% of open interest in maize and 36% to 48% of open interest in wheat. Long positions held by index funds ranged from 39% to 44% of open interest during this period for wheat, and a more modest 21% to 28% for maize.

[13] Finance Watch: *Investing not betting: Making financial markets serve society* – a position paper on MiFID 2/MiFIR, April 2012

[14] Testimony of Michael W. Masters before the Commodities Futures Trading Commission, March 25, 2010

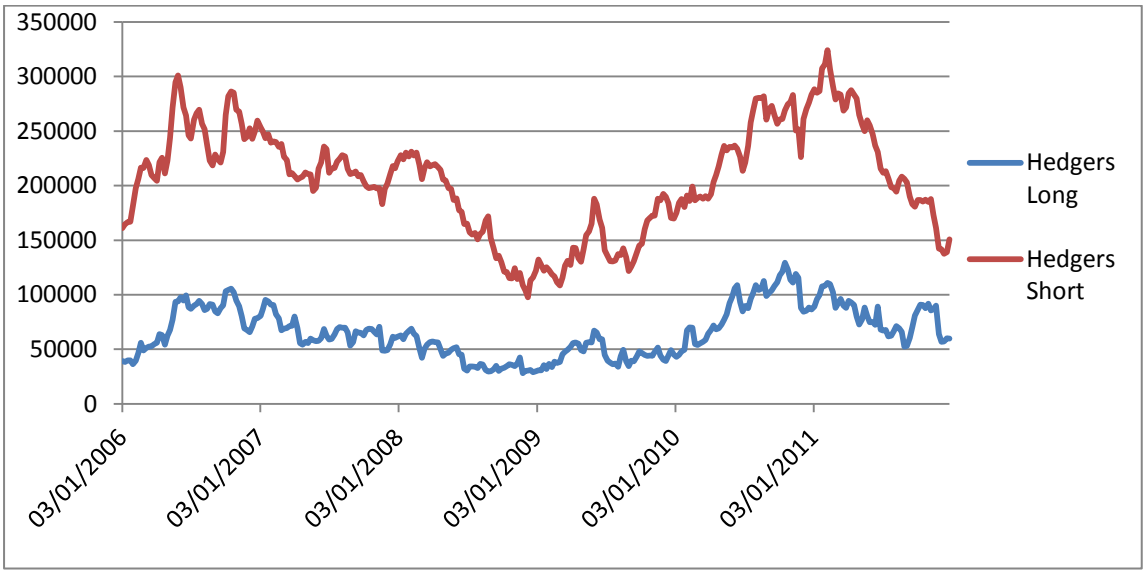
Table 1. Shares of Open Interest on CBoT markets

	MAIZE		WHEAT	
	Index Fund Share of Long Open Interest	Hedgers Share of Short Open Interest	Index Fund Share of Long Open Interest	Hedgers Share of Short Open Interest
2006	**26%**	**47%**	**41%**	**48%**
2007	**21%**	**50%**	**39%**	**43%**
2008	**21%**	**46%**	**42%**	**36%**
2009	**27%**	**40%**	**44%**	**36%**
2010	**28%**	**44%**	**43%**	**41%**
2011	**23%**	**45%**	**42%**	**41%**

Source: Calculations using CFTC COT supplemental data

Indeed, chart 7 illustrates that there is much more hedging on the short side of the market than on the long side. It follows that significant net long speculative positions are required to facilitate hedging on the short side of the market.

Chart 7. CBoT Wheat: Open Interest (contracts) Held by Hedgers

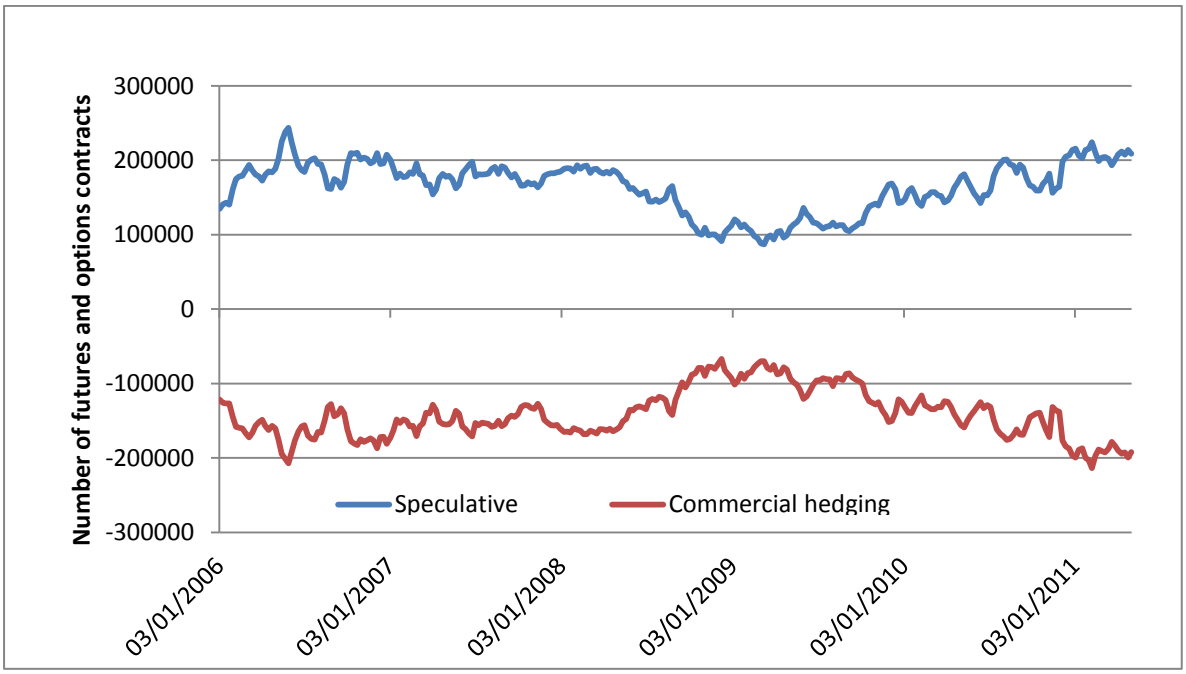


Data source: CFTC (COT Supplemental)

Meanwhile, the net long positions held by speculators (blue line in chart 8) and the net short positions held by commercial hedgers (red line) participating on the CBoT wheat market mirrored each other and were relatively stable between 2006 and 2011.

All of this reinforces two obvious but fundamental points. First, for every long position held (whether by speculators or 'commercials') somebody else has seen fit to take the opposite short position. Second, the net short position held by hedgers needs to be balanced by a net long position held by speculators.

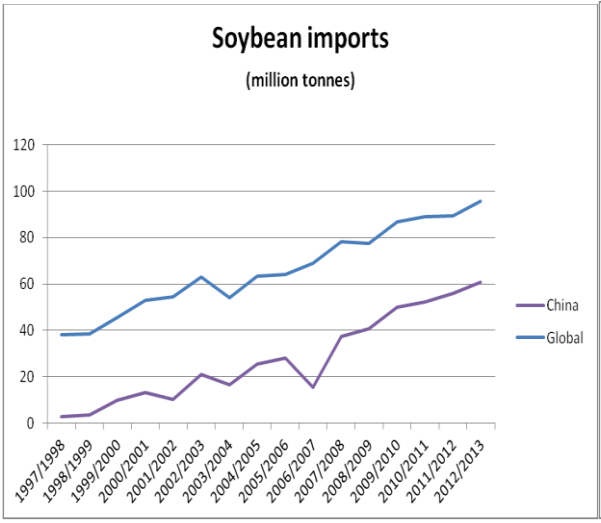
Chart 8 – Net speculative and net commercial positions in wheat (CBoT)



Source: Calculations using CFTC data

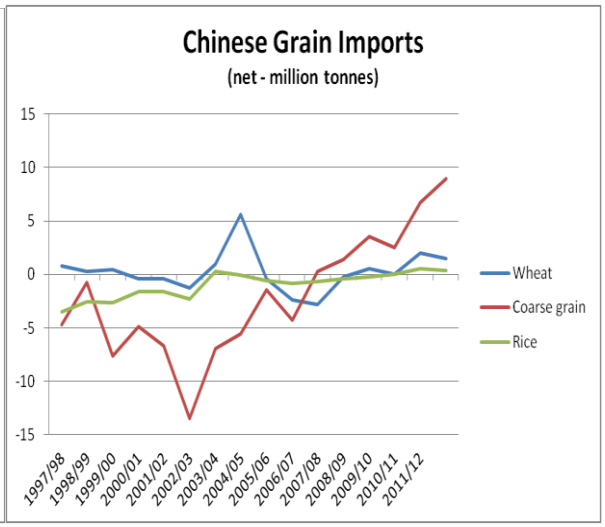
Speculators can only accumulate net long positions to the extent that other speculators or hedgers are willing to be net short at prevailing prices. Potential hedgers are not compelled to use the futures market. They always have the option to try to manage their price risk by other means. As noted in section 2, those with open interest in a futures contract (whether they be long or short) have the option of closing out their positions as the contract nears maturity, or, if they feel that the prevailing prices do not reflect spot market conditions, they can opt to go to physical delivery, so providing a crucial discipline that keeps the futures market focused on supply and demand fundamentals. Furthermore, changing structures in the derivative markets need to be seen in a broader context of constantly changing market structure in the physical market.

Chart 9



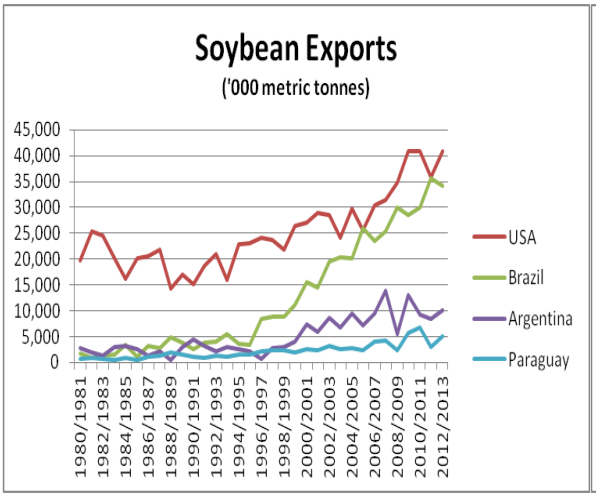
Source: USDA data

Chart 10



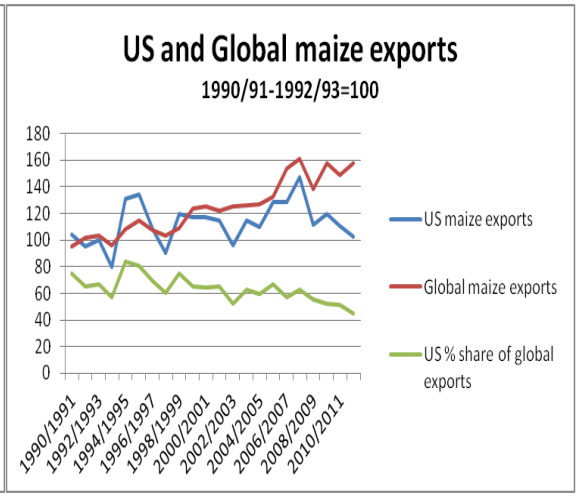
Source: USDA data

Chart 11



Source: USDA data

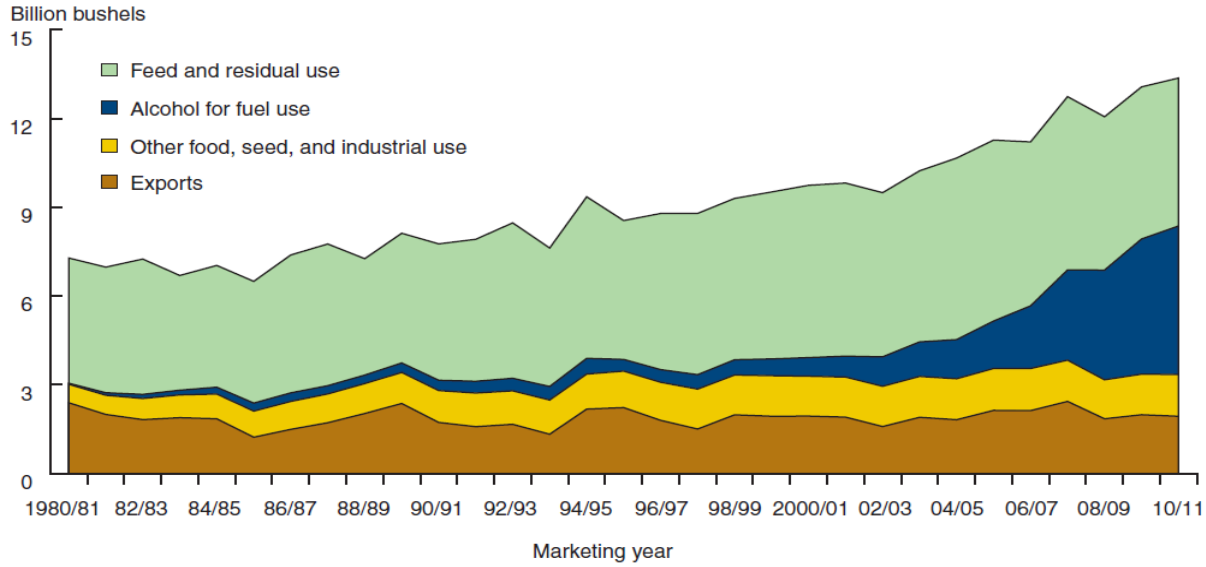
Chart 12



Source: USDA data

So for example, whilst it continues to be the case that the main international flows of grain and oilseeds are from North and South America to Asia and to Europe, the structure of world markets is changing apace. China is a modest participant in international grain markets, but its imports of soybeans have grown rapidly over the last fifteen years and now account for just under two thirds of the international market (chart 9), whilst it is possible, though by no means certain, that China could become a significant net importer of maize (see chart 10) if recent trends continue.[15] At the same time, Brazilian exports of soybeans are now as important as US exports (chart 11) and it appears that US exports of maize may not be keeping up with the growth in international import demand (chart 12), at least in part because of the rapid growth in the share of US maize production going to biofuel production (chart 13).

Chart 13. US use and exports of maize

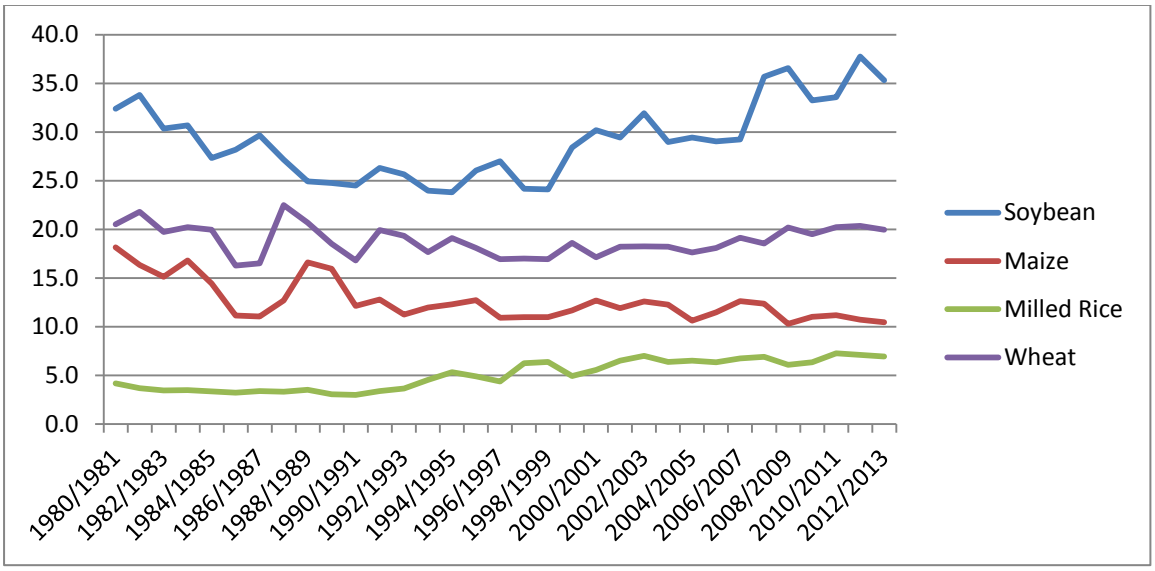


Source: USDA, Economic Research Service.

[15] See Wiggins, S., and Keats, S. (2012) *Food Prices March 2012 update & Annual Review April 2011 to March 2012*, Overseas Development Institute.

The precise market structure is not important *per se*. What matters is that markets are contestable and efficient, with prices reflecting the fundamentals of supply and demand. That said, there are risks (of increased volatility) if changing market structure results in thinner world markets, because thinner markets have less scope to absorb any given production shock.

Chart 14. Proportion of Global Grain Production Traded Internationally (%)



Data Source: USDA

Indeed, whilst the share of global soybean production that is traded internationally has risen appreciably over recent years, the share of global maize production traded internationally has fallen substantially, towards the low levels of trade in the rice market (chart 14).[16]

Does the evidence corroborate the potential theoretical mechanisms?

As noted in section 2 trades by wheat futures market participants do not create wheat or remove it from the market. Nevertheless, economic theory is clear that futures markets can potentially affect spot prices through their impact on physical stock levels. The mechanisms would be (1) increasing futures prices, so (2) increasing the incentive to increase stock-holdings, so (3) reducing the supply available to the spot market, and thereby (4) sending spot prices higher.

This could happen for rational market related reasons. For example, if a good harvest is followed by expectations of a subsequent poor harvest, futures prices may rise to the point where the spot price plus storage and financing costs are low compared to the futures price so encouraging inter-season storage. Such reallocation to the future would tend to reduce the amount of the commodity available in the current year, so raising spot prices, but smoothing the impact of the coming poor harvest.

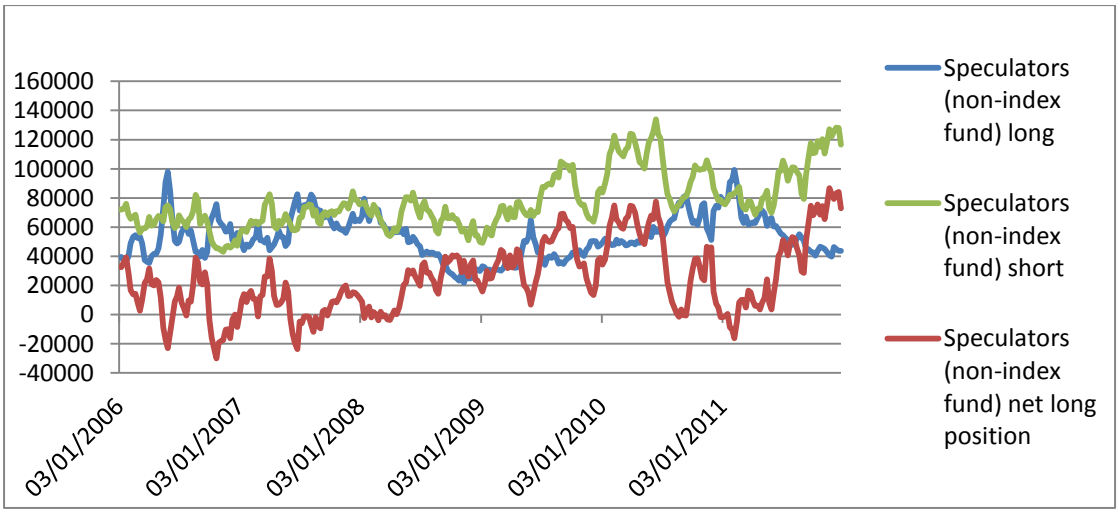
Or it could happen, in principle, because of a weight of money impact. For example, if market liquidity is low, then the influx of large amounts of money bidding for long positions might drive prices beyond levels indicated by available supply and demand data, because a

[16] Taking the longer view, Liapis (2012) demonstrates that for most of the commodities he examines from 1970 to 2010, markets have not become thinner. See Liapis, P. (2012), "*Structural Change in Commodity Markets: Have Agricultural Markets Become Thinner?*", OECD Food, Agriculture and Fisheries Working Papers, No. 54, OECD Publishing.

limited number of potential sellers in the market might only be prepared to go short at higher prices. Of course, such an impact would be against the interests of those investing in index funds. They would be taking on long positions at a price above 'fair value'. But in principle, with low levels of liquidity, such an impact is possible; likewise with 'herding'. However, charts 3 to 8 call into question suggestions that a wall of speculative money drove prices. At the same time chart 15 shows that hedge funds (money managers) have had long and short positions. If there had been herd behaviour we should expect to see money managers suddenly, and collectively, shifting to long or short positions. Chart 15 shows how short and long positions held by speculators other than index funds moved during the period 2006-2011. The position is complicated. But chart 15 does illustrate a diversity of view amongst (non-index fund) speculators who are, as a group, generally net long, so helping to balance the generally net short position taken by hedgers. The net long position of (non index fund) speculators as a group also demonstrates (the red line) a considerable degree of variability and suggests that, as a group, speculators have not always benefited from the positions they have taken (see the fluctuation in net positions during 2006-08 as prices were rising, and the increasing net long position from early 2011 even as prices fell).

Furthermore, the mechanism whereby we would expect to see the futures market impacting the spot market would be increasing stocks. However, charts 18 and 19 in section 4, and the charts presented in Annex A, show very clearly that projected end-stock levels in the world's main exporters of wheat and coarse grains were falling as prices rose. In short, the data on stocks also appears to be inconsistent with suggestions that long speculative positions in futures markets have been inflating spot prices.

Chart 15. CBoT Wheat. Open Interest Held by non-Index Fund Speculators

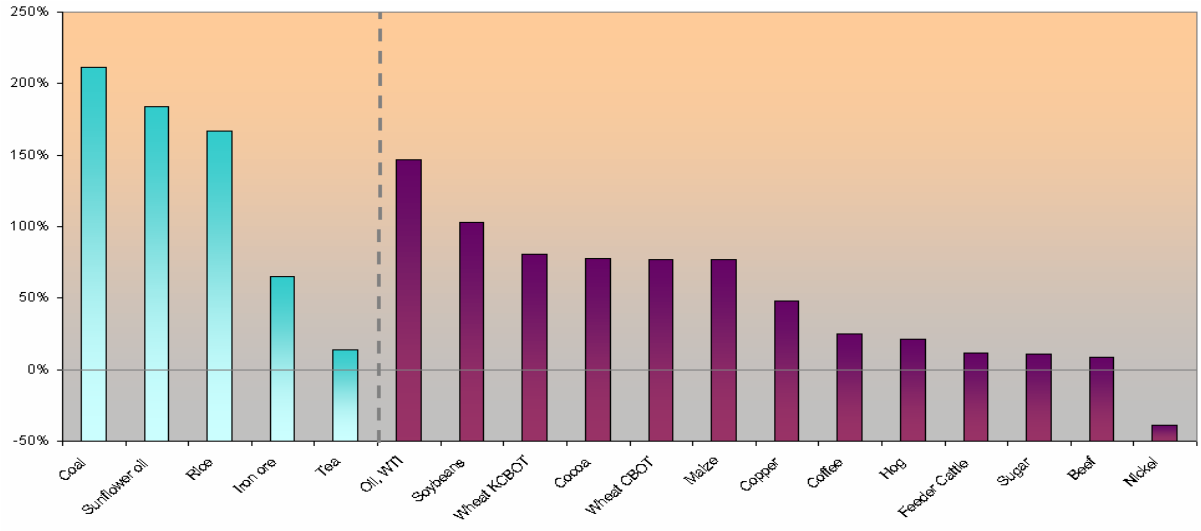


Data source: CFTC COT Supplemental

At the same time, if speculators in commodity derivatives markets were driving price movements, one might expect to see a difference between those commodities that are traded on derivatives markets and those that are not. In fact, such a difference is not apparent. If anything the increases during the 2007/08 spikes were higher for commodities without a significant derivatives market. Rice is a particularly important example. As demonstrated by chart 16, commodities for which futures markets are either negligible or non-existent or which are not traded by popular commodity index funds also saw very significant price increases in 2007/08. If speculation in futures markets was a significant

causal driver of price increases, one might expect to see a clear difference between the two categories.

Chart 16. Price changes in selected exchange traded commodities (purple) and non-exchange traded commodities (turquoise) 2007-2008



Source: HMG 2010[17]

Finally, some commentators have pointed to the increased correlation between financial markets and commodity markets as an indication that financial markets are influencing commodity markets. However, commodity markets have always been sensitive to movements in financial markets, particularly at times of macro-economic instability (e.g. the early 1970s). Exchange rates, interest rates and energy prices (themselves affected by changing economic growth projections) are all examples of links between the macro-economy (and related financial markets) and fundamentals affecting agricultural markets (spot and futures).

- Energy prices account for a significant share of production costs[18], and affect the profitability of ethanol production. Oil prices also affect transportation costs within and between countries. Higher oil prices will, all else held equal, reduce the level of international trade, making for thinner, more volatile markets.
- Exchange rate movements will affect the amount of grain that any importing (exporting) country may buy from (supply to) the world market at any given US Dollar price. Indeed, US Dollar weakness (as seen during the 2007/08 price spikes) tends to push (US Dollar denominated) world prices higher, because any given US Dollar price becomes relatively more affordable for importers, and makes the export market less attractive to US farmers (responsible for around 45% of global maize exports, for example).
- Interest rates affect the cost of storage, and so affect the gap between spot and futures prices under any given market scenario.

* * * * *

[17] HMG (2010). The 2007/08 Agricultural Price Spikes: Causes and Policy Implications

[18] For example, energy related costs (diesel, fertiliser etc) account for around 60% of total operating costs for US wheat producers (source: Economic Research Service, USDA).

This section has considered whether increased levels of speculation may have damaged markets and distorted prices in both the futures and spot markets. It demonstrates that the increased participation of index funds is exaggerated if considered in terms of the *value*, rather than the *volume* of open interest. Indeed, in certain critical periods (e.g. in the CBoT wheat market in 2006 and 2007), the volume of open interest held by index funds was essentially flat, even as wheat prices increased by over 100%. Rather than the increased value of index fund open interest in CBoT wheat causing prices to rise, it would appear that the causation may have worked the other way.

At the same time, the share of long open interest accounted for by index funds has been relatively stable (wheat) or even fallen marginally (maize) between 2006 and 2011. Irrespective, changing market structure is normal, as is evident from changing shares of the world market accounted for by countries such as the US, Brazil and China in commodities like maize and soybeans.

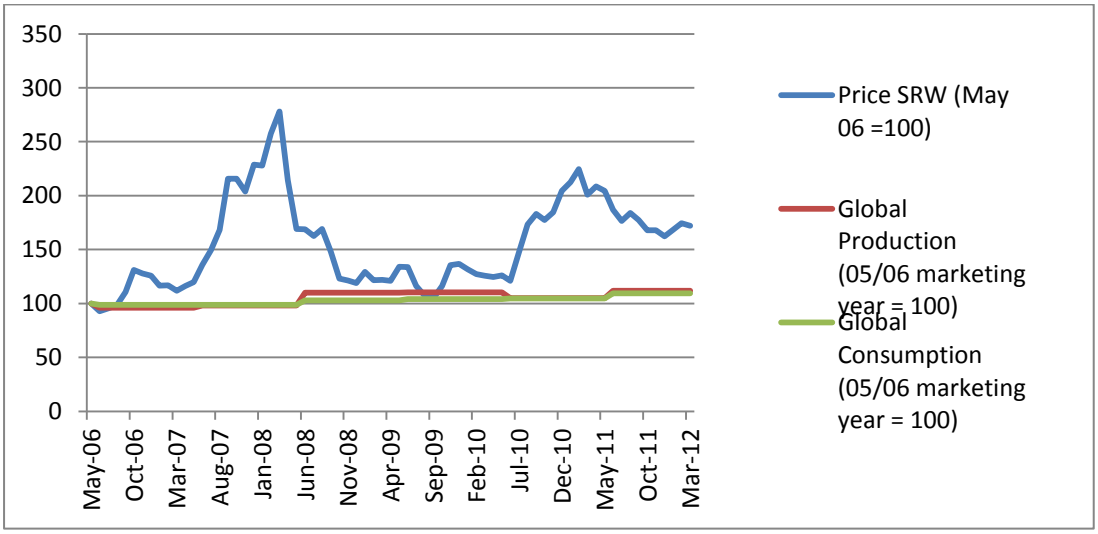
Finally, if price movements in futures markets were dragging up prices in the physical market, theory suggests that we would see increased stock levels in the commodities in question. In fact, projected stocks in the major exporters were falling as prices were spiking. This fact also calls into question the contention in some quarters that changes in supply and demand fundamentals were simply insufficient to explain price spikes of the magnitude we have seen. This is the subject of section 4 (supported by Annex A), which considers what the data from the physical market tells us, and why a focus on aggregated global data can be very misleading.

4. Market fundamentals

The starting point of some of those who are active in the 'speculation debate' is to assert that international price changes have been completely disproportionate to any movement in production and consumption, the implication being that something else (speculation) must be responsible. Indeed, charts like Chart 17 have been presented in the debate, and used to support such assertions.

In fact, a review of the data suggests that it is not credible to assert that supply and demand factors were insufficient to have been driving grain price movements, especially when considered together with *ad hoc* changes in trade policies. The role of market fundamentals is the subject of this section.

Chart 17. Wheat: Global consumption and production vs prices 2006-2012



Data source: USDA

The big exporters and projected end stocks

Focusing on aggregate *global* production and consumption figures can be misleading. Changing projections of end stocks in the major grain exporters suggest that supply and demand fundamentals *are* critical to understanding recent price spikes (even if isolating the relative importance of individual factors is challenging). Indeed, the report of the G20 Commodity Study Group (2011)[19] is clear that

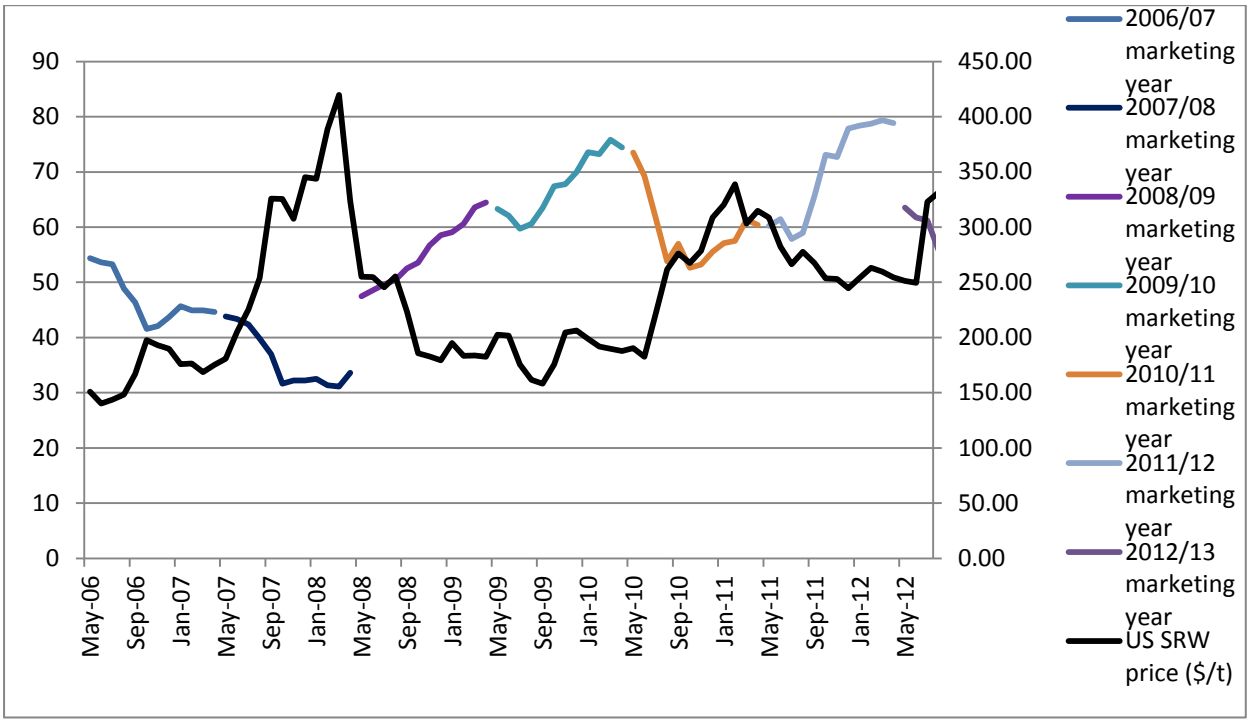
> *'Marked shifts in the physical supply-demand balance for major commodities have been the main driver of the price fluctuations over the past ten years. For many commodities, the expansion of supply has fallen short of buoyant demand growth. As a consequence, inventories and spare capacities have fallen, increasing the exposure of commodity markets to shocks'.*

This issue is considered in more detail in Annex A. But chart 18 below is instructive. It shows how (1) USDA projections of wheat end stocks in the eight major exporters

[19] Report of the G20 Study Group on Commodities under the chairmanship of Mr. Hiroshi Nakaso

(accounting for 85-90% of global wheat exports over the last ten years) and (2) international wheat prices, both changed during the course of the marketing years since 2006.

Chart 18. Wheat: USDA projected end stocks in the 8 biggest exporters (million tonnes – lhs) vs Prices (US$/tonne – rhs)



Data source: USDA and World Bank

Chart 18 shows prices for US wheat (Soft Red Winter) as a solid black line. The broken line shows the most up to date USDA projections for stocks in the eight major exporters at the end of the next marketing year. Different colours represent different marketing years. So, for example, in May 2006, the USDA published its first WASDE[20] projections for the 2006 harvest, together with a range of other projections, including for the level of stocks of wheat (in individual countries and globally) at the end of the 2006/7 marketing year (April 2007).

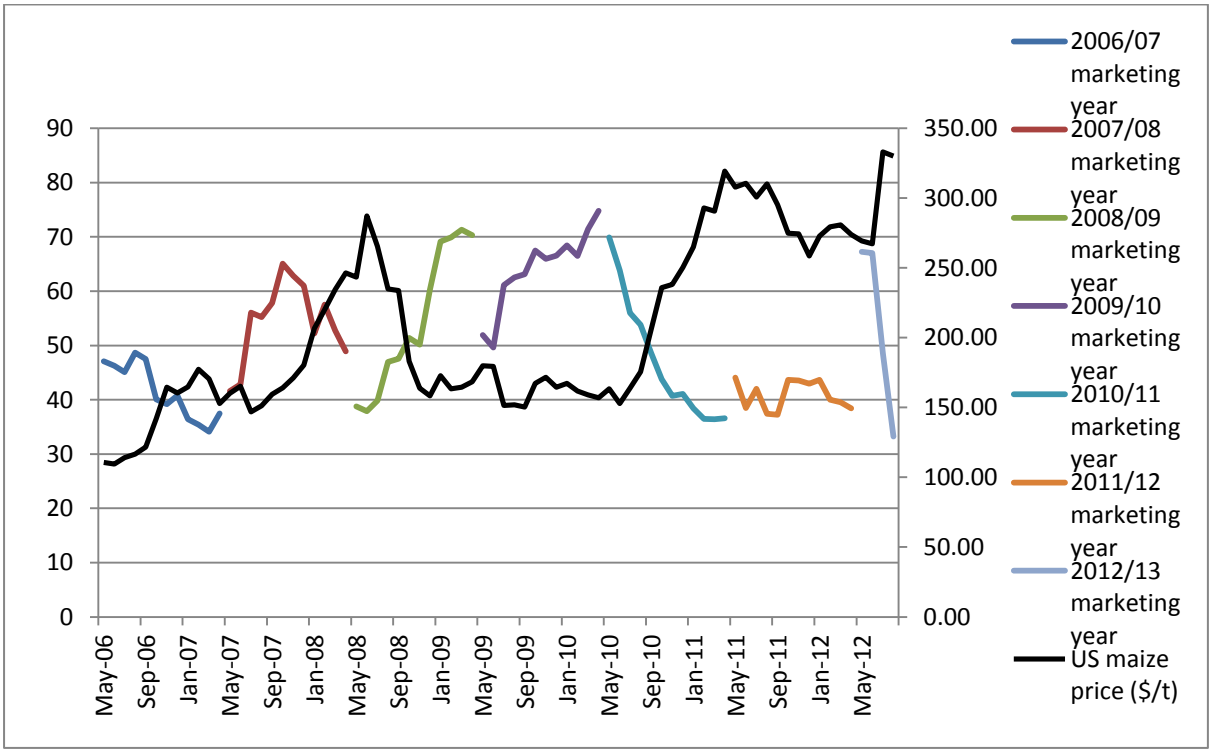
Each subsequent month, the USDA updates its projections of production, consumption, and end-stocks for the 2006/7 marketing year. When we reach May 2007, the cycle starts again, with projections of production and consumption for 2007/8, and stocks at the end of 2007/8. Projections are, by definition, not 100% accurate and change in the face of new information, especially the state of the crop that provides supplies for the marketing year in question. So the broken line gives a very good indication of changing views as to production, consumption, and the overall tightness of the market (as indicated by projected end–stocks) for any given marketing year.

Chart 18 shows how projected end-stocks of wheat in the major exporters fell during 2006, 2007 and early 2008. It was logical that world prices would rise substantially. Prices then fell back as expectations of big crops in the major exporters grew (reflected in growing end-stock projections). Problems with the Russian harvest and falling end-stock projections during 2010 for the 2010/11 marketing year saw prices rising. Recent wheat price increases

[20] World Agricultural Supply and Demand Estimates.

have been driven by expectations that some additional wheat will be used for animal feed, substituting for maize, where USDA projections for the 2012 harvest have fallen dramatically (see chart 19 which shows maize prices and changing USDA projections for coarse grain end stocks in the major exporters).

Chart 19. Coarse grain: USDA projected end stocks in the 7 biggest exporters (million tonnes – lhs) vs Maize prices (US$/tonne – rhs)



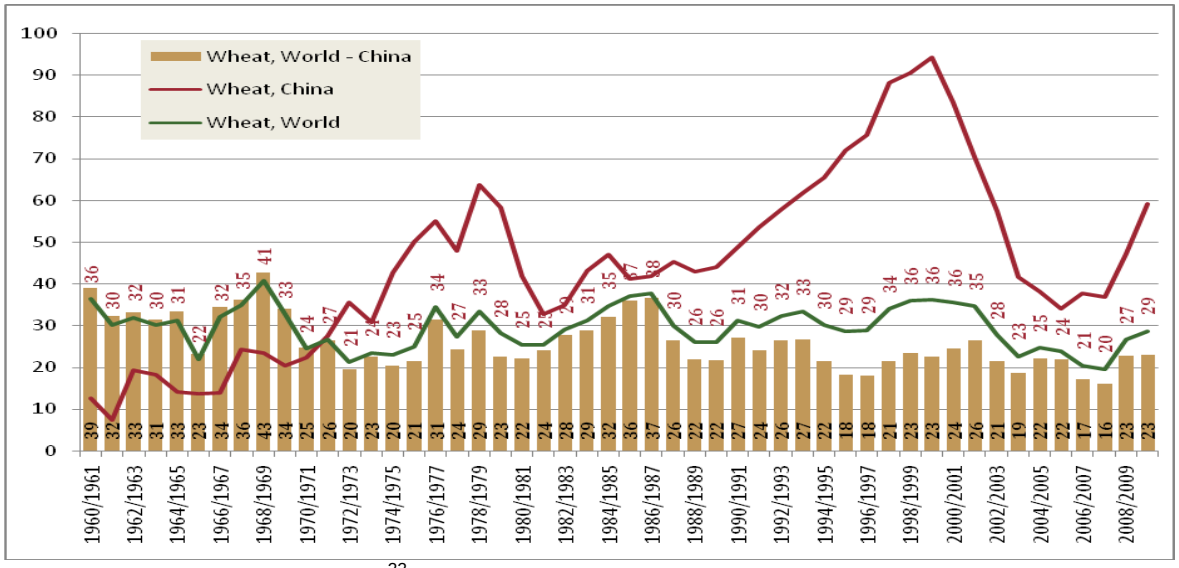
Changing projections of end-stocks in the major exporters reflect information affecting export demand (in particular supply and demand conditions in importing countries) and availability in the major exporters. Hence the causation is not merely one-way (e.g. prices both affect, and are affected by, demand and hence end-stocks). Nevertheless, end-year stock projections will be sensitive to changing harvest projections during the production year. They are a good indicator of the tightness of the international market, and it is logical that movements in these figures over the course of the marketing year would prompt changes in world prices, even if there are second round effects (with higher prices then reducing consumption in ways that mitigate the impact of the initial supply shock).[21] A number of related points are also worth highlighting.

[21] As noted, in chart 18 (and chart 19), the causation is not solely in one direction, with price merely responding to changing end stock projections. The causation also works in the opposite direction, with price impacting supply, demand and stock projections. First of all, prices at planting will affect area planted and hence initial production estimates for the following marketing year (so price leads the first estimates published in May). But from then on, once the crop is in the ground (and aside from the possibility of additional yield increasing applications of fertiliser and pesticides if prices rise between planting and harvest) projected production is, to a very significant extent, driven by weather, which in turn affects projected end stocks and prices (so supply leads prices). That said, changing estimates of production in, for example, the US, do not change USDA projections of end stocks on a one:one basis. Changes to projected end stocks are a function of projected changes in consumption as well as changes in production, and USDA estimates the degree to which higher prices caused by

Global stocks – not all available to the world market

It follows that a focus on aggregate global stocks can also be misleading. Chart 20 helps to illustrate why. Some countries, such as China, may participate in world markets, but their domestic sector is not well integrated with the world market, because of the marketing and trade policies pursued.

Chart 20. Wheat stock-to-use ratios. World, China, and World except China



Source: Wiggins and Keats 2010[22]

Chinese grain stocks are relatively high when expressed as stock-to-use-ratios. They are also estimated to have been highly variable over the last twenty years. The result is that in some years, there is a big difference between global stock-to-use ratios and ratios for 'the world minus China'. China is an extreme case (because of its size and high level of stocks), but it reinforces the point made earlier. When considering international prices, what matter are production, consumption and stocks in the world's *major exporters*. Put another way, an extra million tonnes of stock or production in China will often be of less importance to the world price than an identical extra tonnage in Australia or Canada (major exporters that are well integrated to the world market).

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lower production will in turn reduce consumption before arriving at a revised projection of end stocks. This picture is further complicated by the differences in key dates (planting, harvesting) between different countries (and even different regions of the same country), and especially between the northern and southern hemispheres.

Although there is causation both ways (and although charts 18 and 19 do not specify which supply and demand factors in which country are having an impact on changing end-stock projections), the key benefit of charts 18 and 19 are to show how price has moved as end-stock projections for the subsequent marketing year change (generally driven by within-year changes to production estimates, even if moderated by estimates of reduced demand). Annex A provides a sense-check on this issue. If drops in projected end stocks are out of line with variability in production in the major exporters then this would tend to undermine suggestions that supply variability was a driver in any given case. But Annex A demonstrates that production and exportable surpluses from the major exporters have been much more variable than aggregate global production.

[22] Wiggins and Keats (2010). *Grain Stocks and Price Spikes*. Annex 2 to HMG (2010).

Elasticities

Commentaries on price movements during the price spikes also tend to underplay the importance of low inelasticities of demand and supply. In the short term both demand and supply are relatively unresponsive to changes in price. So prices must move substantially before there can a relatively modest increase in supply or reduction in consumption. Viewed another way, prices will be sensitive to relatively modest changes in projected production and consumption.

So, for example, in the OECD-FAO model, the elasticity of demand for wheat in the EU (relating to food use) is -0.2. This means that a price increase of 5% would be required to cause demand to fall by 1%. Elasticities vary considerably by commodity and by location. And they will change over time. For example, the OECD-FAO Agricultural Outlook for 2008-17 noted (box 2.3) that as income increases and market chains extend, the responsiveness of demand to farm-level prices may decrease. Furthermore, prices will be much more sensitive to supply shocks if projected stock levels are tight in the major exporters (because there is less scope to draw down stocks rather than reducing consumption)[23], and where there are significant biofuel mandates (as there are in the US and the EU) that are relatively inflexible in the face of higher agricultural prices (so forcing prices higher, to the point where the consumption of grain - for food and feed – contracts by enough to bring the market back to equilibrium).[24]

This means that even if movements in the gap between supply and demand appear to be modest, one can expect significant price movements. Where the movement is significant, and stocks in the major exporters are tight, prices will spike.

Ad hoc export restrictions and reductions in import tariffs

Factors other than production, consumption, and stocks influenced market prices. Many countries reacted to the increasing food prices by imposing restrictions on exports of basic food commodities and *ad hoc* reductions in import tariffs, to try to tackle domestic inflation. Export restrictions played a particularly significant role in the rice and wheat markets, restricting supply to international markets, contributing to the price peaks in 2008. As the G20 Commodity Study Group Report noted

> *'Domestic policy measures often have repercussions on international markets. Ad-hoc measures – including tariffs and export restrictions as well as subsidies – can lead to market imbalances, add to price volatility, and weaken international trade as a stabilising mechanism. In the longer run, distortions in domestic and global markets are likely to lead to resource misallocation and suboptimal supply'.*

Export restrictions affected a very significant share of the world market in both wheat and rice (table 2) in 2007/08, and there is a real risk in underplaying their significance.[25]

- In 2008, six countries responsible for 38% of world wheat production and 20.7% of world exports imposed export restrictions.

[23] See for example Wright, B. (2009) *International Grains Reserves and Other Instruments to Address Volatility in Grain Markets.* World Bank Policy Research Working Paper No. 5028. Washington DC:The World Bank.
[24] See for example, Durham, C., Davies, G., and Bhattacharyya, T. *Can biofuels policy work for food security?* An analytical paper for discussion. June 2012
[25] See for example, Headey, D., 2010, *'Rethinking the Global Food Crisis. The Role of Trade Shocks'*, IFPRI Discussion Paper 00958, March 2010. Washington DC: IFPRI

- In 2008, seven countries responsible for 62% of world production of milled rice and 50% of global rice exports imposed export restrictions (see chart 21). There was no significant trade in rice futures in 2008 (hence no speculation on rice futures).

As a result of such export restrictions, the world markets for wheat and maize were even tighter than implied by charts 18 and 19. This is because production and stocks in some major exporters appear in the USDA data (and are reflected in the broken lines in charts 18 and 19), but were not, in reality, available to the world market.

Table 2: Exports as percent of global total and percent of national stock

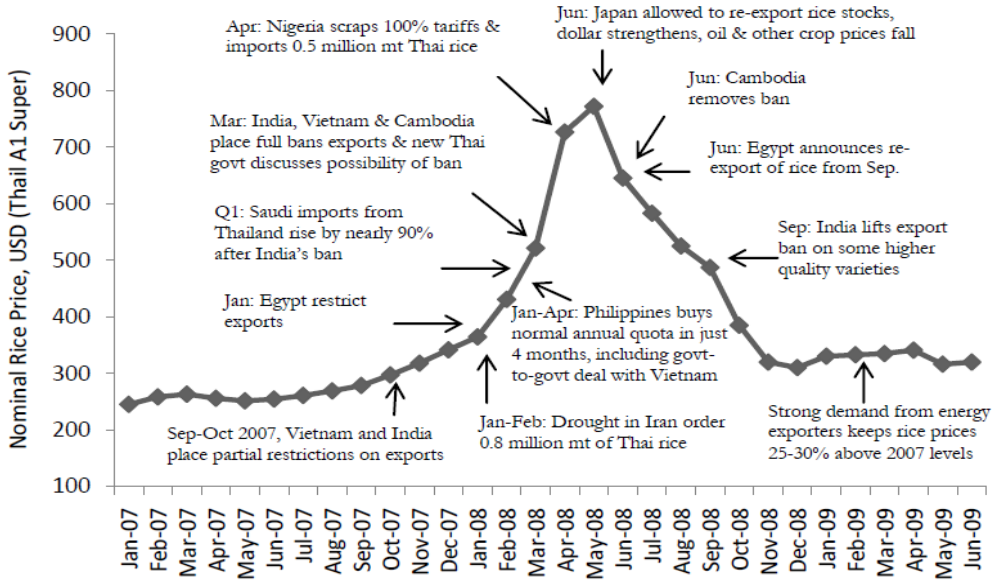
Largest dozen maize exporters 1998/99 – 2007/08				Largest dozen rice exporters 1998/99 – 2007/08				Largest dozen wheat exporters 1998/99 – 2007/08			
	A	B	C		A	B	C		A	B	C
US	63	63	130	*Thailand	29	29	390	US	26	26	160
Argentina	15	77	2,100	*Vietnam	15	44	410	Canada	15	41	220
*China	8.6	86	10	*India	15	59	32	EU	14	54	86
*Brazil	5.2	91	150	US	11	70	330	Australia	13	67	340
South Africa	1.4	93	84	*Pakistan	8.8	79	700	Argentina	9.2	76	1,200
Ukraine	1.4	94	120	*China	6.2	85	3	Russia	6.0	82	220
*India	1.0	95	310	*Egypt	2.7	88	150	Kazakhstan	4.6	87	370
Paraguay	1.0	96	93	Uruguay	2.5	91	1,600	Ukraine	3.1	90	250
EU	0.87	97	17	Argentina	1.4	92	260	*India	1.7	92	15
Canada	0.51	97	36	Burma	1.2	93	33	Turkey	1.7	93	120
*Thailand	0.39	98	130	Australia	1.1	94	170	*China	1.5	95	3.0
Serb & Mtn	0.32	98	67	EU	0.89	95	28	*Pakistan	0.57	95	28

A = Exports as a % of global exports
B = Cumulative % of global exports
C = Exports as % of stock

- Countries which instituted export bans or restrictions in response to the 2007/08 food price spike appear in yellow.
- Countries that released stock nationally at a subsidized price **appear with * in bold red**

Source: Wiggins and Keats (2010)

Chart 21. The effects of export restrictions on rice prices



Source: Reproduced from Headey (2010)

Precautionary demand

Governments and private sector participants in the supply chain may react to higher prices by increasing their demand in a pro-cyclical manner. Tangermann (2011)[26] explains how it is possible for transactions to be shifted by no more than two weeks in different parts of the supply chain, so that 'seemingly small individual changes of behaviour would then make a total of eight weeks product flow 'disappear' in the pipeline, equivalent to about 15% of the total annual crop', and enough to increase prices significantly, especially when the market is already tight.

At the same time, importers can also adjust their buying programmes, especially where managed by parastatals. Tangermann quotes Trostle (2008),[27] who observed that "by late summer 2007, some importers were aggressively contracting for imports of grains and oilseeds. Even though prices were at record highs, importers were buying larger volumes, not less. Some countries that usually imported sufficient quantities of grain to meet their needs for the following 3-4 months began to contract for imports to meet their needs for the following 5-10 months". Such practices would generally take place in countries other than the major exporters. So even if projected end-stocks are unaffected globally, there would be an impact on those figures in the major exporters.

* * *

Supply shocks in major exporters, in the context of tight stocks and inelastic demand and supply, with additional policy-generated supply shocks, courtesy of export restrictions in key countries, mean that it should be no surprise that prices have spiked in international grain markets.

[26] Tangermann, S. (2011). *Policy Solutions to Agricultural Market Volatility: A Synthesis*. International Centre for Trade and Sustainable Development. Issue Paper No. 33

[27] Trostle, R. (2008), *Global Agricultural Supply and Demand: Factors Contributing to the Recent Increase in Food Commodity Prices*. USDA/ERS Report WRS-0801, Revised July 2008. Washington DC: USDA.

5. Conclusion

Theory allows for the possibility that speculation in agricultural futures and options markets may affect pricing in physical markets *under certain conditions*. However, a careful review of the evidence, including the mechanisms by which speculation may have had an impact, points to scepticism that speculation has played a significant causal role in recent price spikes. At the same time, changing market fundamentals and *ad hoc* export restrictions *do* provide a persuasive explanation for what has happened to international prices.

Some have argued for the application of a precautionary principle and suggested that this points to pursuing, rather than holding back from, particular regulatory actions. In fact, it can be argued that the precautionary principle points in the opposite direction.

Futures and options markets (and the liquidity they rely upon) may well grow in importance over the medium term. High levels of speculative involvement are particularly important for the emergence of new agricultural futures and options markets/contracts (e.g. in South Africa in the mid 1990s). And the signals sent by futures markets in 2007/08 were critical in bringing forth the very large global wheat crop (up to that point the largest on record) of 2008.

Focusing on speculation risks undermining the role of these important markets and risks distracting policy makers from the fundamental importance of increasing the efficiency, resilience and responsiveness of the world's agricultural sector (itself a function of efficiency and responsiveness in national sectors) – see Annex B.

Those making the case for the further regulation of agricultural futures and options markets, and the activities of speculators on those markets, need to demonstrate not just that speculation has played a significant causal role in recent price spikes, but that such regulation will mitigate any such impact without a disproportionate negative impact on the liquidity, and hence the functioning, of agricultural derivative markets that play such an economically and socially useful role.

HM Treasury

1st October 2012

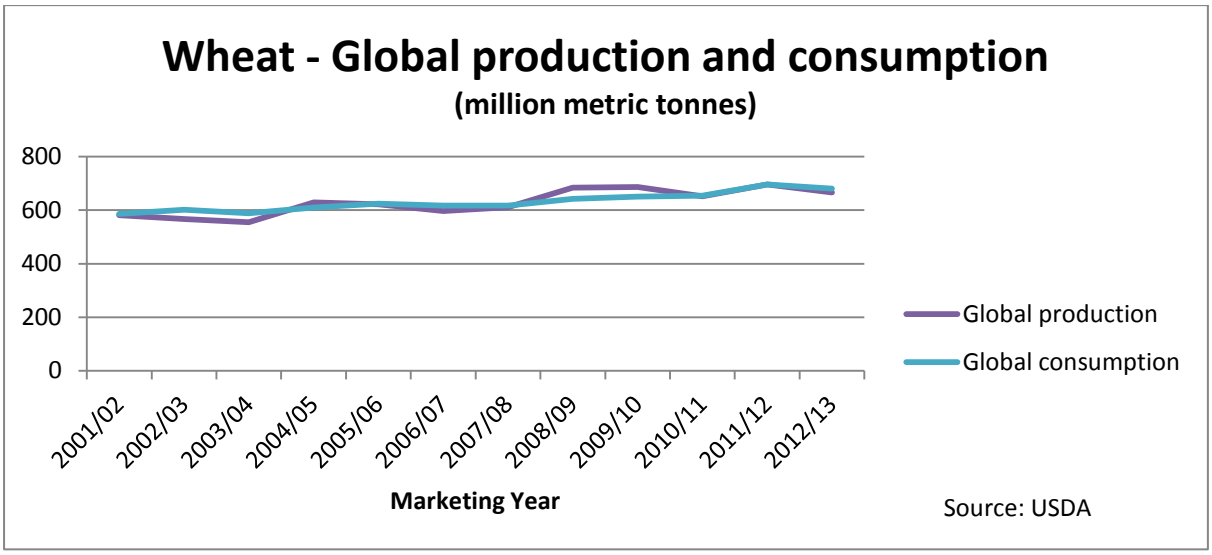
Annex A

International Price Volatility in International Grain Markets:

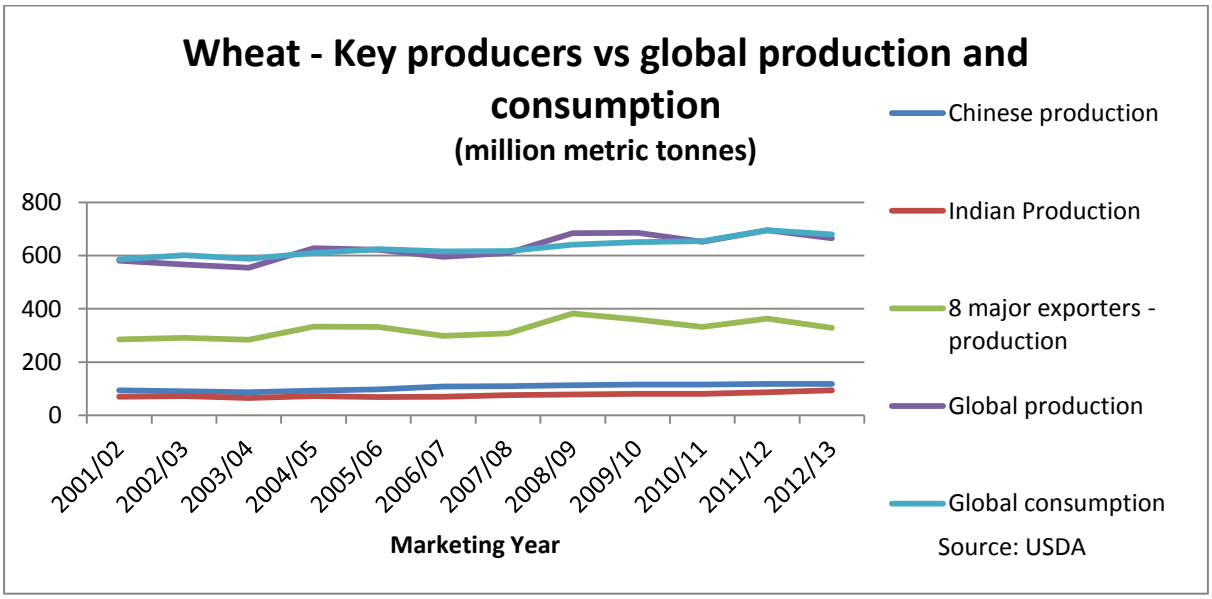
The Role of the Major Exporters

Wheat

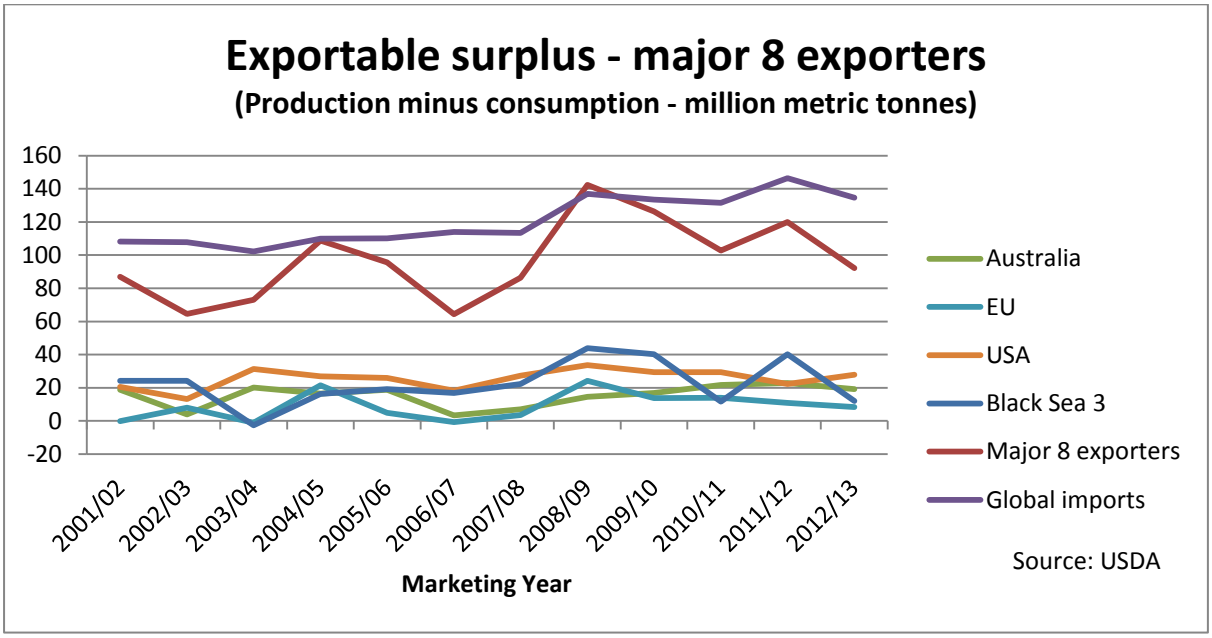
Some argue that fluctuations in the production of wheat are simply insufficient to explain international price volatility over the last few years. For example, see the chart below. But this chart represents a high degree of aggregation that does not distinguish between different production areas and the extent to which they are integrated into the world market.



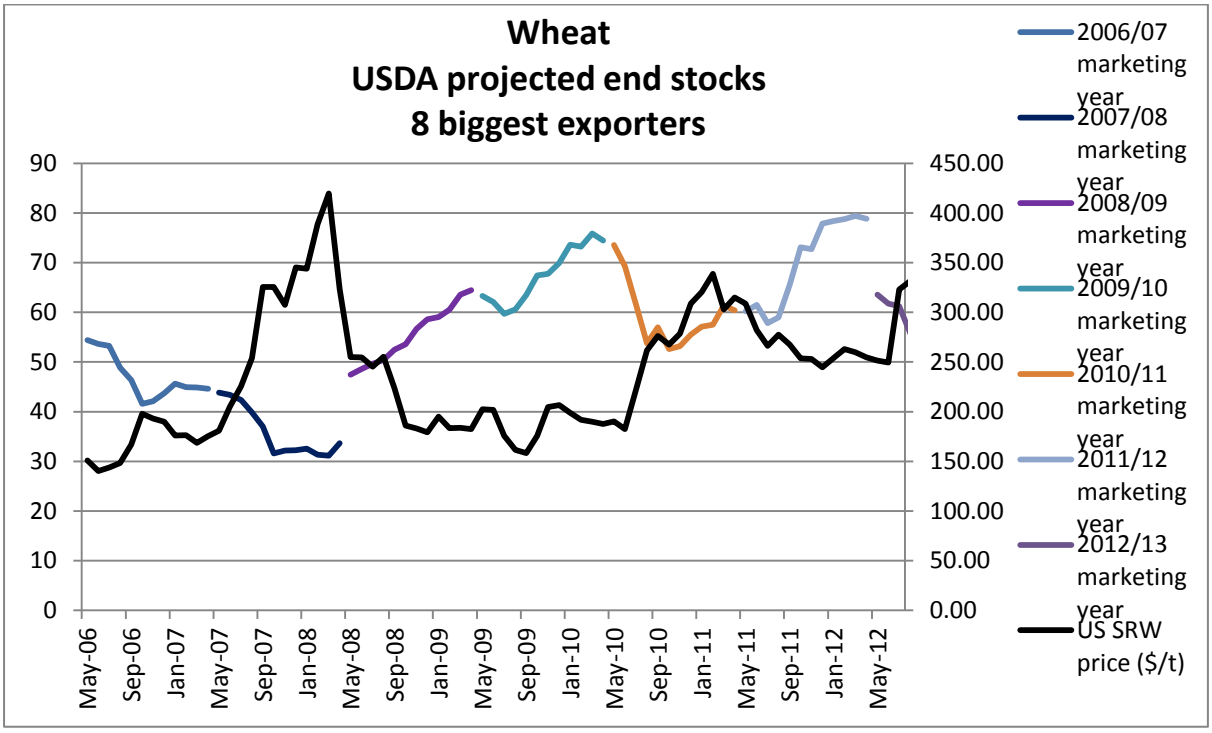
If we focus on production in the eight major exporters of wheat (Argentina, Australia, Canada, the EU, Russia, Ukraine, Kazakhstan and the USA – accounting for 85% - 91% of world exports over the period 2001/02 to 2011/12) then this starts to suggest that supply variation may be more significant than implied by the first chart.



When we consider the exportable surplus (domestic production minus domestic consumption) in the major eight exporters, compared to global imports, the level of variability now looks much more significant.



The exportable surplus in major exporters points to a source of volatility. But there are other sources, such as variations in production (and hence import demand) in countries that are structural net importers. At the same time, countries that do not normally participate to a significant extent in the world market may add to import demand or export supply. These and other relevant factors change over time, and are all reflected in changing projections of end stocks in the major exporters.



The chart on the previous page shows how (1) USDA projections of wheat end stocks in the eight major exporters and (2) international wheat prices, both changed during the course of the marketing years from 2006/07. Changing projections of end stocks in the major exporters are a good indicator of the tightness of the international market for wheat, and it is logical that movements in these figures over the course of the marketing year would be reflected in changing world prices.

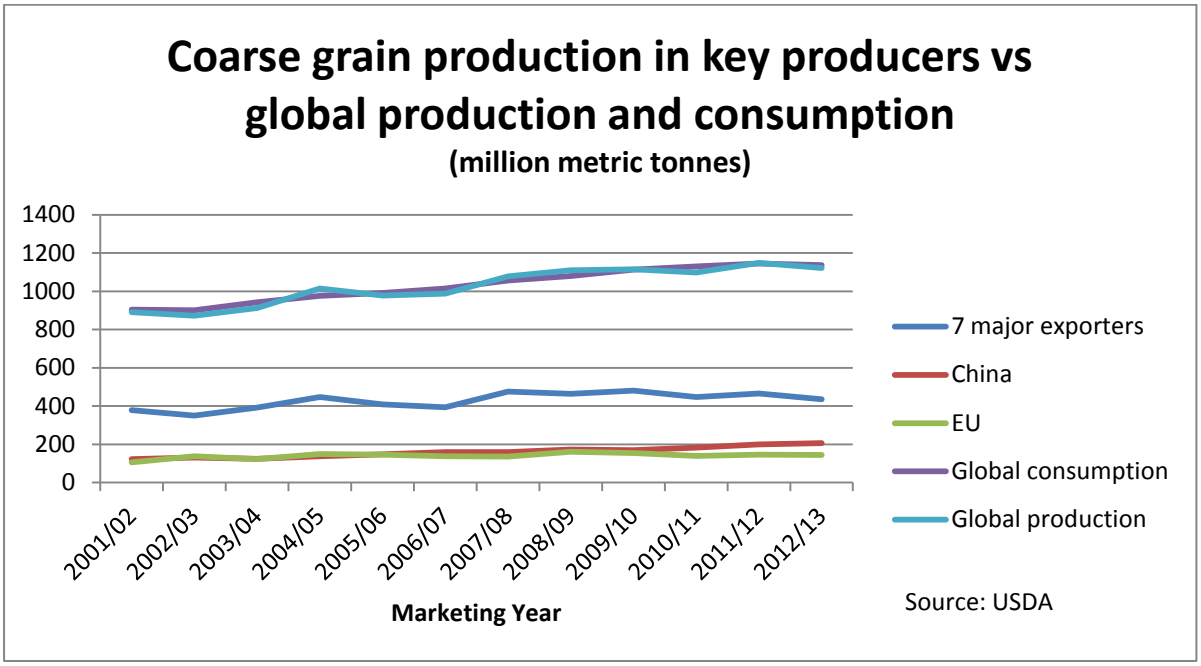
Equally, we would not expect a perfect explanation. The market price will also be sensitive to changing market projections of availability from other potential exporters (the other 10-15% of the world market), movements in end stock projections in other grains where there may be some substitution in consumption (such as coarse grains which are mainly used as feed grains or for industrial purposes – wheat can also be put to both uses), and policy changes (e.g. the announcement of export restrictions). The specifics of the wheat market are also relevant. For example, there are many different grades of bread-making wheat, and depending on the relative supply and demand of different grades of wheat, the relative price of different grades and origins will also change.

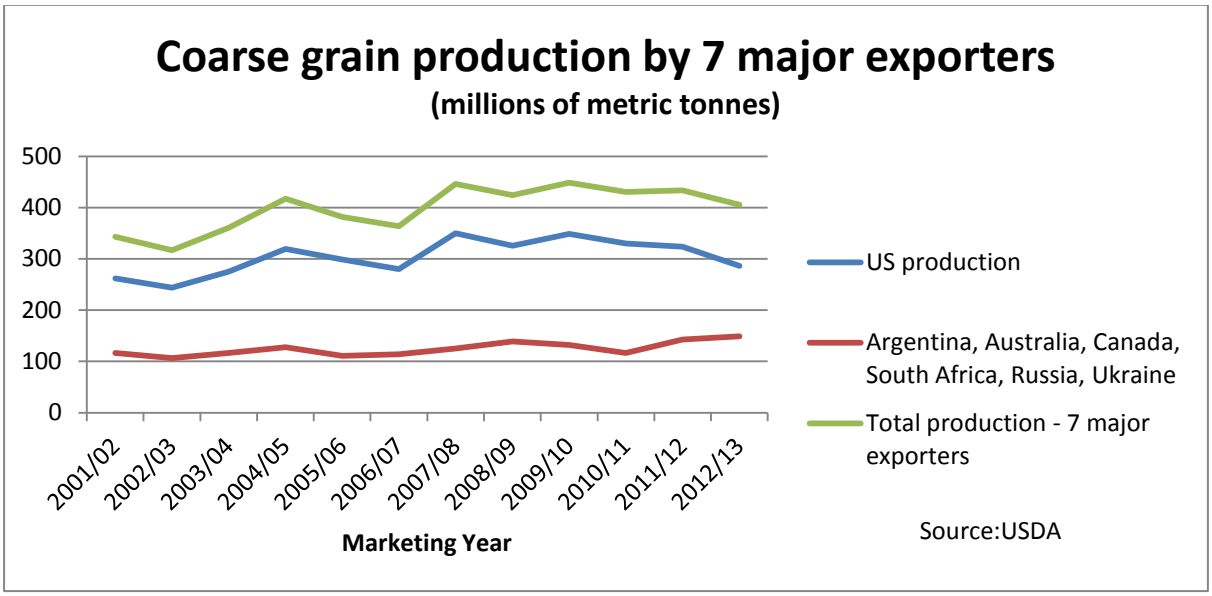
Looking at the chart on the previous page prompts a question. Why was there a spike in 2010/11 when projected end-stocks were relatively healthy? The 2010/11 marketing year was affected by a drought in Russia, Ukraine and Kazakhstan (the Black Sea 3), followed by the imposition of export restrictions. So the figures for BS3 end stocks over state availability in the 2010/11 year and subsequently. There was also a risk that other countries may have introduced export restrictions (as happened in 2007 and 2008). Finally, as subsequent charts demonstrate, the end-stock projections for coarse grains in 2010 and since have been tight, putting a floor under the wheat market.

Coarse Grain

Looking at coarse grain (maize, barley, oats, and sorghum) markets (where 66% of consumption was for animal feed in 2001/02, falling to 57% in 2010/11)[28], the picture is similar if one simply looks at global production versus consumption.

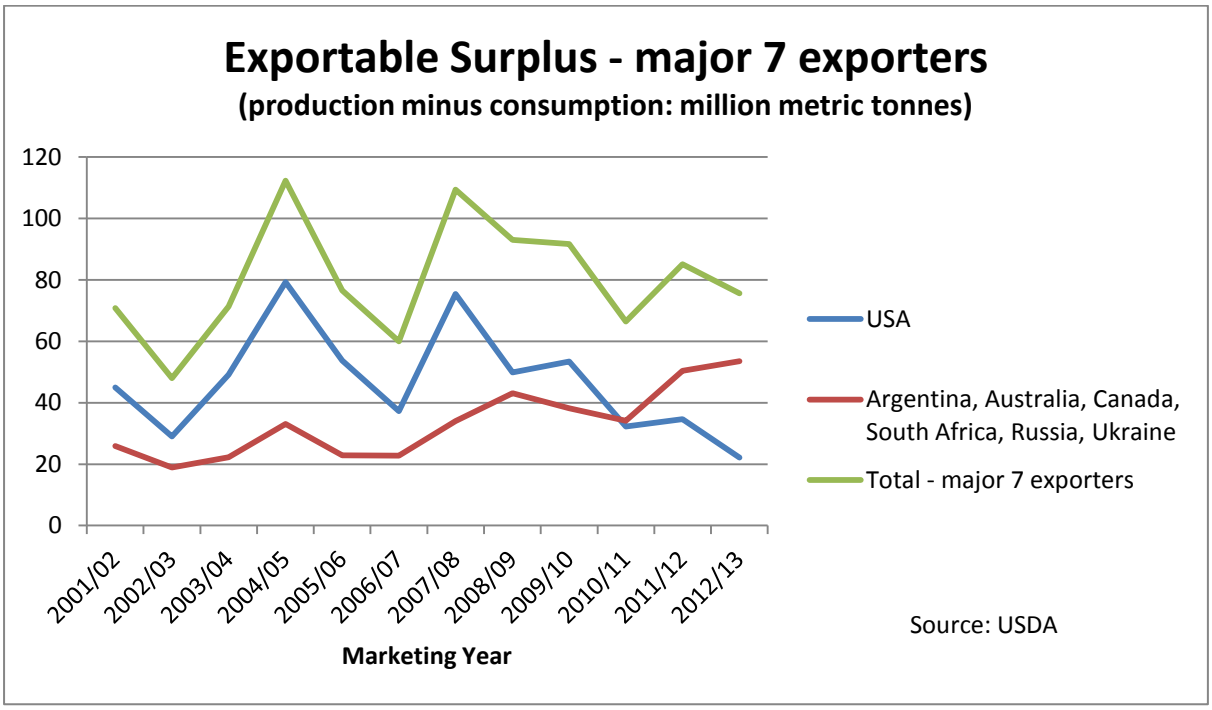
But looking at production in the seven major exporters (accounting for 75 - 83% of global exports of coarse grains in the decade to 2010/11, although sometimes lower – e.g. 67% in 2002/03), the picture is more volatile, especially in the USA.



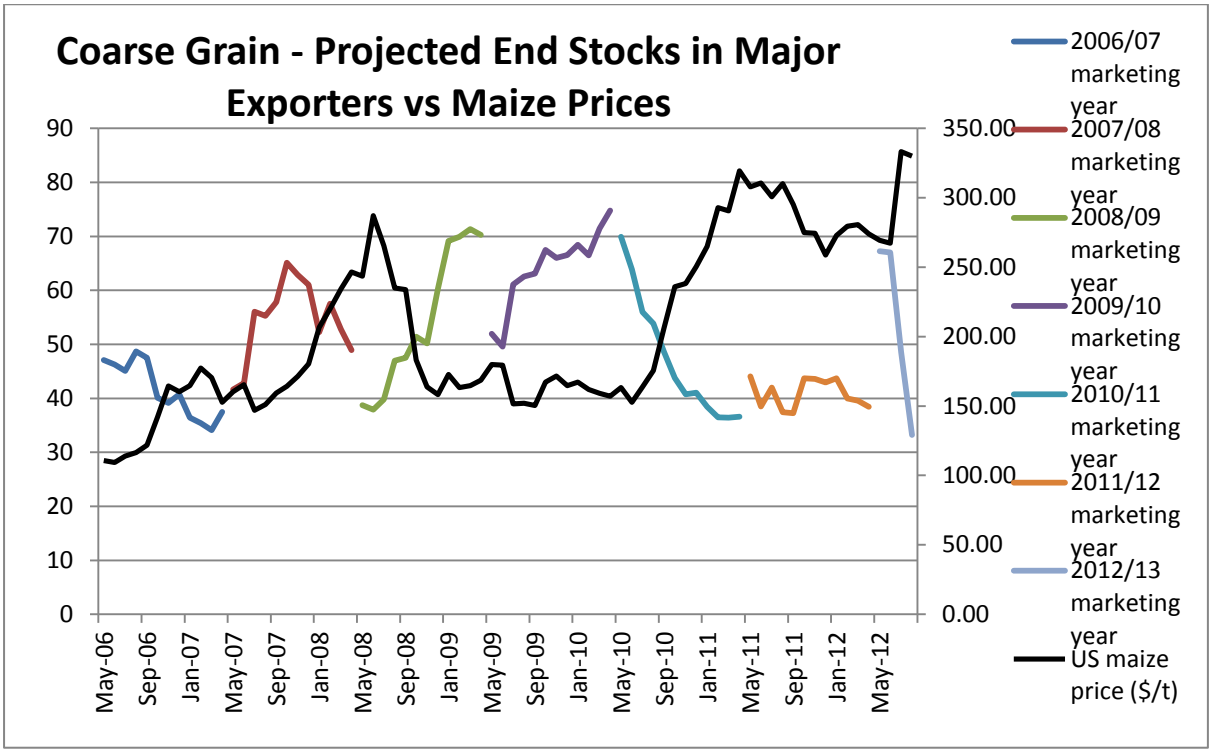


[28] For wheat the proportion of global production going to feed was 18% in 2001/02, and 17% in 2010/11, much of which is produced in the EU and BS3.

This is especially true when one considers the size of exportable surpluses in the 'seven'.



As with wheat, changes in exportable surplus in the major exporters do not account for all sources of variability in the supply-demand balance. Changing projections of end stocks in the major exporters are also affected by supply and demand arising from other participants in the world market (actual and potential).



As with wheat, changing projections of end-stocks in coarse grains in the major exporters do not appear to fully explain the changes in price. Nor would we expect them to (given that the seven major exporters normally account for around 75-83% of global exports). Nevertheless, the chart on the previous page prompts at least two questions.

- **Why did relatively low projected end-stocks in 2006/7 not prompt a price spike of a similar size to the one experienced in 2007/08?** A number of factors are relevant. None of these taken by themselves are a sufficient explanation, but taken cumulatively, their impact would have made a significant difference in a world export market of between 110 million tonnes (2006/07) and 120 million tonnes (2007/08).
    - The projected end stocks in wheat in 2006/07 were 14 million tonnes higher than in 2007/08, so the overall international grain market was not as tight.
    - Projected coarse grain exports in 2006/07 were around 10 million tonnes lower than in 2007/08, so for any given level of end-stock projection in the major exporters, the pressure on other sources of exports was higher in 2007/08.
    - Projected end-stocks in the major importers of coarse grains were around 5.5 million tonnes higher in March 2007 than one year on, putting less pressure on available stocks in the major exporters.
    - Critically, there were no export restrictions in 2006/07. In 2007/08, Argentina, Brazil, and Ukraine (together accounting for around 10 million tonnes of end-stocks that ordinarily would have been available to the world market).

- **Why have prices been higher in 2012 than 2008, even though projected end-stocks were similar in early 2011 to June/July 2008?** Again, a range of factors will be at work. But the following points are worth noting.
    - Projected end stocks in the major exporters in April 2011 were lower in absolute terms than in mid 2008 (although by only around 1.5 million tonnes).
    - Projected end stocks in the major importers were higher (around 1.5 million tonnes) in June 2008 than in March 2011.
    - The consumption of coarse grains in the major exporters (especially the US), and major importers has been growing steadily over the last four years. In June 2008, projected consumption of coarse grains globally and in the US, Argentina, South Africa, Australia, Canada and the major importers were projected at 1,082 million and 638 million tonnes respectively for the 2007/08 marketing year. In May 2011, those figures were 1,143 million and 672 million tonnes respectively for the 2011/12 marketing year. So any given level of end stocks (say 40 million tonnes) in 2011/12 implies a lower stock-to-use ratio (and a tighter market) than four years earlier.
    - When markets are tight, relatively small differences in availability will have a disproportionate impact on price.

Conclusion

The purpose of this annex is not to try to give a comprehensive explanation of the relative importance of different market factors driving the price spikes. Its purpose is simply to demonstrate that supply and demand factors in the international market (as reflected in changing end-stock projections in the major exporters) are indeed central to understanding recent price spikes, especially when taken together with *ad hoc* changes to trade policies (both reductions in import tariffs and the introduction of export restrictions).

Focusing on aggregate global production figures can be misleading. Aggregate figures for grain production and grain stocks matter. But so do many other factors operating below the surface of aggregate figures. The particular location of production and stocks matters for a range of reasons.

- Are production and stocks located in countries which are consistent net exporters to the world market, or in countries which are highly insulated from the world market and rarely, if ever, export significant volumes? It is quite possible for aggregate global production to be flat, but for the distribution of grain production between significant net exporters and the rest of the world to change substantially and have large implications for world prices.
- A further related point is that any given percentage increase or decrease in production in the major exporters (where consumption is generally much more stable but significant) leverages a much larger percentage increase or decrease in the size of the exportable surplus. This leverage may be mitigated or amplified depending on stock levels, especially those in the major exporting countries.
- Location also matters because, for example, wheat produced in certain countries consists of a much high proportion of feed wheat (EU, Black Sea 3). Shortfalls in these areas may be compensated for by the market situation in respect of coarse grains. By contrast, shortfalls in those countries most important for supplying high protein wheats (North America, Australia, Argentina) to the international market are more difficult to compensate for.
- Looking at unusual export patterns from countries normally insulated from world markets is also important.

Annex B. Underpinnings for an efficient and responsive agricultural sector

An undue focus on regulating levels of speculation in agricultural derivative markets is a distraction from an important policy agenda; improving the efficiency, resilience and responsiveness of the agricultural sector.

Theory and international experience point to a number of inter-connected factors that affect levels of agricultural productivity, efficiency and responsiveness. This annex briefly reviews some of the more important; processes of adjustment and development, the efficiency of factor markets, access to risk markets, access to international markets; research and development, training, and infrastructure. This list is not exhaustive but helps to provide a framework against which national policies and their impact can be assessed.

Processes of agricultural adjustment and development

As economies grow and develop their structure changes. First, agriculture's share of the economy and of the workforce shrink. Eventually economies reach a turning point where absolute numbers employed in agriculture will also fall. A number of powerful economic forces are at work in this process.

- As household incomes rise a declining share of total income is spent on food (and a growing share on manufactures and services).
- Economic growth and productivity improvements in the non-farm economy increase off-farm wages, drawing labour away from the farm sector, bidding up agricultural wages, and encouraging investment in machinery and other substitutes for labour.
- Technological developments facilitate this substitution of capital for labour, and increase agricultural productivity.

As a result of the sort of forces described above, optimal farm size for example keeps changing, creating ongoing pressures for farm structures to change over time. This can manifest itself in changes in average farm size and/or an increase in part-time farming.[29] Even in countries where agriculture is already a small proportion of the workforce, the agricultural sector continues to shed labour.

It is important that farm size and structure adjust. If the agricultural sector doesn't adjust, and if marginal farmers do not leave the agricultural sector sufficiently quickly then it is more difficult for more successful farmers to expand. As a result, agricultural development will tend to lag behind broader economic developments and the returns to agricultural labour and agricultural capital will lag behind those in the rest of the economy.

Efficient land, labour and capital (factor) markets play an important, though not exclusive, role in facilitating the process of long run agricultural adjustment. If these markets are inefficient (whether because of under-development, market segmentation, or because of policy distortions)[30] then the process of adjustment is hampered, with implications for the

[29] But adjustment can manifest itself in a range of additional ways such as changes in the combination of production activities (agricultural and non-agricultural), changes in production methods and intensities, the use of outside contractors for production or marketing activities (see Blandford (2007): *Policies for Agricultural Adjustment in Developed Countries under Trade Policy Reform*. Policy Brief, German Marshall Fund).

[30] For example, if those farming the land (either as owners or tenants) do not enjoy secure tenure, then their incentives to invest (and indeed their *ability* to invest if they cannot secure adequate access to capital as a result) will be impaired. At the same time, good communications (transport and telecoms/IT) in rural areas will tend to facilitate the movement of farm labour into alternative sectors (whether rural or urban based).

efficiency and productivity of the farming sector. For a comprehensive review of adjustment processes in agriculture see OECD (1998)[31] and Blandford and Hill (2006)[32].

Agricultural Factor Markets

As well as determining the speed with which the farm sector responds to the sort of adjustment pressures described above, the efficiency with which agricultural land, labour and capital markets operate in a given country will also help to determine:

- the level of production in the face of any given set of agricultural commodity prices;
- the extent and the speed with which changes in agricultural commodity prices cause a supply response; and
- the extent/efficiency with which agricultural risk can be managed.

Countries or trading blocs that pursue policies that defend historic production patterns, or where factor markets are inefficient, will reduce the speed with which agricultural sectors adjust in the face of shifting comparative advantage. But the efficiency of factor markets also matters for other reasons.

- It has implications for the process of economic development in countries where agriculture accounts for a relatively high share of GDP and employment, and where food accounts for a high share of household expenditure. The ability of an agricultural sector to release resources (especially labour) into the rest of the economy and so increase labour productivity in agriculture and the economy as a whole is particularly important in transitional and developing countries.
- It affects the ability of an agricultural sector (and farmers working within it) to adjust in the face of significant sector-wide developments such as policy reform or climate change, a consideration that is particularly relevant in those OECD countries or trading blocs where agricultural support levels are unsustainably high[33].

Access to risk markets

Agricultural markets demonstrate a propensity for price variability. And it is possible, though by no means certain, that this volatility will increase as the global climate changes. Some things can be done by policy makers that would reduce price volatility such as better integrated world markets (trade liberalisation, domestic market liberalisation and improved infrastructure) but farmers and processors need to manage the price risks they face.

Section 2 of the main paper explains that market mechanisms for the management of agricultural price risk do exist, and that futures and option markets are a critical part of the

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[31] OECD (1998). *Adjustment in OECD Agriculture: Reforming Farmland Policies*.

[32] Blandford, D. & Hill, B (eds) (2006) *Policy Reform and Adjustment in the Agricultural Sectors of Developed Countries*, CAB International: Wallingford.

[33] According to the OECD (1998), for agricultural policy reform to be successful, factors of production should be sufficiently mobile. For example, labour immobility may be caused by impediments such as advanced age, few non-farm skills, low educational attainment, lack of alternative job opportunities and high cost of moving. Many farm specific assets may be too specific to find uses in other sectors. There may be rigidities in land markets due to regulations that restrict land holding or farm size, give special tax treatment to landholders or circumscribe economic activities in an area. Elimination of barriers to factor mobility should permit a better allocation of resources and thus contribute to an improved economic performance in rural areas.

available menu of risk management tools. It goes on to explain that apart from their direct commercial importance to those involved in the supply chain, futures and options markets also play other important roles in ensuring the effective operation of the global food system.

International trade

Open agricultural trading arrangements are critically important. First, increased trade has helped drive global economic growth. Second, as the OECD notes, "agricultural trade enhances national and global food security by increasing the sources of food supply and lowering prices in importing countries, stimulating food production in countries that have a natural or structural advantage in agriculture, and increasing overall economic growth rates through a more efficient allocation of resources. Trade reform would deepen world markets, so tending to reduce international price volatility and encourage farmers around the world to produce according to their respective comparative advantages".

Third, trade helps mitigate geographic-specific risks, so that if there is a constraint on supply in one region, alternative suppliers can fill the gap. This is particularly important given the prospect of climate change. In short, international trade is a key underpinning of food security at all levels. Fourth, trade facilitates the transmission of international price signals to national markets, which in turn facilitates a supply response. Market integration (and the depth of world markets and price transmission) is affected by the quality of transport infrastructure, distance, energy prices, and trade policies. Higher energy prices and/or trade barriers will both tend to make international markets more fragmented and residual. This tends to increase volatility because the thinner the market then the greater the size of any given supply or demand shock relative to the size of the international market.

The role of national agricultural policies

Across the OECD and beyond, national agricultural sectors are subject to a range of subsidies and other very significant interventions that distort relative prices, inhibit processes of agricultural adjustment and development that underpin improvements in the efficiency of agricultural production, and make world markets more residual. These interventions cannot be said to have played a significant causal role in the price spikes. But they render the world's agricultural sector less effective in bringing forward a supply response in the face of a given price spike, implying that the policy environment has a material impact on the size and duration of any given price spike. Examples of such policies include market price support (often combined with trade barriers), direct payments to farmers, and inflexible biofuel mandates.

A positive role for the state

Many of the innovations and efficiencies that can lead to enhancements in productivity must occur at firm/farm-level to be effective – so good policy in many cases can mean facilitating and catalysing innovation rather than heavy handed intervention. But the evidence from the literature is that, aside from policy reform, there are a number of well trodden methods of increasing competitiveness across and within different sectors:

- Research and development;
- Encouraging innovation, transferring knowledge and investing in technology;
- Building human capital; and
- Provision of infrastructure.