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Development of Input and Output Prices in Farming

Up to 2000, prices for many of the commodities in the agricultural produce markets were on a steady downward course, a trend that was substantially reversed only in 2002. Since then prices of key agricultural products have exploded, the consequence of a global expansion in demand as well as interventions in the farm markets motivated by agricultural and environmental policies. Another factor driving up agricultural commodity prices is the rapid rise of energy costs. Reflecting the high prices of crude oil and natural gas, the production costs of inputs for agriculture have recently soared. Higher input prices are likely to reduce supply and, consequent to the slightly growing demand, drive up prices for farming commodities. According to estimates by OECD and FAO the upward movement will continue for the next decade, even though the peak prices reached by some products in 2007-08 appear to have been an exception.

Franz Sinabell is an economist at WIFO. The author is grateful to Josef Baumgartner for helpful and constructive comments. • The data were processed and analysed with the assistance of Dietmar Weinberger. • Cut-off date: 1 December 2008. • E-mail address: Franz.Sinabell@wifo.ac.at

In order to produce agricultural commodities it is necessary to make available operating resources and expendables the prices of which are linked to the supply and demand situation of key raw materials such as crude oil, ores and minerals. The crucial factor in the development of input prices is the cost of energy. Based on the dollar, crude oil prices increased by 339 percent between January 2004 and August 2008, although in terms of the euro the rise was notably slower (+252 percent) due to the euro's strength. The high price for energy was reflected in the prices for follow-up products which need considerable energy to be manufactured. These include, chiefly, nitrogen fertiliser obtained from atmospheric nitrogen through the medium of natural gas. According to the World Bank, the price of urea nitrogen fertiliser rose from \$ 223 to \$ 770 per ton between 2004 and August 2008.

The time series published by the World Bank for prices of mineral phosphate (used to produce phosphorus fertiliser and requiring considerable energy for its mining and processing) shows an even brisker rise in prices since mid-2007 (Figure 1), responding to the changes in energy costs with some delay. The tenfold increase from early 2004 to August 2008 nevertheless appears to be due not just to the development of input costs: other drivers involved are speculation as well as, apparently, market concentration. For the time being, however, there are insufficient facts to allow quantifying each of the factors, which also include export taxes used by major producer countries to counter domestic inflation (*ICIS*, 2008). Between 2004 and August 2008, prices for diammonium phosphate, a fertiliser extracted from the mineral, rose at a lesser rate than those for mineral phosphate (from \$ 221 to \$ 1,177 per ton).

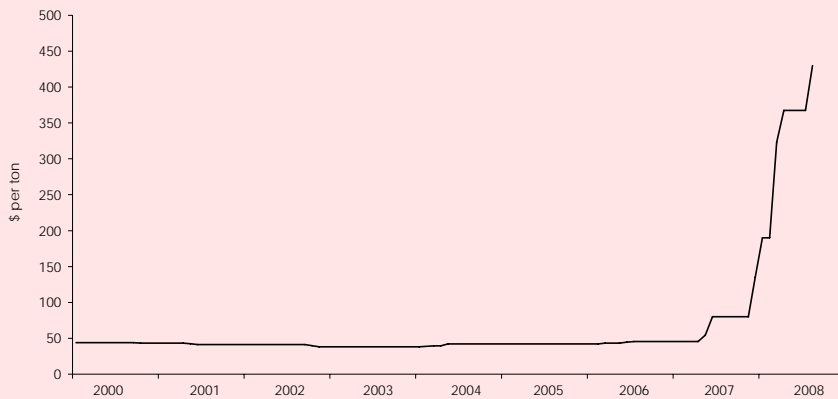
Prices for agricultural commodities depend on effects and framework conditions that are specific for each market. This paper focuses on the markets for grain and cereal products, soy, vegetable oil, milk and dairy products as these are of special importance for Austrian agriculture. Farming commodities markets are affected by three spheres of market influences:

**Global market prices
of selected non-
farming resources**

**International prices for
selected farming raw
materials**

- Supply effects: development of factors used for production (especially soil and capital) plus productivity, production cost and input prices, as well as natural influences such as droughts or beneficial meteorological production conditions;
- demand effects: economic framework conditions such as income development and consumer preferences;
- politics: market intervention motivated by agricultural, food and environmental policies.

Figure 1: Prices of mineral phosphate for fertiliser production in the global market



Source: World Bank commodity prices; WIFO calculations. Phosphate rock (Moroccan), 70 percent BPL, contract, f.a.s. Casablanca.

Seen in the long term, real prices for agricultural commodities were on a downward spiral up to 2000. For long periods, prices went down even in nominal terms on the global market, especially because supply grew much more strongly than demand. Rapid and sustained progress in crop and livestock breeding, improvements in farming organisation and increased mechanisation have for decades resulted in an ongoing rise in productivity.

Such progress will not come to a halt. New technologies (such as genetic engineering or precision farming) which go light on resources and permit stable yields are constantly being developed. Innovations in logistics and storage technologies steadily cut down on losses from wastage. Productivity is boosted by continuous investment in R&D, consulting and education.

However, since 2002, there are indications that the downward trend of agricultural commodity prices is being reversed. The forecasts of *OECD – FAO* (2008), which extend to 2017 and encompass all price-determining factors, generally expect a rise over the reference year of 2000.

It is virtually impossible to exactly predict the supply of farming commodities, considering annual variations in weather conditions. Harvest fluctuations may cause a temporary scarcity in the markets and consequent rise in prices when stocks do not suffice to ensure continuous market supply. In the past years, it was particularly a lengthy arid spell in Australia which cut down on the supply (the wheat harvest declined from 25.1 million tons in 2005/06 to 10.8 million tons the next year). Its effects made themselves felt especially in the grain and dairy markets. In general, however, agricultural production was continuously increased. For 2008, the *USDA* (2008) forecasts a global wheat harvest of 670 million tons, substantially more than the previous high mark of 626 million tons achieved in 2004-05. The total grain harvest (i.e., wheat, maize, oats, barley, rye, millet, sorghum, rice) should exceed 2,190 million tons in 2008-09 – substantially more than in 2000-01 (1,863 million tons; Table 1). The hefty increase in output was due mostly to productivity increases and rather less to an increase in arable land, but it still did not quite keep up with the growing demand.

Table 1: World grain balance, FAO figures

	Ø 1979-1981	Ø 1997-1999	2000-01	2005-06	2006-07	2007-08 Estimate	2008-09 Forecast
	Million tons						
Production	1,442	1,889	1,863.6	2,050.3	2,013.3	2,111.9	2,191.9
Trade			233.4	247.0	255.5	261.9	251.8
Consumption	1,437	1,864	1,896.6	2,033.5	2,064.8	2,127.2	2,176.0
Food	706	1,003		986.5	994.0	1,006.6	1,002.1
Feed	575	657		747.2	741.4	756.8	760.3
Other	156	204		299.8	329.3	363.8	393.5
Stock (final status)			599.2	471.5	427.2	408.8	421.3

Source: FAO, Food Outlook (<http://www.fao.org/giews/english/fo/index.htm>); FAO, World Agriculture Towards 2015-2030 (<http://www.fao.org/docrep/004/y3557e/y3557e17.htm#a5>).

The soaring demand is driven by the steady expansion of the world's population, the economic upswing in Eastern Europe and in populous threshold countries, and the intensified use of agricultural raw materials for energy generation (*OECD*, 2008, *Trostle*, 2008):

- A growing global population translates into greater demand for food commodities. This steady long-term trend is set to continue over the next decade. *OECD – FAO* (2008) expect the global population to grow by 1.1 percent (medium variant) on average per year, to reach about 7.3 billion by 2016. In the medium to long run, prices for farming commodities and food (in particular rice) therefore can be expected to rise world-wide.
- Eastern Europe and the threshold countries will experience dynamic economic growth rates, especially those with large populations such as Brazil (real GDP forecasts by *OECD – FAO*, 2008, Table A1: +3.6 percent), India (+6.3 percent), China (+7.7 percent) and Russia (+4.2 percent). This trend will continue for the next decade. The consequent rise in incomes will push up demand in general, resulting in a change of consumption habits which will converge with those in the OECD countries (*Regmi – Takeshima – Unnevehari*, 2008). There will be a greater demand for milk, meat and grain, as well as processed food – once again a trend that is expected to continue in the medium to long term.
- High crude oil prices make it increasingly profitable to use bio resources as substitutes for fossil fuels (e.g., sugar cane to produce ethanol, chippings instead of fuel oil). Both the USA and the EU make efforts to throttle CO₂ emissions from cars by stepping up the use of vegetable-based fuel. More than a third of the maize harvest in the USA is already diverted to the production of ethanol for use as an additive to petrol. Seen globally, the percentage of arable land dedicated to producing bio fuels is still small (about 1.3 percent of the land used to grow grain, oil seeds and cotton). Yet the explosive expansion within a short period has made itself felt on the markets. According to estimates by the Economic Research Service of the USDA, about a quarter of the almost 10 million hectares reverted to production between 2004 and 2007 is dedicated to bio fuel production (*Trostle*, 2008).

These factors apart, there are more grounds listed to explain the excessive rise in prices for farming commodities, among them increased speculation due to price volatility which heightened profit expectations. Some countries also interfered with their commodity markets in order to stabilise domestic prices, i.a., by banning exports which further accelerated inflation on the global market (*Mitchell*, 2008).

Prices for agricultural commodities fared variably on the world market. Prices for grain and vegetable oil went up substantially, chiefly because more of it was used to produce bio fuels. Prices for dairy products, however, underwent a similar rise though there is no direct link to the fuel market. On the other hand, a large part of the sugar production (mostly from sugar cane) is used, e.g., in Brazil, to produce ethanol for fuel. Nevertheless, sugar prices, having reached a peak in the first quarter of 2006, dived again in mid 2008 (Table 2).

Table 2: World market prices of selected farming commodities

	Wheat	Grain maize	Soy oil	Soy bean meal	Soy	Sunflower oil € per ton	Sugar	Beef	Butter	Whole-milk powder	Skim-milk powder
2000	118.4	90.4	384.1	184.3	200.1	425.0	197.1	2,095	1,495	2,025	2,081
2001	126.0	92.7	390.9	183.6	190.1	541.5	205.7	2,380	1,562	2,160	2,257
2002	137.4	96.1	435.7	177.0	200.7	628.8	150.2	2,243	1,226	1,492	1,438
2003	114.2	82.8	445.9	171.3	206.8	524.9	133.5	1,749	1,254	1,580	1,544
2004	109.9	82.1	481.9	188.3	223.5	549.4	131.0	2,023	1,527	1,751	1,668
2005	103.3	67.8	402.4	150.8	181.5	542.7	177.8	2,106	1,586	1,821	1,823
2006	138.4	83.4	442.8	140.4	175.5	524.1	258.5	2,029	1,524	1,867	2,007
2007	173.0	109.9	587.0	170.0	233.0	725.7	159.5	1,902	2,885	3,364	3,230
First quarter 2007	138.4	123.0	509.6	163.9	209.1	546.7	179.3	1,994	1,564	2,546	2,489
Second quarter 2007	140.1	110.4	563.0	157.2	214.0	624.5	149.9	1,928	2,307	3,598	3,641
Third quarter 2007	189.5	98.8	603.7	174.6	237.8	808.6	155.8	1,894	4,098	3,928	3,814
Fourth quarter 2007	224.3	107.5	671.9	202.0	271.3	923.2	152.9	1,792	3,569	3,384	2,977
First quarter 2008	265.2	138.6	850.4	234.0	330.2	1,200.5	184.5	1,881	2,823	3,007	2,415
Second quarter 2008	209.5	161.7	871.1	229.4	328.5	1,184.7	157.3	2,131	2,713	2,902	2,343
January 2008	240.5	132.9	786.7	233.5	317.6	1,158.9	174.2	1,825	2,718	2,922	2,378
February 2008	278.9	140.0	893.3	244.0	347.1	1,241.5	196.2	1,923	2,967	3,136	2,636
March 2008	276.3	142.9	871.1	224.5	325.9	1,201.2	183.0	1,894	2,785	2,963	2,230
April 2008	220.6	150.8	826.7	216.2	309.0	1,168.8	165.3	1,919	2,682	2,889	2,222
May 2008	196.9	154.6	868.9	217.2	318.9	1,202.6	154.3	2,178	2,668	2,893	2,330
June 2008	211.1	179.8	917.8	254.8	357.6	1,182.8	152.1	2,295	2,789	2,925	2,475
July 2008	199.4	165.2	882.2	259.3	354.7	1,018.4	185.2	2,455	2,854	2,861	2,505
August 2008	211.1	146.9	784.4	233.8	316.6	884.0	200.6	2,494	2,738	2,671	2,254

Source: World Bank, Commodity Prices; Hamburgisches Weltwirtschaftsinstitut, HWWI Commodity Price Index; WIFO calculations. Wheat US hard red winter, first notice month Kansas City; maize US no. 2 yellow, first notice month Chicago; Soy oil raw, ex warehouse, first notice month Chicago; soy bean meal 48 percent protein, fob railroad cars at shipping plants, first notice month Chicago; soy beans US no. 2 yellow, in wagon loads, first notice month Chicago; sunflower oil of various origins, ex tank Rotterdam, first notice month London; raw sugar, CSCE, contract no. 11, first notice month New York; USDA, International Dairy Market News, Western Export Prices; Australian-New Zealand beef, until October 2002 cow forequarters, frozen boneless, 85 percent chemical lean, c.i.f. US port (East Coast), ex-dock and from November 2002 chucks and cow forequarters.

Businesses and farmers in Austria cannot decouple from international developments. Their inclusion in the euro area and the strength of the euro mean that an international increase in import good prices quoted in dollars will be effective in Austria, although with less impact and with some delay only (*Baumgartner – Sinabell, 2007*).

Prices of selected input goods (Table 3) were generally higher in 2008 than in 2007. The only exception was feed maize (produced in Austria), which was offered more cheaply at times than in the previous period.

The higher price of inputs was reflected in the agricultural cost structure, as is evidenced by the food commodity indices: altogether, production expenditure in the first quarter of 2008 was almost 10 percent higher than in 2007 (*LBG, 2008*).

High international prices also impact on the earnings side: almost all product categories show price increases over the 2007 harvest: grain and milk prices reached their peak in the first half of 2008, and appear to have been on a downward slide since.

In 2007, production costs rose at a slightly lesser rate than production earnings (*Statistics Austria, 2008, Sinabell, 2008*), resulting in a jump in the value added by agriculture and in incomes. For 2008, the picture appears less rosy for farmers: due to the fall in output prices and rise in production costs, profitability of farm production is expected to decline in some production segments (*Sinabell – Kniepert, 2008*).

Any assessment of future trends in the raw commodities markets and global food commodities market is aggravated chiefly by the considerable uncertainty pertaining to future crude oil prices. It is only from a long-term perspective that conclusions for future development can be drawn from the past, always assuming that situations are similar.

Price development of agricultural inputs in Austria

Outlook on the price development in the global agricultural commodities markets

Table 3: Domestic prices for selected inputs for Austrian farmers

	Fertilisers				Hyperkorn 26 percent P ₂ O ₅	Fuels		Agricultural diesel ex petrol station	Feed	
	Nitro chalk 27 percent N	Urea 46 percent N	Diammonium phosphate	Potash 60 percent K ₂ O		Diesel fuel as per OMV	Extracted soy bean meal ¹		Feed maize	
	€ per ton in bulk, exclusive VAT					€ per litre	€ per ton			
2000	141.78	–	258.25	152.48	164.58	0.65	0.84	249.18	122.56	
2001	169.90	–	274.50	179.03	171.53	0.62	0.82	252.11	90.78	
2002	157.08	–	256.55	172.50	177.03	0.60	0.81	231.48	110.96	
2003	160.58	101.00	249.58	176.10	181.48	0.63	0.81	229.95	116.56	
2004	164.65	205.85	248.20	167.40	184.40	0.67	0.89	252.80	139.50	
2005	173.03	235.93	281.83	184.40	198.93	0.79	1.02	246.20	97.09	
2006	190.10	277.95	302.70	187.83	214.68	0.84	1.08	239.43	108.23	
2007	206.63	287.75	339.53	215.40	231.23	0.86	1.11	311.43	164.97	
First quarter 2007	207.90	259.80	291.80	190.10	215.80	0.79	1.02	276.90	138.27	
Second quarter 2007	210.20	274.30	329.30	211.70	225.70	0.82	1.06	273.07	135.10	
Third quarter 2007	212.30	301.30	302.20	234.60	221.70	0.88	1.15	302.37	181.25	
Fourth quarter 2007	196.10	315.60	434.80	225.20	261.70	0.96	1.22	393.40	210.70	
First quarter 2008	240.30	349.00	492.50	322.70	331.70	0.99	1.27	431.87	208.50	
Second quarter 2008	280.60	384.20	530.30	386.50	384.50	1.10	1.41	413.77	192.87	
January 2008	.	.	.	.	.	0.97	1.25	430.00	208.50
February 2008	.	.	.	.	.	0.98	1.25	442.50	–
March 2008	.	.	.	.	.	1.01	1.31	423.10	–
April 2008	.	.	.	.	.	1.04	1.33	412.50	200.50
May 2008	.	.	.	.	.	1.11	1.42	405.00	189.50
June 2008	.	.	.	.	.	1.16	1.49	423.80	188.60
July 2008	.	.	.	.	.	1.18	1.49	435.00	192.50
August 2008	.	.	.	.	.	.	1.42	385.00	200.00

Source: AMA, Daten und Fakten der Agrarmarkt Austria für den Bereich Getreide und Ölsaaten; Bundesanstalt für Agrarwirtschaft, Internet data pool (<http://www.awi.bmlfuw.gv.at/datenpool.html>); Börse für landwirtschaftliche Produkte in Wien, Amtliche Kursblätter; Statistics Austria, GHPI; OMV, Treibstoffpreisentwicklung (<http://www.omv.at/>); WIFO Database. – ¹ Extracted soy bean meal, 44 percent raw protein and fat, max. 7 percent crude fibres, bulk. Prices for extracted soy bean meal and feed maize are wholesale sales prices.

Table 4: Austrian producer prices for selected food commodities

	Quality wheat	Grain maize	Rape	Soy beans	Dessert apples class I	Tomatoes class I	Milk ¹	Young bulls R3	Pigs class E	Poulards ready for roasting	Eggs ²
	€ per ton							€ per ton of slaughter weight		€ per ton	€ per 100
2000	125.6	115.2	145.7	181.2	256.5	589.4	278.3	2,820	1,430	1,823	8.14
2001	123.4	114.4	191.8	179.5	325.6	549.4	319.0	2,450	1,710	1,942	8.21
2002	114.1	105.1	191.3	218.3	342.5	675.8	301.4	2,680	1,370	1,936	8.61
2003	117.3	112.9	205.2	203.4	424.4	773.0	281.8	2,690	1,280	1,916	8.84
2004	113.5	125.3	190.7	197.0	350.5	338.7	278.9	2,690	1,430	1,935	9.10
2005	99.3	94.0	184.4	196.5	298.7	440.3	279.5	3,010	1,450	1,917	8.93
2006	110.1	105.8	199.3	188.0	309.8	524.2	285.4	3,120	1,510	1,920	8.99
2007	180.1	161.8	296.7	213.9	496.4	360.6	322.5	3,020	1,380	1,970	10.86
First quarter 2007	139.7	129.7	222.3	192.2	429.5	.	293.5	3,147	1,307	1,950	10.50
Second quarter 2007	138.9	128.6	231.5	208.9	428.3	446.0	287.6	2,930	1,350	1,960	10.50
Third quarter 2007	207.8	180.6	319.2	215.7	513.8	349.9	327.5	2,907	1,497	1,957	10.58
Fourth quarter 2007	220.4	208.1	345.7	229.4	459.1	380.4	388.4	3,123	1,363	2,017	11.88
First quarter 2008	231.2	204.8	377.8	220.0	495.2	.	402.8	3,267	1,413	2,043	12.27
Second quarter 2008	215.1	198.0	.	338.0	426.8	541.9	384.4	3,123	1,540	2,033	11.73
January 2008	222.1	203.7	362.9	210.0	491.4	.	404.5	3,280	1,360	2,050	11.88
February 2008	229.7	205.1	345.0	200.0	508.1	.	403.7	3,290	1,400	2,040	12.49
March 2008	241.7	205.6	425.6	250.0	486.2	.	400.3	3,230	1,480	2,040	12.44
April 2008	233.9	204.4	.	338.0	466.2	749.8	395.1	3,140	1,410	2,030	12.32
May 2008	209.4	197.8	.	.	444.0	519.4	383.3	3,110	1,550	2,040	11.34
June 2008	201.9	191.9	.	.	370.0	356.5	374.9	3,120	1,660	2,040	11.54
July 2008	.	.	.	.	.	.	.	3,110	1,710	2,030	11.72

Source: Statistics Austria, Agrarmarkt Austria, WIFO calculations. – ¹ Price ex farm, 3,7 percent fat and 3.4 percent protein. – ² Contract goods, free-range, weight class M.

The decline in real prices for agricultural raw materials, observed over many decades, appears to have come to a standstill and has even taken on signs of a trend reversal since 2002. Figure 2 demonstrates this development using the world food

commodities price index between 1960 and 2008. Some agricultural commodities are included in this index at a weight corresponding to their international trade volume. Accordingly, the index also covers price developments for many goods which are not produced in Europe but for which there is a demand on the continent (e.g., coffee).

The time series shows that a ten-year trend of food commodities prices declining in real terms came to a halt in 2002. In 2007 and 2008, prices for major food commodities shot up. In real terms (i.e., after accounting for the inflation rate), world market prices for food commodities are at present at a level they last had from 1995 to 1996.

Figure 2: Real-term food commodities price index on the global market



Source: Weltbank, Prospects for the Global Economy, 29 May 2007, <http://web.worldbank.org/external/default/main?theSitePK=659149&pagePK=2470434&contentMDK=21292224&menuPK=2300882&piPK=2470429>. Nominal values based on the dollar, deflated by the US consumer price index; extended from May 2007 by WIFO calculations based on the monthly "Commodity Price Data" (Pink Sheet) published monthly by the World Bank (<http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTDECPROSPECTS/0..contentMDK:21148472~menuPK:556802~pagePK:64165401~piPK:64165026~theSitePK:476883.00.html>).

A similar development could be observed in the 1970s when agricultural commodities became more expensive in parallel to the bull market for crude oil. During 1974 farm commodity prices on the world market fluctuated considerably, and they retained their volatility for almost a decade. A major price hike for crude oil in the 1980s once again left food prices to follow suit, albeit at a lesser rate and lower level. At present we have insufficient data to assess whether the current development will emulate that of the 1970s or rather the 1980s. A major uncertainty factor is whether prices for crude oil will go down again.

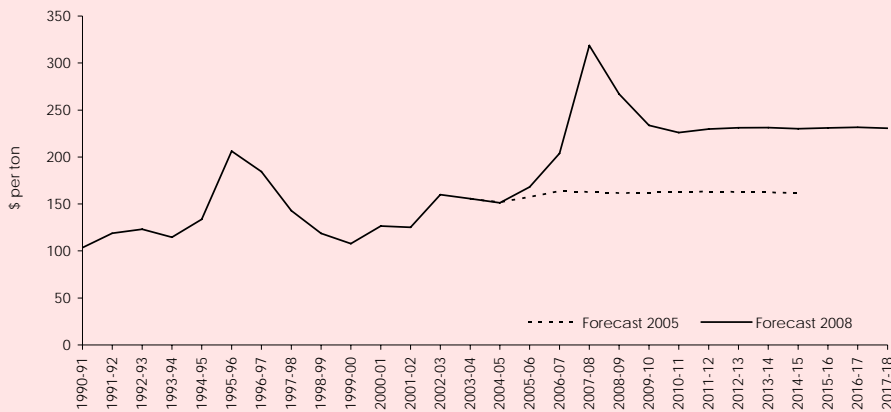
OECD, FAO and FAPRI (Food and Agricultural Policy Research Institute, Iowa State University and University of Missouri Columbia) make regular forecasts of the medium- to long-term development of agricultural commodity prices, and occasionally also look at the development of production costs. According to their figures, food prices on the global markets will be higher in the coming years than during 2000-2004, but lower than in 2007 (Figure 3, using wheat as an example). Combined with the development in real international agricultural commodity prices, it appears that the upward movement shown in Figure 2 should flatten over the coming years.

Public stock keeping can help stabilise prices, as is confirmed by the low price fluctuations across long periods achieved in the EU. With the reduction of publicly financed stocks in the EU, this function is no longer an option in many markets. As CAP policymakers are increasingly shying away from direct intervention in the market, price volatility on the agricultural commodities markets should be expected to rise.

Accordingly it will be increasingly important for farms to have tools to shore themselves up against price risks. In the past, agricultural operations diversified into a wide

range of farm commodities in the hope of securing themselves against yield and price risks. Today, however, an increase in price volatility does not mean that they should reduce their degree of specialisation in order to achieve better risk compensation. Earnings insurance and hedging are further tools to reduce the market price risk.

Figure 3: Wheat prices on the global market and price forecasts from 2005 and 2008



Source: OECD – FAO, Agricultural Outlook 2008 and 2005.

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Up to 2000, prices in the agricultural produce markets were on a steady downward course, a trend that was at last and substantially reversed in 2002. Since then prices of key agricultural products have exploded, the consequence of interventions in the farm markets motivated by agricultural and environmental policies. Measures to boost plant-based fuel production played a major role: in the USA more than a third of the maize (corn) harvest goes into the production of ethanol which can be used as a fuel additive. Another factor driving up farm goods prices is the rapid rise of energy costs. Reflecting the high prices of crude oil and natural gas, the production costs of inputs for agriculture have recently soared. Higher prices are likely to reduce supply and, consequent to the growing demand, drive up prices for farming produce. According to estimates by OECD and FAO the upward movement will continue for the next decade, even though the peak prices reached by some products in 2007-08 appear to have been an exception.

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