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A Note on Rising Food Prices

Donald Mitchell

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Abstract

The rapid rise in food prices has been a burden on the poor in developing countries, who spend roughly half of their household incomes on food. This paper examines the factors behind the rapid increase in internationally traded food prices since 2002 and estimates the contribution of various factors such as the increased production of biofuels from food grains and oilseeds, the weak dollar, and the increase in food production costs due to higher energy prices. It concludes that the most important factor was the large increase in biofuels production in the U.S. and the EU. Without these increases, global wheat and maize stocks would not have declined appreciably, oilseed prices would not have tripled, and price increases due to other factors, such as droughts, would have been more moderate. Recent export bans and speculative activities would probably not have occurred because they were largely responses to rising prices. While it is difficult to compare the results of this study with those of other studies due to differences in methodologies, time periods and prices considered, many other studies have also recognized biofuels production as a major driver of food prices. The contribution of biofuels to the rise in food prices raises an important policy issue, since much of the increase was due to EU and U.S. government policies that provided incentives to biofuels production, and biofuels policies which subsidize production need to be reconsidered in light of their impact on food prices.

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Produced by the Research Support Team

A Note on Rising Food Prices[1]

Donald Mitchell[2]

I. Introduction

Internationally traded food commodities prices have increased sharply since 2002 and especially since late-2006, and prices of major staples, such as grains and oilseeds,[3] have doubled in just the past two years. Rising prices have caused food riots in several countries and led to policy actions such as the banning of grain and other food exports by a number of countries and tariff reductions on imported foods in others. The policy actions reflect the concern of governments about the impact of food price increases on the poor in developing countries who, on average, spend half of their household incomes on food. This paper examines how internationally traded food commodities prices (maize, wheat, rice, soybeans, etc.) have changed, and analyzes the factors contributing to these increases. In particular, it looks at the contribution of biofuels production to food price increases. In this paper biofuels refer to ethanol and biodiesel.[4]

II. The rise in global food prices

The IMF's index of internationally traded food commodities prices[5] increased 130 percent from January 2002 to June 2008 and 56 percent from January 2007 to June 2008 (Figure 1). Prior to that, food commodities prices had been relatively stable after reaching lows in 2000 and 2001 following the Asia financial crisis. The low levels of global grain stocks had been identified as a cause for concern in a number of fora[6] and the risk of higher food prices was highlighted in a recent World Bank publication[7] and online.[8]

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[1] The views expressed in this paper are those of the author and should not be attributed to the World Bank or its Executive Directors.

[2] Lead Economist, Development Prospects Group (DECPG), World Bank, Washington. Comments should be sent to dmitchell@worldbank.org.

Thanks are expressed to Hans Timmer, Ron Steenblik, Harry de Gorter, and Masami Kojima for useful comments. Any remaining errors or omissions are the sole responsibility of the author.

[3] Oilseeds are crops with high oil content such as soybeans, rapeseed, sunflower, flax and cottonseed.

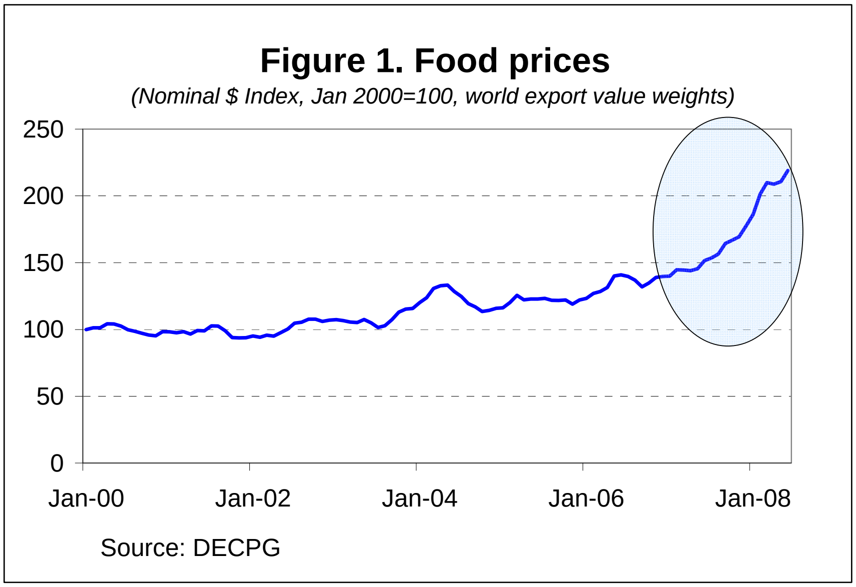
4 Ethanol is produced from sugar crops, such as sugar cane or beets, or starchy crops such as maize. Biodiesel is produced from vegetable oils or animal fats.

[5] A nominal dollar index of food commodity prices using global export value weighs.

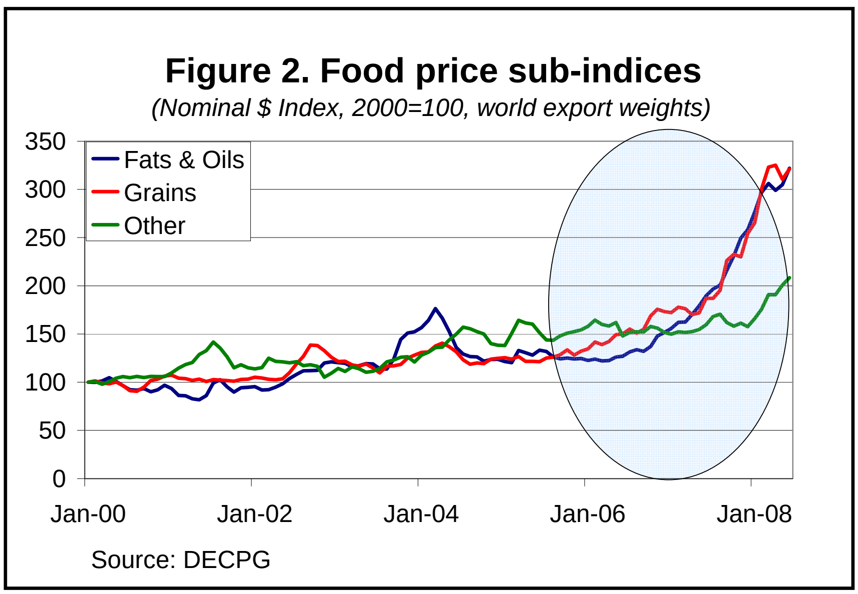
[6] "Are we facing a food price spike", session at Rural Week 2004, Mitchell and Le Vallee (2005) Food Price Variability in Global Markets.

[7] Global Development Finance 2007, May 2007,

[8] Mitchell, Donald "A coming spike in grain prices?" Focus Topic, April 2007.



The increase in food commodities prices was led by grains (Figure 2) which began sustained price increases in 2005 despite a record global crop in the 2004/05 crop year[9] that was 10.2 percent larger than the average of the three previous years and a near-record crop in 2005/06 that was still 8.9 percent larger. Global stocks of grain increased in 2004/05 but declined in 2005/06 as demand increased more than production. From January 2005 until June 2008, maize prices almost tripled, wheat prices increased 127 percent and rice prices increased 170 percent. The increase in grain prices was followed by increases in fats & oils prices in mid-2006, and that also followed a record 2004/05 global oilseed crop that was 13 percent larger than in the previous year and an even larger crop in 2005/06. Fats & oils prices have shown similar increases to grains, with palm oil prices up 200 percent from January 2005 until June 2008, soybean oil prices up 192 percent, and other vegetable oils prices increasing by similar amounts. Other foods prices (sugar, citrus, bananas, shrimp and meats) increased 48 percent from January 2005 to June 2008.



[9] Crop years begin with harvest and continue until the next harvest.

III. Recent estimates of the contribution of biofuels production to food prices

Estimates of the contribution of biofuels production to food price increases are difficult, if not impossible to compare. Estimates can differ widely due to different time periods considered, different prices (export, import, wholesale, retail) considered, and different coverage of food products. Moreover, the analyses depend on the currency in which prices are expressed, and whether the price increases are inflation adjusted (real) or not (nominal). Different methodologies will likely yield different results. General equilibrium model exercises generate long-term price impacts of specific shocks. They take into account interactions with other markets, but do not capture short-term price dynamics that are significantly more pronounced. Detailed studies of specific crops may include the short-term dynamics, but often exclude the impact on other markets. Methodologies may also differ to the extent they consider shocks to be independent. For example, speculation may be seen as an independent driver, or may be attributed to a change in fundamentals that would not have otherwise occurred.

Despite all the differences in approach, many studies recognize biofuels production as a major driver of food prices. The USDA's chief economist in testimony before the Joint Economic Committee of Congress on May 1, attributed much of the increase in farm prices of maize and soybeans to biofuels production (Glauber, May 1, 2008). The IMF estimated that the increased demand for biofuels accounted for 70 percent of the increase in maize prices and 40 percent of the increase in soybean prices (Lipsky, May 8, 2008). Collins (2008) used a mathematical simulation to estimate that about 60 percent of the increase in maize prices from 2006 to 2008 may have been due to the increase in maize used in ethanol. Rosegrant, et al. (2008), using a general equilibrium model, calculated the long-term impact on weighted cereal prices of the acceleration in biofuel production from 2000 to 2007 to be 30 percent in real terms. Maize prices were estimated to have increased 39 percent in real terms, wheat prices increased 22 percent and rice prices increased 21 percent. During this period, the U.S. CPI increased by 20.4 percent, which would imply nominal prices increases of 47, 26, and 25, respectively, for maize, wheat and rice prices. This is the same order of magnitude as was calculated with the World Bank's linkages model (van der Mensbrugghe 2006). Differences in the estimates of the impact of biofuels on the price index of all food depend largely on how broadly the food basket is defined and what is assumed about the interaction between prices of maize and vegetable oils (directly influenced by demand for biofuels) to prices of other crops such as rice through substitution on the supply or demand side. For example, the Council of Economic Advisors (Lazear, May 14, 2008) estimated that retail food prices increased only about 3 percent over the past 12 months due to ethanol production, in part because they only considered the impact of maize prices, directly and indirectly, on retail prices.

Many other potential drivers of the escalating food prices are mentioned in discussions, but there are few quantitative estimates of their impacts. For example, a recent USDA report (Trostle, May 2008) attributed the increase in world market prices for major food commodities such as grains and vegetable oils to many factors including biofuels as well as other factors including the declining dollar, rising energy prices, increasing agricultural costs of production, growing foreign exchange holdings by major food-importing countries, and recent policies by some exporting countries to mitigate their own food-price inflation.

The methodology used in this paper is ad hoc as it does not use structural models to calculate the driving factors. Instead, the paper tries to identify a few key factors that have contributed to the increase in food commodities prices and identify other indirect impacts that were the result of scarcity in agricultural markets that was caused by the key drivers. This is an ad hoc approach, but it has the advantage that indirect, difficult-to-quantify, and short-term impacts can be explored in detail. The analysis focuses on the increase in individual food crop prices such as maize, wheat, rice oilseeds, and on the index of food commodities prices since 2002. These prices reflect export prices of food commodities, not retail prices or import prices of developing countries, which would be influenced more by freight rates, exchange rates and domestic inflation. The analysis is not forward looking and does not consider how supply would respond to high commodity prices and moderate price increases over time.

IV. Estimates of factors contributing to the rise in food commodities prices

There are a number of factors that have contributed to the rise in food prices. Among these are the increase in energy prices and the related increases in prices of fertilizer and chemicals, which are either produced from energy or are heavy users of energy in their production process. This has increased the cost of production, which ultimately gets reflected in higher food prices. Higher energy prices have also increased the cost of transportation, and increased the incentive to produce biofuels and encouraged policy support for biofuels production. The increase in biofuels production has not only increased demand for food commodities, but also led to large land use changes which reduced supplies of wheat and crops that compete with food commodities used for biofuels. Drought in Australia in 2006 and 2007 and poor crops in Europe in 2007 added to the grain and oilseed price increases, and rapid import demand increases for oilseeds by China to feed its growing livestock and poultry industry contributed to oilseed price increases. Other factors, including the decline of the dollar, and the increased investment in commodities by institutional investors to hedge against inflation and diversify portfolios may have also contributed to the price increases. The remainder of this section will examine these factors.

High energy prices have contributed about 15-20 percent to higher U.S. food commodities production and transport costs. Production costs per acre for U.S. corn[10], soybeans and wheat increased 32.3, 25.6 and 31.4 percent, respectively, from 2002 to 2007, according to the USDA's cost-of-production surveys (USDA 2008b) and forecasts (Table 1). However, yield increases during this period reduced the per bushel cost increases to 17.0, 24.1 and 6.7 percent, respectively. The contribution of the energy-intensive components of production costs—fertilizer, chemicals, fuel, lubricants and electricity—were 13.4 percent for corn, 6.7 percent for soybeans and 9.4 percent for wheat per bushel. The production-weighted average increase in the cost of production due to these energy-intensive inputs for these crops was 11.5 percent between 2002 and

[10] Corn and maize are used interchangeably in this paper.

2007. In addition to the increase in production costs, transport costs also increased due to higher fuel costs and the margin between domestic and export prices reflect this cost (Table 2). However, these margins also include handling and other charges, such as insurance, which increase with crop prices. The margin for corn between central Illinois cash and the Gulf Ports barge increased from $0.36 to $0.72 per bushel for an increase of 15.5 percent, while the margin between Kansas City and the Gulf Ports wheat increased only $1 per metric ton. An export weighted average of these prices suggests that transport costs could have added as much as 10.2 percent to the export prices of corn and wheat. Comparable data was not available for soybeans. Thus, the combined increase in production costs and transport costs for the major U.S. food commodities—corn, soybeans and wheat—was at most 21.7 percent, and this amount likely overstates the increase, because transport costs are not estimated separately. It therefore seems reasonable to conclude that higher energy and related costs increased export prices of major U.S. food commodities by about 15-20 percent between 2002 and 2007.

Table 1. Cost of production for corn, soybeans and wheat, 2002 vs. 2007 (dollars per acre)

	Corn		Soybeans		Wheat	
	2002	2007**	2002	2007**	2002	2007**
Operating costs:						
Seed	31.84	48.93	25.45	38.27	6.65	9.51
Fertilizer	42.51	93.96	6.79	13.94	17.71	33.33
Chemicals	26.11	24.67	17.12	14.79	7.13	9.23
Custom operations	10.79	10.93	6.16	7.25	5.67	6.93
Fuel*	18.93	30.98	6.98	16.98	8.67	19.20
Repairs	13.91	14.86	9.76	11.93	10.15	12.78
Other	0.22	0.12	0.63	0.15	0.61	0.34
Interest	1.17	5.16	0.61	2.37	0.48	2.14
Total Operating	145.48	229.61	73.5	105.68	57.07	93.46
Allocated overhead:						
Hired labor	3.06	2.22	1.84	2.15	2.53	2.52
Unpaid labor	25.74	23.86	15.59	17.02	16.72	21.97
Capital recovery	55.26	69.99	43.30	54.00	48.97	53.86
Land	87.44	95.44	80.74	92.72	39.19	42.93
Taxes & ins.	5.42	7.39	5.66	6.93	3.90	7.24
Overhead	11.91	13.83	11.37	12.90	7.25	8.78
Total Allocated Overhead	188.83	212.73	158.5	185.72	118.56	137.3
Total Costs ($per Acre)	334.31	442.34	232	291.4	175.63	230.76
Yields	134	151.5	40	40.5	27.9	34.4
Total Cost ($/bu)	2.49	2.92	5.80	7.20	6.29	6.71

Source: USDA Cost of Production Surveys and Forecasts, July 2008. *Fuels include lubricants and electricity. ** is USDA's forecast.

Table 2. Margins between major producing areas and the U.S. Gulf Ports.

Crop year	Corn prices $/bu. Central Illinois	Gulf Port	Margin	Wheat prices $/metric ton Kansas City HRW	Gulf Port HRW	Margin
2002	2.34	2.70	0.36	155	160	5.00
2003	2.52	2.94	0.42	148	156	8.00
2004	1.93	2.48	0.55	147	151	4.00
2005	2.00	2.69	0.69	164	168	4.00
2006	3.33	3.94	0.61	198	204	6.00
2007	4.43	5.16	0.72	335	341	6.00
Increase 2002-07 (percent)			15.53			0.65

Source: USDA Feed Grains and Wheat Yearbook Tables, July 2008.

Increased biofuel production has increased the demand for food commodities. The use of maize for ethanol grew especially rapidly from 2004 to 2007 and used 70 percent of the increase in global maize production (Figure 3). In contrast, feed use of maize, which accounts for 65 percent of global maize use, grew by only 1.5 percent per year from 2004 to 2007 while ethanol use grew by 36 percent per year. The share of global feed use of total use declined in response to maize price rises from 69 to 64 percent from 2004 to 2007, and from 70 to 67 percent when the feed by-products from biofuel production are included in feed use.[11]

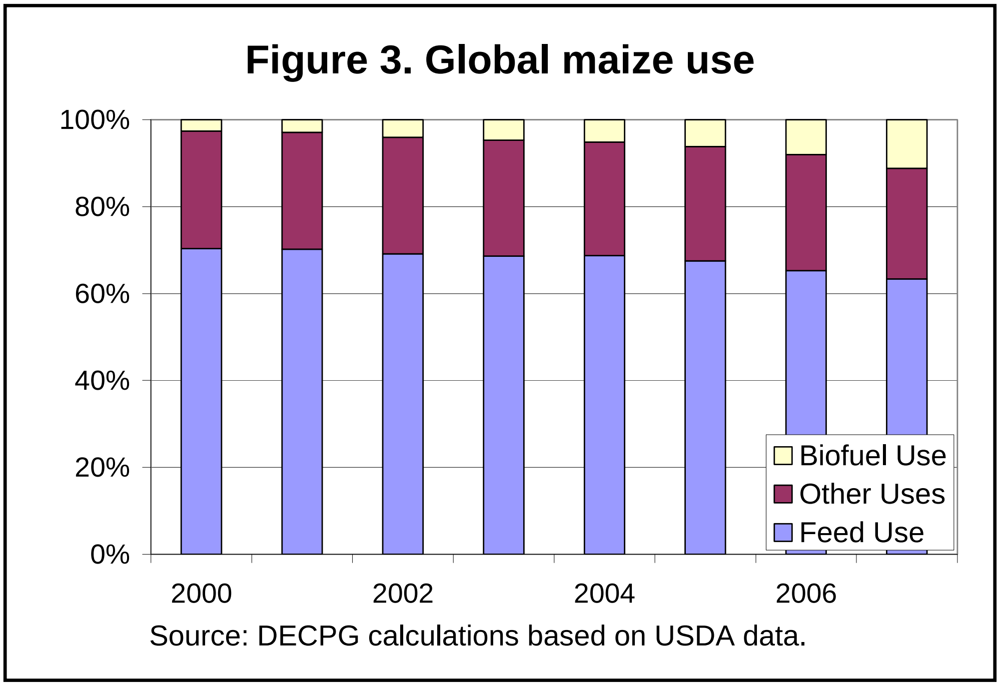
The United States is the largest producer of ethanol from maize and is expected to use about 81 million tons for ethanol in the 2007/08 crop year. Canada, China and the European Union used roughly an additional 5 million tons of maize for ethanol in 2007 (USDA 2008a), bringing the total use of maize for ethanol to 86 million tons, which was about 11 percent of global maize production. The large use of maize for ethanol in the U.S. has important global implications, because the U.S. accounts for about one-third of global maize production and two-thirds of global exports and used 25 percent of its production for ethanol in 2007/08.

About 7 percent of global vegetable oil supplies were used for biodiesel production in 2007 and about one-third of the increase in consumption from 2004 to 2007 was due to biodiesel.[12] The largest biodiesel producers were the European Union, the United States, Argentina, Australia, and Brazil, with a combined use of vegetable oils for biodiesel of about 8.6 million tons in 2007 compared with global vegetable oils production of 132 million tons according to the USDA (2008f). From 2004 to 2007, global consumption of vegetable oils for all uses increased by 20.8 million tons, with food use accounting for 80 percent of total use and 60 percent of the increase. Industrial uses of vegetable oils (which include biodiesel) grew by 15 percent per annum from 2004

[11] Biofuels production from maize uses only the starch in the maize kernel and 30 percent of the maize kernel remains as by-product called distillers dried grains with soluabales (DDGS) which is a high-protein livestock feed.
[12] Data on biodiesel are incomplete and do not allow a precise estimate.

to 2007, compared with 4.2 percent per annum for food use. The share of industrial use of total use rose from 14.4 percent in 2004 to 18.7 percent in 2007 (Figure 4).

Imports of vegetable oils by the EU and U.S. have increased substantially, with the EU-27 increasing imports from 4.4 to 6.9 million tons from 2000 to 2007 (Figure 5) and the U.S. increasing imports from 1.7 to 2.9 million tons. The large imports coincided with the increase in biodiesel production in the EU-27 from .45 billion gallons in 2004 to 1.9 billion gallons in 2007 and from .03 billion gallons in the U.S. in 2004 to an estimated .44 billion gallons in 2007.



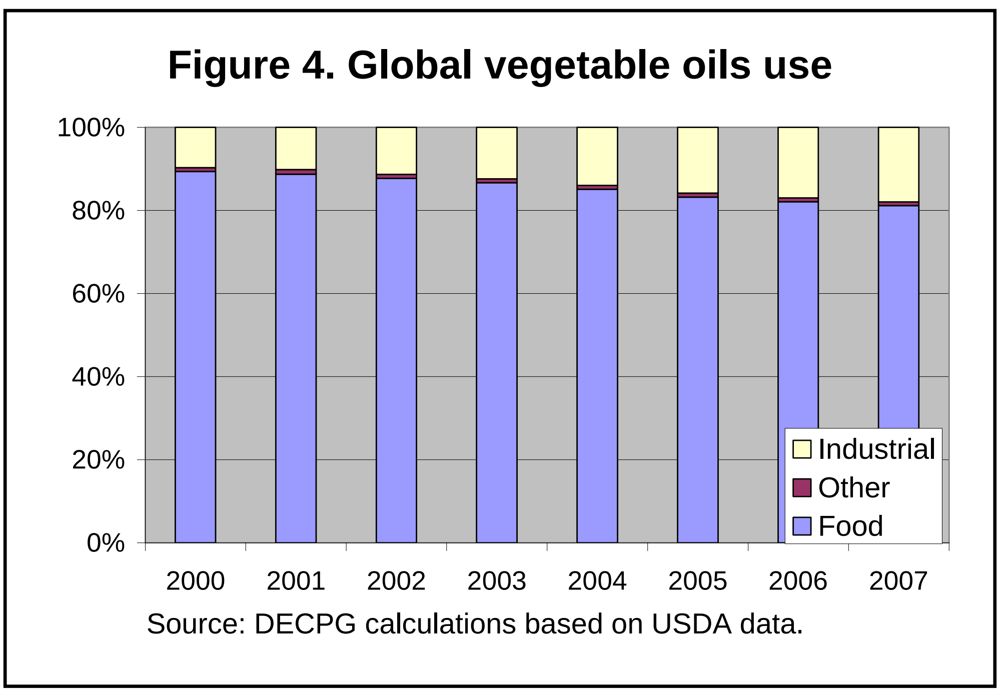
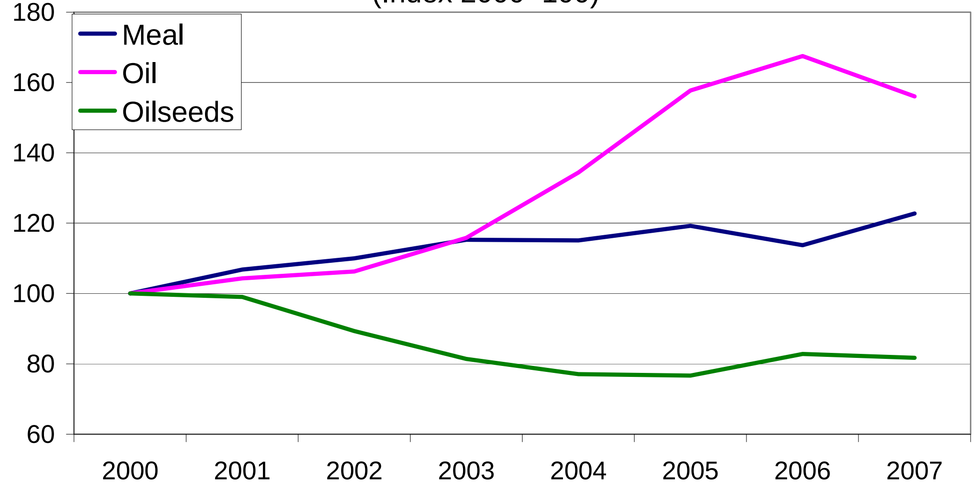


Figure 5. EU oilseeds imports

(Index 2000=100)



Source: DECPG calculations based on USDA data.

Brazilian ethanol production from sugar cane has not contributed appreciably to the recent increase in food commodities prices, because Brazilian sugar cane production has increased rapidly and sugar exports have nearly tripled since 2000. Brazil uses approximately half of its sugar cane to produce ethanol for domestic consumption and exports and the other half to produce sugar. The increase in cane production has been large enough to allow sugar production to increase from 17.1 million tons in 2000 to 32.1 million tons in 2007 and exports to increase from 7.7 million tons to 20.6 million tons. Brazil’s share of global sugar exports increased from 20 percent in 2000 to 40 percent in 2007, and that was sufficient to keep sugar price increases small except for 2005 and early 2006 when Brazil and Thailand had poor crops due to drought.

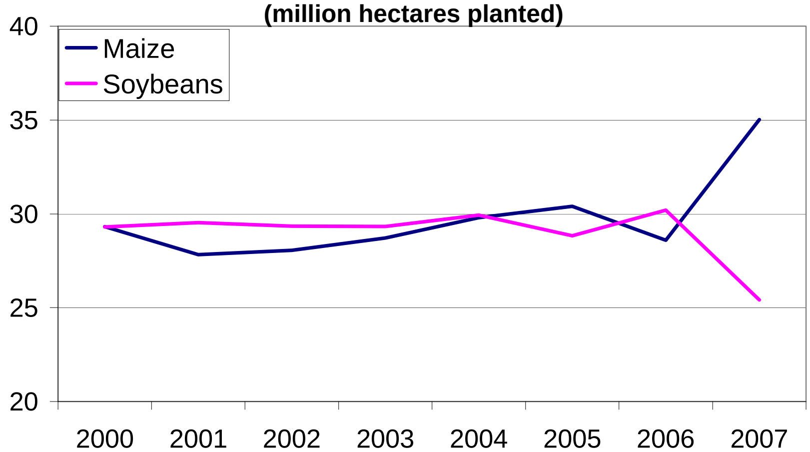
The increases in biofuels production in the EU, U.S. and most other biofuel-producing countries have been driven by subsidies and mandates. The U.S. has a tax credit available to blenders of ethanol of $0.51 per gallon and an import tariff of $0.54 per gallon, as well as a biodiesel blenders tax credit $1.00 per gallon. The U.S. mandated 7.5 billion gallons of renewable fuels by 2012 in its 2005 legislation and raised the mandate to 15 billion gallons of ethanol from conventional sources (maize) by 2022 and 1.0 billion gallons of biodiesel by 2012 in energy legislation passed in late-2007. The new U.S. mandates will require ethanol production to more than double and biodiesel production to triple if they are met from domestic production. The EU has a specific tariff of €0.192/liter of ethanol (€0.727 or about $1.10 per gallon) and an ad valorem duty of 6.5 percent on biodiesel. EU member states are permitted to exempt or reduce excise taxes on biofuels, and several EU member states have introduced mandatory blending requirements. Individual member states have also provided generous excise tax concessions without limit, and Germany for example, has provided tax exemptions of €0.4704/ ($0.64) per liter of biodiesel and €0.6545 ($0.88) per liter of ethanol prior to new legislation in 2006 (Kojima, Mitchell and Ward, 2007; Global Subsidies Initiative 2008). These strong incentives and mandates encouraged the rapid expansion of biofuels in both the EU and U.S.

The EU began to rapidly expand biodiesel production after the EU directive on biofuels (2003/03/EC) entered into effect in October 2001 stipulating that national measures must be taken by EU countries aimed at replacing 5.75 percent of all transport fossil fuels with biofuels by 2010. This led to an increase in biodiesel production from 0.28 billion gallons in 2001 to 1.78 billion gallons in 2007 (FAPRI 2008). Rapeseed was the primary feedstock, followed by soybean oil and sunflower oil. The combined use of vegetable oils for biodiesel was 6.1 million tons in 2007 compared with about 1.0 million tons in 2001.

The U.S. expanded its biodiesel production following legislation passed in 2004 which took effect in January 2005, providing an excise tax credit of US$1.00 per gallon of biodiesel made from agricultural products. This contributed to an increase in biodiesel production in the U.S. from 0.03 billion gallons in 2005 to .44 billion gallons in 2007 and used 3.0 million tons of soybean oil and 0.3 million tons of other fats and oils. These two policies encouraged the rapid expansion of oilseeds production for biodiesel and contributed to the surge in vegetable oils prices, with annual average soybean oil prices rising from $354/ton in 2001 to $881 per ton in 2007. Monthly soybean oil prices rose to $1,522/ton in June 2008. Since oilseeds are close substitutes and prices highly correlated, this led to similar increases in other oilseeds prices.

Figure 6. U.S. Maize and Soybean Area

(million hectares planted)

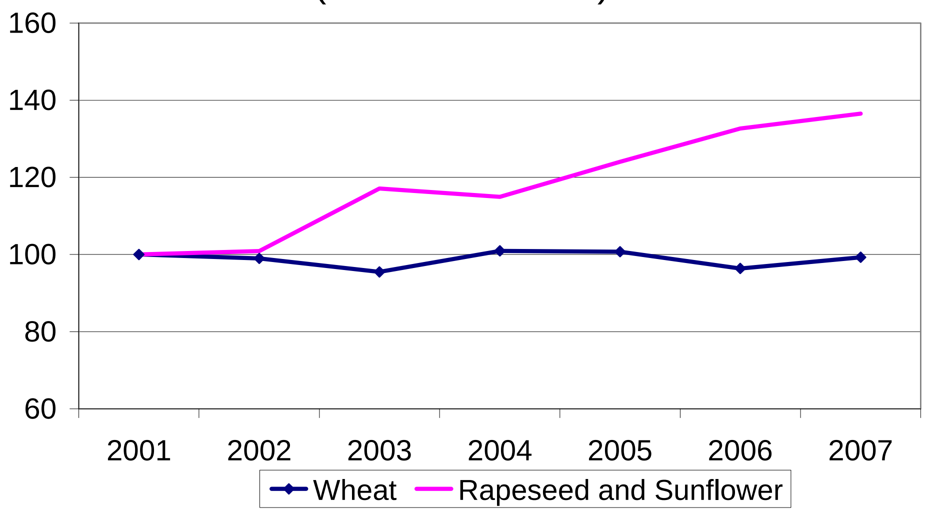


Source: DECPG calculations based on USDA data.

Land use changes due to expanded biofuel's feedstock production have been large and have led to reduced production of other crops. The U.S. expanded maize area 23 percent in 2007 in response to high maize prices and rapid demand growth for maize for ethanol production. This expansion resulted in a 16 percent decline in soybean area (Figure 6) which reduced soybean production and contributed to a 75 percent rise in soybean prices between April 2007 and April 2008.

While maize displaced soybeans in the U.S., other oilseeds displaced wheat in the EU and other wheat exporting countries. The expansion of biodiesel production in the EU diverted land from wheat and slowed the increase in wheat production which would have otherwise kept wheat stocks higher. In response to the increased demand and rising prices for oilseeds, land planted to oilseeds increased, especially rapeseed and to a lesser extent sunflower. The increase was primarily in the countries that are also major wheat exporters such as Argentina, Canada, the EU, Russia and Ukraine. Oilseeds and wheat are grown under similar climatic conditions and in similar areas and most of the expansion of rapeseed and sunflower displaced wheat or was on land that could have grown wheat. The 8 largest wheat exporting countries[13] expanded area in rapeseed and sunflower by 36 percent (8.4 million hectares) between 2001 and 2007 while wheat area fell by 1.0 percent (Figure 7). The wheat production potential of this land was 26 million tons in 2007 based on average wheat yields in each country, and the cumulative wheat production potential of that land totaled 92 million tons from 2002 to 2007. To illustrate the impact of this land shift on wheat stocks, Figure 8 shows the simulated wheat stocks compared to actual wheat stocks if the land planted to rapeseed and sunflower had been planted to wheat and if wheat stocks had increased by the same amounts. The simulation shows that wheat stocks would have been almost as large in 2007 as in 2001 rather than lower by almost half. Figure 9 shows the relationship between wheat stocks and prices.

Figure 7. Wheat and Oilseeds Area
(Index 2001=100)



Source: DECPG

[13] Eight countries and groups accounted for 90 percent of global wheat exports during 2005-07. These countries and their shares were: U.S. 25.4%. Canada 15.3%, EU-27 11.9%, Russian Federation 9.8%, Australia 9.3%, Argentina 8.8%, Kazakhstan 6.0% and Ukraine 3.2%.

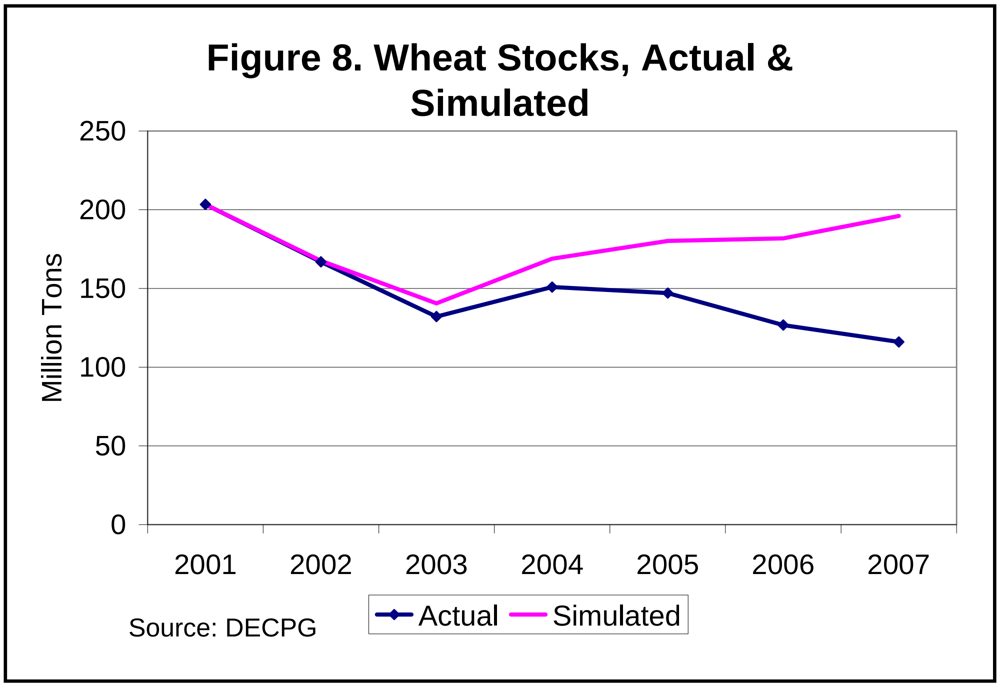


Figure 8. Wheat Stocks, Actual & Simulated
Million Tons
250
200
150
100
50
0
2001
2002
2003
2004
2005
2006
2007
Source: DECPG
Actual
Simulated

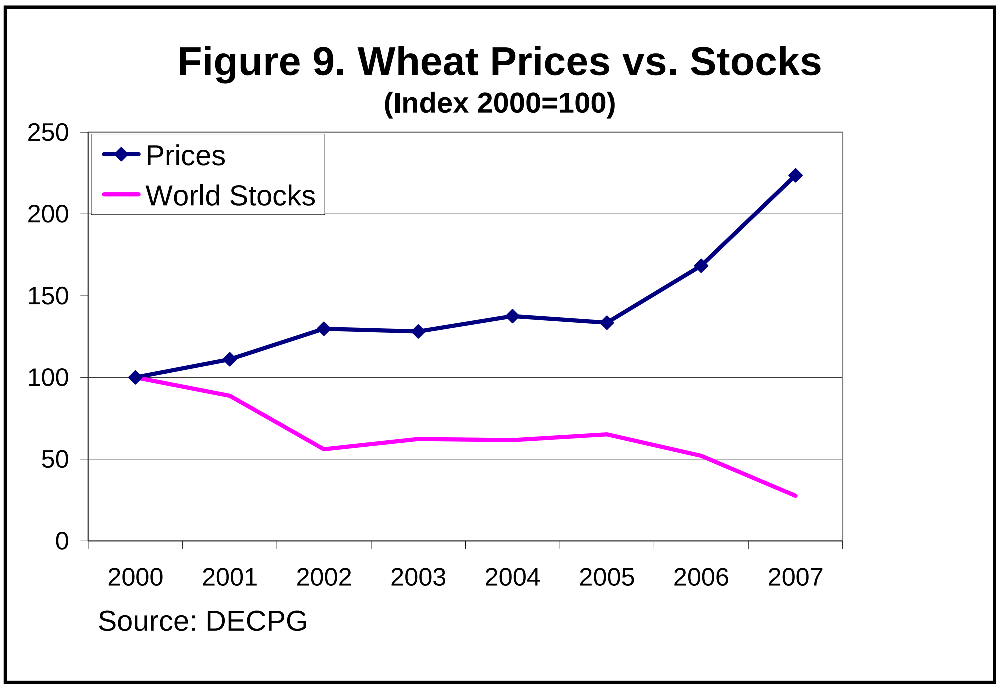
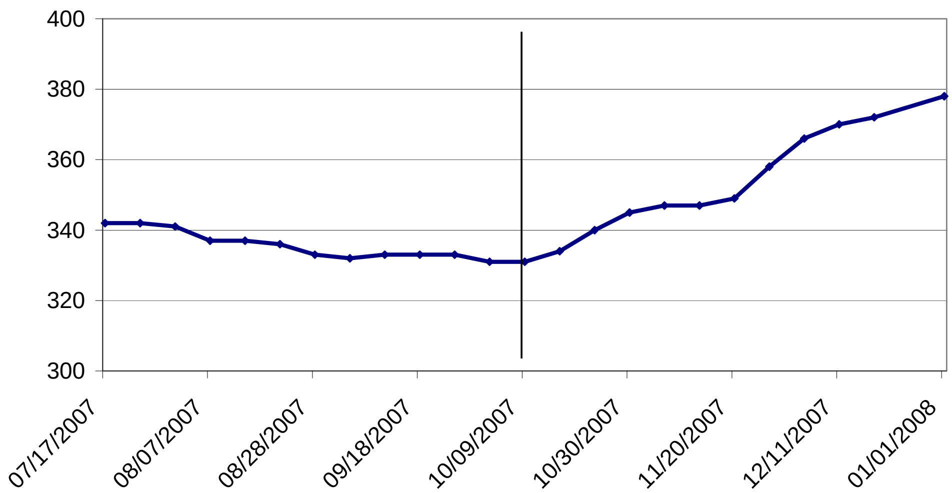


Figure 9. Wheat Prices vs. Stocks
(Index 2000=100)
250
200
150
100
50
0
Prices
World Stocks
2000
2001
2002
2003
2004
2005
2006
2007
Source: DECPG

Export bans and restrictions fueled the price increases by restricting access to supplies. A number of countries have imposed export restrictions or bans on grain exports to contain domestic price increases. These include Argentina, India, Kazakhstan, Pakistan, Ukraine, Russia and Vietnam. The impact of these bans or restrictions is illustrated in Figure 10 which shows Thailand's rice export price in the weeks prior to and after India banned rice exports on October 9, 2007. According to the USDA (USDA 2007) and the International Grains Council (2007), there were no other important market developments at that time that could account for the subsequent rice price increases. The USDA had projected India to export 4.1 million tons in the month prior to the ban and that was revised to 3.4 million tons in the month following the ban. The ban on exports led to a steady increase in prices over the following weeks. While it is probably not correct to say that all of the price increases were due to the ban, it likely focused attention on the market fundamentals and the rise in wheat prices and caused market participants to reconsider their imports and exports.

Figure 10. Impact of India's ban on rice exports (Thai rice export prices, $/ton)



Source: International Grains Council data.

Rice is not used for biofuels, but the increase in prices of other commodities contributed to the rapid rise in rice prices. Rice prices almost tripled from January to April 2008 despite little change in production or stocks. This increase was mostly in response to the surge in wheat prices in 2007 (up 88 percent from January to December) which raised concerns about the adequacy of global grain supplies and encouraged several countries to ban rice exports to protect consumers from international price increases, and caused others to increase imports.

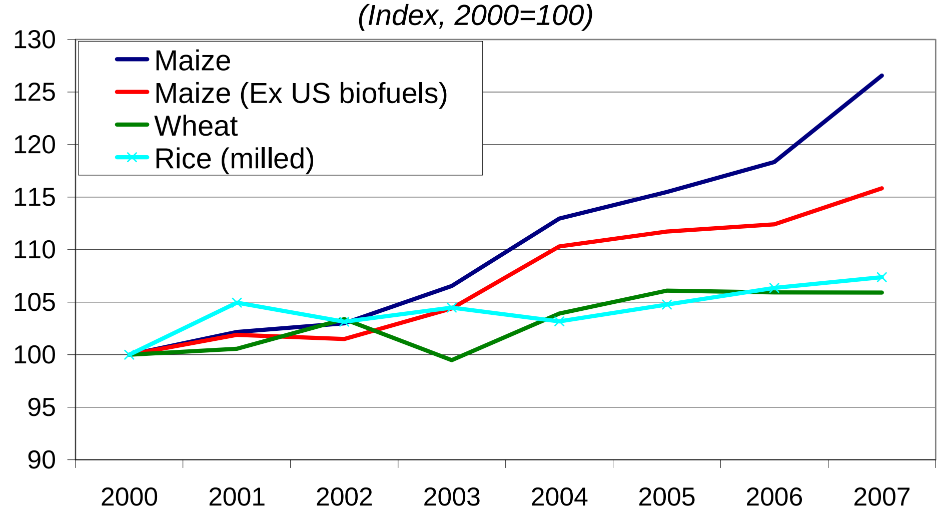
Weather-related production shortfalls have been identified as a major factor underpinning world cereals prices, especially in Australia, U.S., EU, Canada, Russia and Ukraine (OECD-FAO 2007). The back-to-back droughts in Australia in 2006 and

2007 reduced grain exports by an average of 9.2 million tons per year compared with 2005, and poor crops in the EU and Ukraine reduced their exports by an additional 10 million tons in 2007. However, these declines were more than offset by large crops in Argentina, Kazakhstan, Russia and the U.S. Total grain exports from these countries in 2007 increased by about 22 million tons compared with 2006. Global grain production *did* decline by 1.3 percent in 2006 but it then increased 4.7 percent in 2007. Thus the production shortfall in grains would not, by itself, have been a major contributor to the increase in grain prices. But when combined with large increases in biofuels production, land use changes, and stock declines it undoubtedly contributed to higher prices. The production shortfall was most significant in wheat, where global production declined 4.5 percent in 2006 and then increased only 2 percent in 2007. Global oilseed production rose 5.4 percent in 2006/07 and declined 3.4 percent in 2007/08.

Rapid income growth in developing countries has not led to large increases in global grain consumption and was not a major factor responsible for the large grain price increases. However, it has contributed to increased oilseed demand and higher oilseed prices as China increased soybean imports for its livestock and poultry industry. Both China and India have been net grain exporters since 2000, although exports have declined as consumption has increased. Global consumption of wheat and rice grew by only 0.8 and 1.0 percent per annum, respectively, from 2000 to 2007 while maize consumption grew by 2.1 percent (excluding the demand for biofuels in the U.S.) as shown in Figure 11. This was slower than demand growth during 1995-2000 when wheat, rice and maize consumption increased by 1.4, 1.4 and 2.6 percent per annum, respectively.

Figure 11. Global Grain Consumption

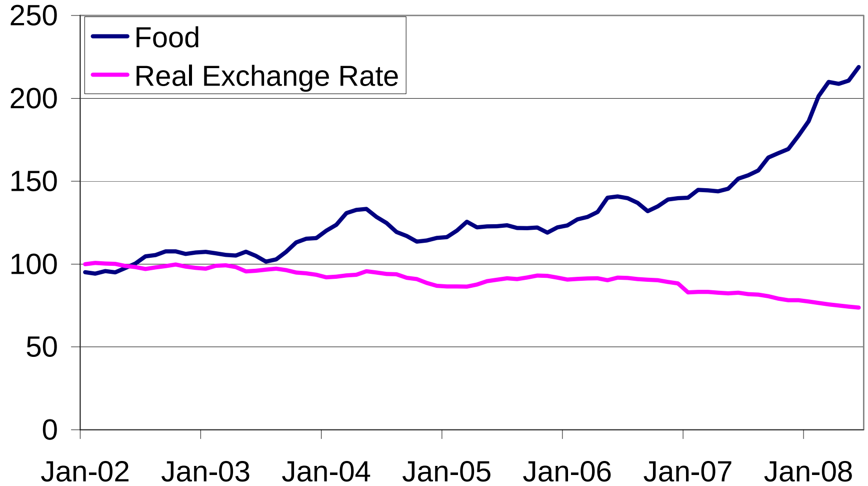
(Index, 2000=100)



Source: DECPG calculations based on USDA data.

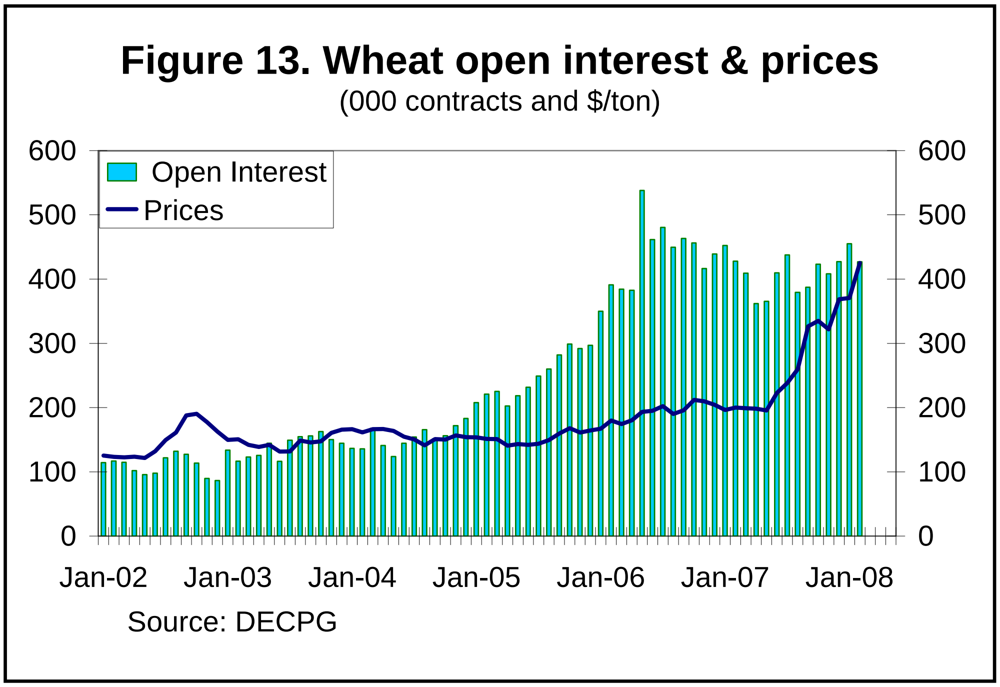
Other factors, such as the decline of the dollar contributed to food commodity price increases. The U.S. dollar depreciated about 35 percent against the euro from January 2002 to June 2008, and the depreciation of the dollar has been shown to increase dollar commodity prices with an elasticity between 0.5 and 1.0 (Gilbert 1989, Baffes 1997). However the dollar depreciated much less against most Asian currencies and a trade-weighted real exchange rate for U.S. bulk agricultural exports computed by the USDA (USDA 2008h) depreciated only 26 percent during that period. The elasticity should be less than 1.0, because the exchange rate does not pass-through completely in many countries due to policies (Shane and Liefert 2007). A comparison of the real trade-weighted exchange rate and the index of food prices (Figure 12) shows a general correspondence between dollar depreciation and food price increases. If the elasticity is taken as the mid-point of the range from 0.5 to 1.0, the increase in food prices due to the decline of the dollar would have been about 20 percent (26% x 0.75) between January 2002 and June 2008.

Figure 12. Food Prices vs. Exchange Rate



Source: DECPG calculations based on USDA data.

Speculative and investor activity has also increased and could have contributed to food price increases. A reflection of this increased activity was the quadrupling of the number of wheat futures contacts traded on the Chicago Board of Trade from 2002 to 2006 as shown in Figure 13. However, the increase in futures contracts does not coincide closely with the increase in wheat prices, which raises doubts about the impact on prices. The impact on prices is hard to quantify and most studies do not find that such activity changes prices from the levels which would have prevailed without such activity (Gilbert 2007), however, they may change the rate of adjustment to a new equilibrium when fundamental factors change.



V. Summary and Conclusions

The increase in internationally traded food prices from January 2002 to June 2008 was caused by a confluence of factors, but the most important was the large increase in biofuels production from grains and oilseeds in the U.S. and EU. Without these increases, global wheat and maize stocks would not have declined appreciably and price increases due to other factors would have been moderate. Land use changes in wheat exporting countries in response to increased plantings of oilseeds for biodiesel production limited expansion of wheat production that could have otherwise prevented the large declines in global wheat stocks and the resulting rise in wheat prices. The rapid rise in oilseed prices was caused mostly by demand for biodiesel production in response to incentives provided by policy changes in the EU beginning in 2001 and in the U.S. beginning in 2004. The large increase in rice prices was largely a response to the increase in wheat prices rather than to changes in rice production or stocks, and was thus indirectly related to the increase in biofuels. Recent export bans on grains and speculative activity would probably not have occurred without the large price increases due to biofuels production because they were largely responses to rising prices. Higher energy and fertilizer prices would have still increased crop production costs by about 15-20 percentage points in the U.S. and lesser amounts in countries with less intensive production practices. The back-to-back droughts in Australia would not have had a large impact because they only reduced global grain exports by about 4 percent and other exporters would normally have been able to offset this loss. The decline of the dollar has contributed about 20 percentage points to the rise in dollar food prices.

Thus, the combination of higher energy prices and related increases in fertilizer prices and transport costs, and dollar weakness caused food prices to rise by about 35-40 percentage points from January 2002 until June 2008. These factors explain 25-30 percent of the total price increase, and most of the remaining 70-75 percent increase in food commodities prices was due to biofuels and the related consequences of low grain stocks, large land use shifts, speculative activity and export bans. It is difficult, if not impossible, to compare these estimates with estimates from other studies because of different methodologies, widely different time periods considered, different prices compared, and different food products examined, however most other studies have also recognized biofuels production as a major factor driving food prices. The increase in grain consumption in developing countries has been moderate and did not lead to large price increases. Growth in global grain consumption (excluding biofuels) was only 1.7 percent per annum from 2000 to 2007, while yields grew by 1.3 percent and area grew by 0.4 percent, which would have kept global demand and supply roughly in balance. This was slower than growth during 1995-2000 when wheat, rice and maize consumption increased by 1.4, 1.4 and 2.6 percent per annum, respectively.

The large increases in biofuels production in the U.S. and EU were supported by subsidies, mandates, and tariffs on imports. Without these policies, biofuels production would have been lower and food commodity price increases would have been smaller. Biofuels production from sugar cane in Brazil is lower-cost than biofuels production in the U.S. or EU and has not raised sugar prices significantly because sugar cane production has grown fast enough to meet both the demand for sugar and ethanol. Removing tariffs on ethanol imports in the U.S. and EU would allow more efficient producers such as Brazil and other developing countries, including many African countries, to produce ethanol profitably for export to meet the mandates in the U.S. and EU. Biofuels policies which subsidize production need to be reconsidered in light of their impact on food prices.

References

ABARE, "Australian commodities," March 2008. http://www.abare.gov.au/publications_html/ac/ac_08/ac_march08.pdf

Baffes, John. "Explaining Stationary Variable with Non-stationary Regressors." Applied Economics Letters, 4(1997):69-75.

Collins, Keith, "The Role of Biofuels and Other Factors in Increasing Farm and Food Prices: A Review of Recent Development with a Focus on Feed Grain Markets and Market Prospects," June 19, 2008.

FAO, "Crop Prospects and Food Situation," February 2008. http://www.fao.org/giews/english/cpfs/index.htm

FAO, "Growing demand on agriculture and rising prices of commodities," February 2008. http://www.ifad.org/events/gc/31/roundtable/food.pdf

FAPRI, US Baseline Briefing Book, March 2008. http://www.fapri.missouri.edu/outreach/publications/2008/FAPRI_MU_Report_03_08.pd

FAPRI, "The Energy Independence Act of 2007: Preliminary Evaluations of Selected Provisions," January 2008. http://www.fapri.missouri.edu/outreach/publications/2008/FAPRI_MU_Report_01_08.pdf

Glauber, Joseph, USDA Chief Economist, in testimony before the Joint Economic committee of Congress on May 1, 2008.

Gilbert, Christopher, "How Should Governments React to High Food Prices?" manuscript, July 2008.

Gilbert, Christopher, "Commodity Speculation and Commodity Investmetns," manuscript, October 2007.

Gilbert, Christopher. "The Impact of Exchange Rate Changes and Developing Country Debt on Commodity Prices." Economic Journal, 99(1989):773-784.

Global Subsidies Initiative, International Institute for Sustainable Development, Geneva, Switzerland, 2008. http://www.globalsubsidies.org/en/research/biofuel-subsidies.

IFPRI, von Braun, J. "The World Food Situation: New Driving Forces and Required Actions," IFPRI, December 2007. http://www.ifpri.org/pubs/fpr/pr18.pdf

International Grains Council, "Grain Market Indicators," October 2007.

Lazear, Edward, "White House Disputes Role of Biofuels in Food Prices," Associated Press, May 15, 2008.

Lipsky, John, First Deputy Managing Director, IMF, Commodity Prices and Global Inflation, Remarks At the Council on Foreign Relations, New York City, May 8, 2008.

Mitchell, Donald, "The Case for Higher Grain Prices," April 2007.

OECD-FAO, "Agricultural Outlook 2007-2016," 2007. http://www.oecd.org/dataoecd/6/10/38893266.pdf

Rosegrant, Mark W., Tingju Zhu, Siwa Msangi, Timothy Sulser, "The Impact of Biofuel Production on World Cereal Prices, International Food Policy Research Institute, Washington, D.C., unpublished paper quoted with permission July 2008.

Shane, Mathew and William Liefert, "Weaker Dollar Strengthens U.S. Agriculrue," Amber Waves, February 2007.

Steenblick, Ron, personal communication, July 2008.

U.S. Bureau of Labor Statistics, Consumer Prices, July 2008.

USDA, GAIN, "Thailand Grain and Feed Report Intervention Policy Overhauled," November 2006. http://www.fas.usda.gov/gainfiles/200611/146249481.pdf

USDA, 2007. "Grain: World Markets and Trade," October 2007.

U. S. Department of Agriculture (USDA), 2008a. "Agricultural Projections to 2017," February 2008. http://www.ers.usda.gov/Publications/OCE081/OCE20081.pdf

———. 2008b. Cost-of-Production Forecasts, Data Sets. http://www.ers.usda.gov/Data/CostsAndReturns/

———. 2008c. GAIN report, "Grain and feed annual report," February 2008. http://www.fas.usda.gov/gainfiles/200802/146293727.pdf

———. 2008d. "Grain and Oilseeds Outlook, February 22, 2008", Agricultural Outlook Forum, February 22, 2008. http://www.usda.gov/oce/forum/2008Speeches/Commodity/GrainsandOilseeds.pdf

———. 2008e. "Grain: World Markets and Trade," March 2008. http://www.fas.usda.gov/grain/circular/2008/03-08/graintoc.asp

———. 2008f. PS&D online database, March 2008.

———. 2008g. "Oilseeds: World Markets and Trade," March 2008. http://www.fas.usda.gov/oilseeds/circular/Current.asp

———. 2008h. “Real Monthly Commodity Exchange Rates,” Macroeconomic Briefing Room, July 2008.

van der Mensbrugghe, Dominique (2006), “Linkage Technical Reference Document,” The World Bank, Washington, DC.

World Bank, Global Development Finance 2007.
http://www.worldbank.org/prospects