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THE WORLD FOOD CRISIS:

CAUSES AND THE IMPLICATIONS FOR

ONTARIO AGRICLTURE

by

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Executive Summary

The upheaval in the global food market involving the dramatic increases in crop prices and riots prompted by unaffordable food to many of the world' s poorest has placed agriculture back in the public eye. Questions are being raised surrounding what has happened, why, and what can be done. This report has provided an overview of the food crisis and its potential impact on agri-food sector in Ontario.

The boom in crop prices is primarily related to demand side factors rather than a supply-side shock from a production shortfall that were behind previous price spikes. There have been some supply side shifts: weather-related shortfalls occurred in the last two crop years, especially for wheat, yield increases are falling due to lagging research and development, and some countries implemented export restrictions. However, the primary push upward is due to structural shifts in demand from growing economies and biofuels (which will continue to grow albeit limited to some extent by the rising prices). Speculative activity has likely contributed to the sudden nature of the increase in price and to a bubble at the top of the market, but does not alter the fundamental demand and supply trends that have created the declining stocks. Supply cannot adjust immediately due to the annual nature of crop production, so stock levels will continue to be under pressure and crop prices supported for the next several years.

The effect of higher crop prices on food prices depends on the share of the food dollar going to the farmer and the share of disposable income spent on food. These shares are large for poor households in developing countries but small for most Canadian consumers. There is a distinction between crop price and food price in Canada. Consequently, domestic food inflation will not be driven by rising crop prices but rather pushed be energy prices which will drive general price inflation.

More specifically, the report has found the following:

What has happened to crop prices?

- Crop prices have doubled over the last two years reaching record nominal levels.
- Real crop prices are still below the peaks of the early 1970s.
- Nominal prices have often surged since the early 1970s generally due to production shortfalls but have then fallen back.
- Rates of increase in demand have outstripped supply rate increases resulting in declining stock to use ratios.
- Stocks to use ratios are inversely related to crop prices.
- Price spikes if stock to use ratio falls below 0.15.

Why have crop prices increased?

Supply plateau

- The high prices are being experienced during a time of relative abundance in production.
- There have been some supply interruptions for wheat in the last two crop years from major exporting countries that did affect price.
- The rate of increase in yield has fallen significantly over the last decade.
- The yield plateaus are particularly evident in developing countries, which rely on publicly-funded research for productivity improvements.
- Production shortfalls are temporary but slowing supply growth is structural.

Developing Country Demand Increases

- Over 100 million people from China and India have joined the middle class.
- Such an increase in income means more calories are consumed and different types of calories.
- Increasing income has increased consumption of all goods, not only food.
- The declining US$ has spurred demand since commodities are priced on US$.

Biofuels

- Over 25% of the US corn crop is targeted for ethanol 335 in 2008/09
- Approximately 30% of the increase in corn and soy price is attributable to ethanol policy.
- US ethanol policy is primarily based on national security interests.
- Corn price is now influenced by energy price but the reverse is not true.
- With high crude oil prices, corn prices will remain high even without mandates and other policy initiatives since ethanol is a substitute for gasoline.

Speculation

- The volume of trade in the Chicago futures market coincides with the dramatic rise in prices.
- Commodity index funds have become attractive investment outlets as money has shifted in turn away from equity funds and then real estate.
- Traditional speculators in the futures market are necessary for an efficient market but concerns over the price influence of commodity index funds that take very long positions in the market.
- Speculative activity by governments (i.e. export bans, large stock orders) have accentuated the volatility in crop prices.

What are the projections?

- The permanence of the price increase depends upon which of the above factors dominate.
- Weather-related supply shocks, exchange rate changes, speculator investment levels are transitory factors that create a blip in price.
- Income growth, biofuel consumption and slowing supply growth are structural changes that would imply a more permanent price increase.
- OECD/FAO expect crop prices to settle over the next couple of years at levels below current peaks but substantially above levels before the price rise.

What are the implications on food prices?

- The effect of rising crop prices on food prices increases with the share that the crop represents of the consumer's food dollar.
- The sensitivity of higher food prices is inversely related to the share of disposable income spent on food.
- The effects of rising crop prices are consequently felt most by the urban poor in developing countries relying on imports.
- The impact on the most vulnerable is malnutrition due to unaffordable food rather than starvation due to lack of food.
- Domestic consumers have seen little impact on food prices due to the appreciating Canadian dollar, grocery store competition, and the small share that crops represent in the food dollar.
- Food prices will follow the rate of inflation that is likely to driven by energy prices.

What are the implications for the Ontario agri-food sector?

- Margins will not increase to the same extent as crop prices due to rising input costs and the capitalization of returns into asset values.
- Land owners will become a primary beneficiary of crop price increases.
- Higher cost structures with only slightly larger margins make the sector vulnerable to price falls.
- The competitiveness of the Ontario livestock sector depends on relative changes in feeding costs and changes in output prices.
- There is greater need for risk management but risk-shifting options have shrunk without the availability of forward contracting.
- Pressures for – and the need to avoid- asset-based lending rather than debt repayment capacity or there is risk of a repeat of the farm financial crisis of the 1980s.
- Commodity price is increasingly linked to energy price.
- Public support for
    i. biofuel policy will continue to wane;
    ii. genetically modified crops will grow;
    iii. a trade deal involving agriculture will increase.

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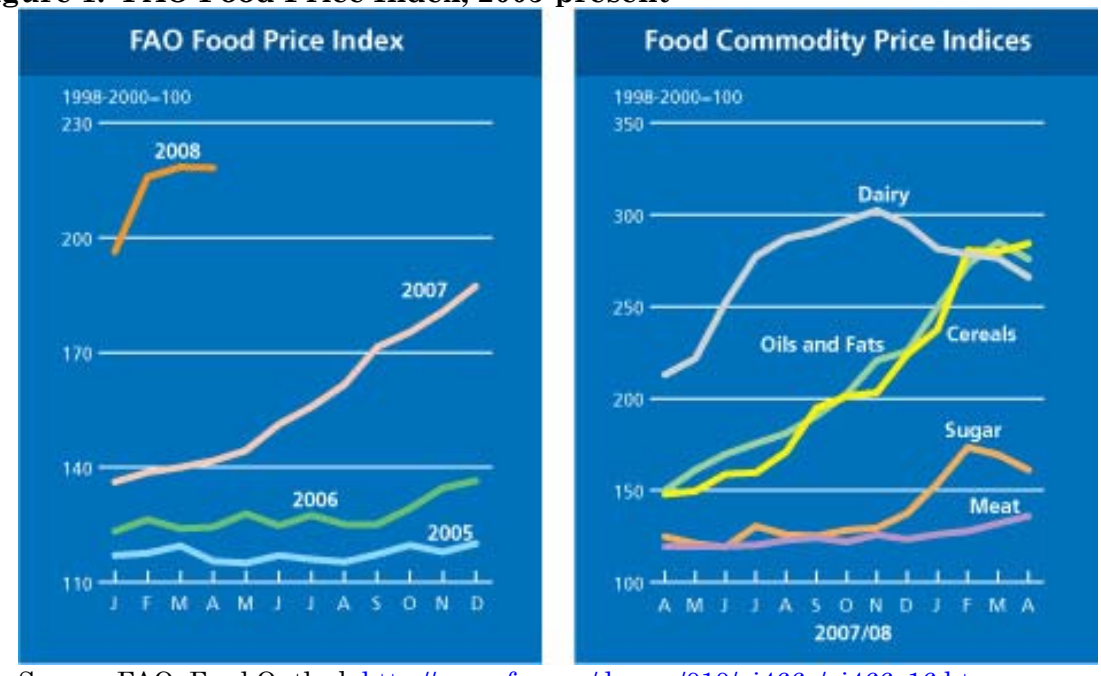
1. Introduction

The global food market has experienced an upheaval over the last two years not seen since the early 1970s. Dramatic increases in grain and oilseed prices (see Figure 1) have made food unaffordable to many of the world's poorest, and social unrest is a consequence of their despair. Media attention on the increasing cost of food and subsequent riots in some nations has generated public concern over the reasons for rising crop prices, how this will affect food prices both domestically and internationally, and the means to ease the adjustments faced by the most vulnerable.

This report provides an overview of the food crisis and its potential impact on agri-food sector in Ontario. It begins by illustrating the changes in prices and stock levels for the 4 major crops: corn, soybeans, wheat, and rice. Section 3 discusses the drivers behind the price increases described in Section 2. The major long-term demand factors are increasing demand from growing economies such as China and India, and the biofuel policy, which has taken a significant amount of feedstock out of the food system. It also discusses the supply-side, which has not kept pace with demand, and the hotly debated role of financial markets in the sudden price rise for both fuel and grains. Section 4 gives the projected prices for grains and oilseeds based on recent forecasts from FAO-OECD. Section 5 describes the effect of the rising crop prices on food prices and the dramatic distributional differences globally. Section 6 outlines the implications of the structural shift in prices for Ontario agriculture and policy makers.

Figure 1. FAO Food Price Index, 2005-present



Source: FAO, Food Outlook http://www.fao.org/docrep/010/ai466e/ai466e16.htm

2. Crop Prices and Stock Levels

Crop prices have doubled over the past two years reaching nominal levels not seen since the early 1970s. The price changes illustrated in Figure 1 began with an increase in corn price in the fall of 2006 and have continued to rise to record levels in each successive time period for most crops. The turnaround represents a dramatic change in fortune (at least on the revenue side) for crop farmers who were protesting over low returns in the winter of 2005-06. Prior to the recent rise, crop prices had been falling both in nominal and real terms over the last 3 decades with occasional spikes that were generally weather-related and short-lived. The section briefly reviews the recent changes in the prices and underlying supply and demand indicators for corn, soybeans, wheat and rice.

2.A. Corn

Corn was the first of the major crops to experience a sharp rise in price. Nominal corn prices on the CBOT had been in the low $2 per bushel range for most of the last decade until a near doubling occurred in September 2006 (Figure 2). Prices peaked at a ten-year high around $4.30[1] per bushel in February 2007 due to strong demand and tight export supplies but settled in the mid-high $3 per bushel for the rest of the year. Prices have again surged upward since late November 2007 and are at record levels in nominal terms.

The price movements are related to the underlying supply and demand situation (Table 1). It is particularly important to note the increase in production over time emphasizing the importance of the demand drivers behind the price increase (see Section 3). Global corn output reached a record level of 780 million tones in the last production year due largely to increased plantings and bumper crops in the US and South America. Growing conditions were not as favourable in Europe over the last year and the resulting tighter supply has forced the EU to purchase more corn and pushed global corn trade to record levels (FAO 2007).

Continual increases in utilization have more than offset the increases in supply. Feed use for livestock increased by approximately 2% last year to record levels but is expected to drop in the future as livestock farmers lower demand in response to the higher prices. In contrast, total other uses have risen by approximately 140 million tonnes over the last 5 years. The average annual growth of 4% is driven mostly by industrial use increases for the production of ethanol (see Section 3.B).

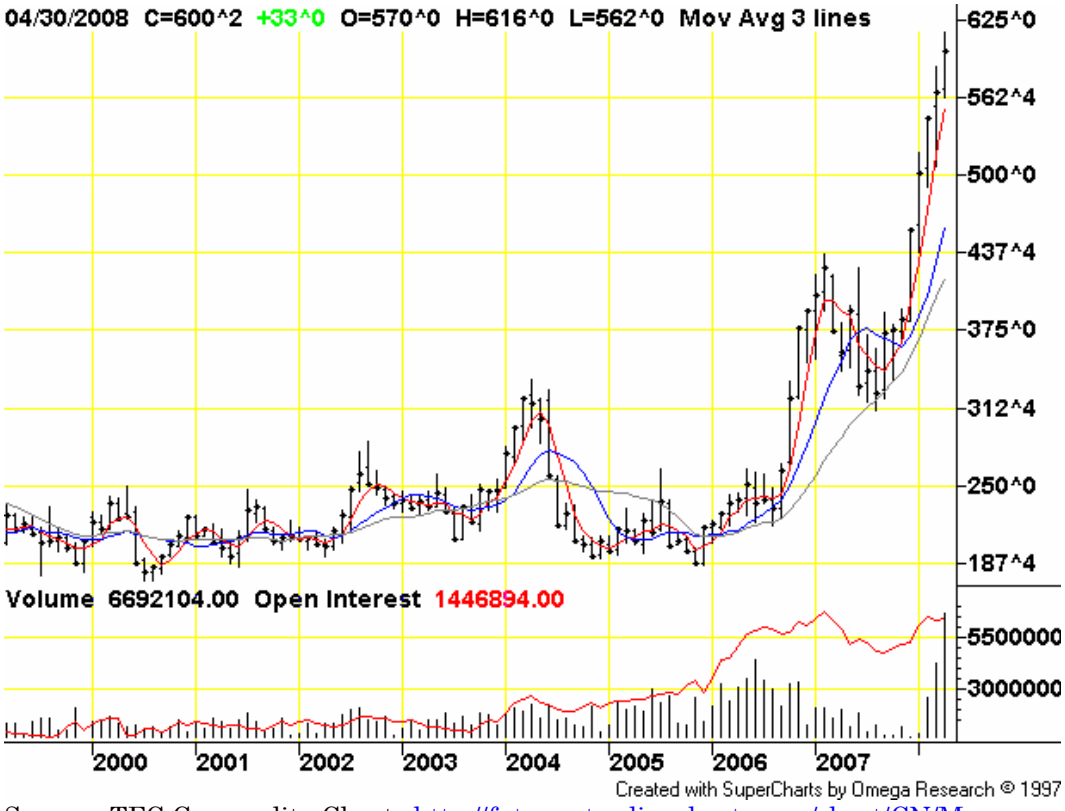
USDA projections for the upcoming crop year with continued high production but also higher utilization suggest ending stocks below 100 million tonnes, which is the lowest level since 1983. The 2008/09 expected stock to use ratio of 12.6% will be the lowest since 1973.

[1] Prices are given in US dollars throughout the report unless otherwise indicated.

The record US corn crop pushed up global ending stocks to around 110 million tonnes in 2007/08 from around 105 million tonnes in 2006/07, but the higher demand lowered the stock to use ratio to 14.1% in 2007/08 from 14.5% in 2006/07. Projections for the upcoming crop year with continued high production but also higher utilization suggest ending stocks below 100 million tonnes, which is the lowest level since 1983. The 2008/09 expected stock to use ratio of 12.6% will be the lowest since 1973 (USDA, 2008). Given the low stock to use ratio, prices are susceptible to weather scares as reflected in the recent record price levels that were established due to wet and cool conditions in the US Midwest that have delayed corn planting. Corn area is likely to be lower than initially projected and yields on the remaining areas below average given the late start. However, weather conditions are now favorable and the corn crop is projected to be near a record level.

Low stock levels make prices during the growing seasons particularly sensitive to weather conditions. Corn prices jumped from $6 at the beginning of June to a peak of $7.50 due to supply concerns associated with wet conditions in the US Midwest. Prices have fallen back to around $6 with favourable weather.

Figure 2. Nearby CBOT Futures Price and Volume Traded for Corn



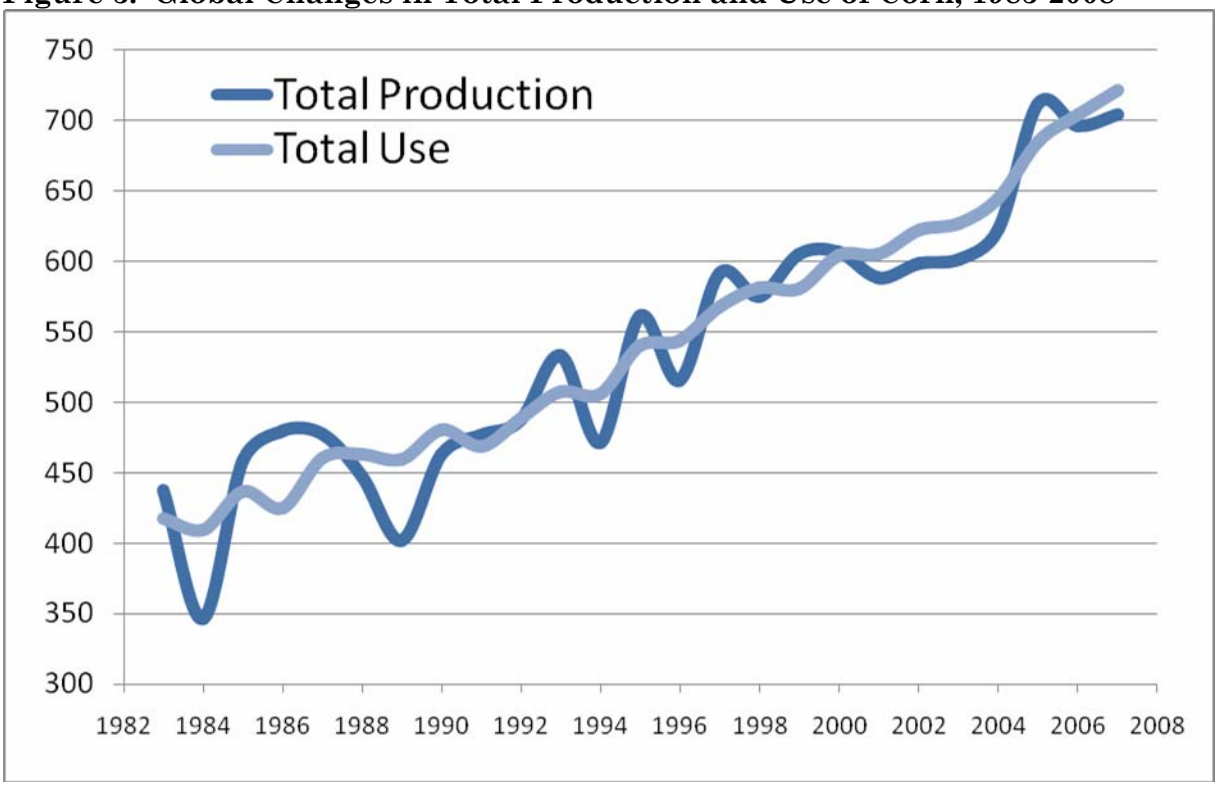
Source: TFC Commodity Charts http://futures.tradingcharts.com/chart/CN/M

Table 1. World Supply/Demand Indicators for Corn (million tonnes)

	03-04	04-05	05-06	06-07	07-08	08-09
Supply						
Beg Stocks	126.21	104.58	132.14	124.49	105.46	109.69
Production	627.25	714.76	696.86	706.70	779.83	777.56
Imports	76.39	76.67	79.47	90.65	94.32	90.70
Use						
Feed	445.09	473.41	476.31	476.09	496.52	482.47
Non-feed	648.88	687.98	703.89	725.76	775.60	788.21
Exports	77.28	77.64	80.93	93.06	99.13	92.31
Ending Stocks	104.58	131.36	125.11	105.46	109.69	99.03
Stock/Use	16.1%	19.1%	17.8%	14.5%	14.1%	12.6%

Source: USDA Supply & Demand Review, May 2008

Figure 3. Global Changes in Total Production and Use of Corn, 1983-2008



Data Source: http://www.reuters.com/news/globalcoverage/agflation

2.B. Soybeans

Soybean prices rose slightly in the fall of 2006 but did not jump to the extent of corn prices (Figure 4). After hovering around $7.50 per bushel for the early part of 2007, prices have trended upwards since May 2007. Prices peaked at levels close to $16 on the CBOT but have since fallen to the $14 range. Both nearby and distant CBOT contracts are trading in this range.

The record high prices for oilseeds are a spillover from the surge in corn prices discussed in the previous Section. Another factor pulling up soybean prices is the market for edible oils. The demand for soybeans is a derived demand based on the demand for its joint products, oil and meal. Meal used to the primary demand but now oil has become relatively more valuable due to factors discussed in the next section. Prices in the oil and meal markets have reached 23 and 34 year highs respectively and this has pulled up soybean prices.

Global supplies of soybeans have not matched the increases noted for corn. After many years of steady expansion in production including in Ontario, global production of soybeans fell by 6% in the last growing season. This was due largely to the 15% decline in planted area in the US as farmers shifted land to corn and a similar reduction occurred in China. With continued high prices projected for corn, soybeans supply levels are not expected to change in the next crop year (FAO, 2007).

Figure 4. Nearby CBOT Futures Price and Volume Traded for Soybeans

Source: TFC Commodity Charts: http://tfc-charts.w2d.com/chart/SB/M

As in the corn market, the demand for soybeans continues to rise. Total demand of approximately 440 million tonnes for the current crop year is a record driven by increases in the demand for feed in the meal market and by consumption of oil in the food market (sees Section 3.A). In addition, oil is increasingly used as a feedstock for biodiesel and in the generation of electricity and heat (see Section 3.B).

The supply and demand changes over the past year have lowered the global stock to use ratio to 21% with continued tightness projected in the next crop year.

Soybean production levels rose during the time of the large price increases starting in 2004 to 2007. The decline in production last year was due to a decline in acreage rather than weather-related.

Table 2. World Supply/Demand Indicators for Soybeans (million tonnes)

	02-03	03-04	04-05	05-06	06-07	07-08
Supply						
Beg Stocks	35.35	42.70	37.72	47.46	52.79	63.02
Production	196.79	186.53	215.69	220.54	237.36	219.72
Imports	62.91	54.01	63.52	64.05	69.08	75.26
Use						
Crush	165.54	163.68	175.56	185.21	195.66	205.38
Other	191.36	189.34	204.77	215.33	225.18	233.63
Exports	60.98	56.19	64.74	63.93	71.03	75.33
Ending Stocks	42.70	37.72	47.41	52.79	63.02	49.04
Stock/Use	22.3%	19.9%	23.2%	24.5%	28.0%	21.0%

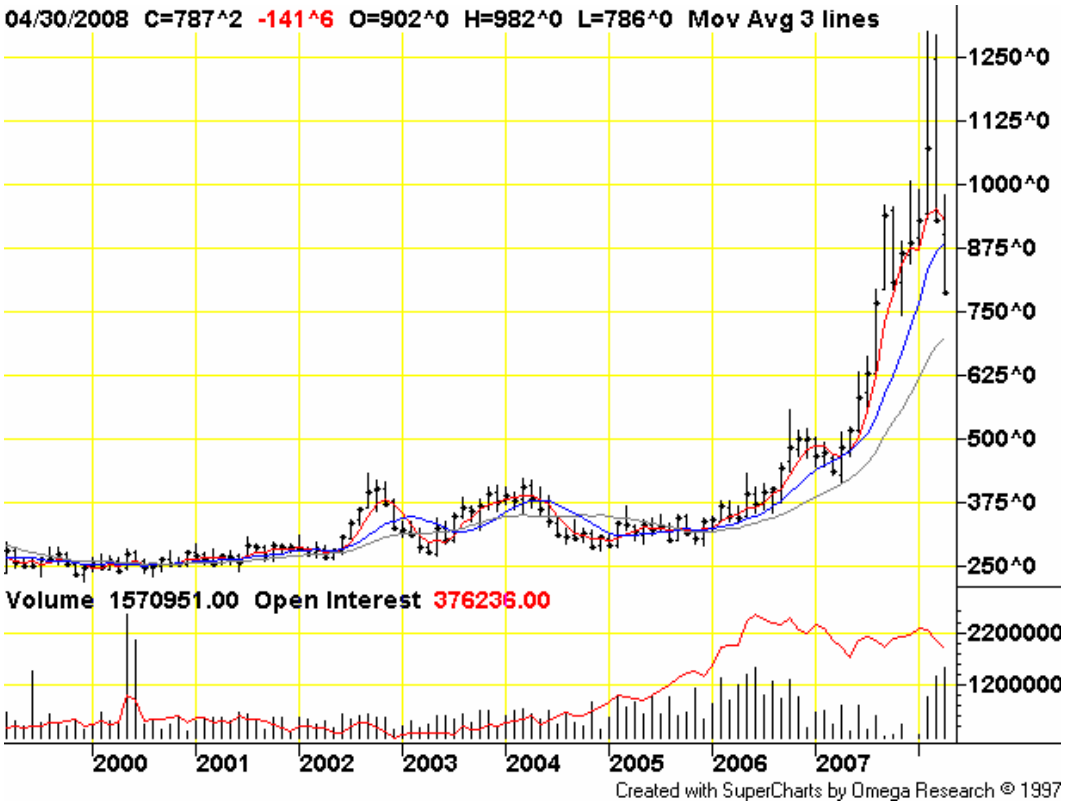
Source: USDA Supply & Demand Review, May 2008

Stock levels for soybeans have fallen but demand and supply levels have not risen to the same extent as corn.

2.C. Wheat

Wheat prices on the CBOT traded around $4.50-5.00 per bushel for most of the 2006-07 crop year. However, in June 2007, price steadily increased until it reached a temporary record level of $9.50 in late September (Figure 5). Low stock levels and continual reductions in production forecasts elevated prices to these record levels (see Section 3.3). Prices fell back to around $8 in November but then bounced up to new record levels approaching $13 in early March. Prices have since fallen to the $8 range and appear to have settled at that level for the near term. The cash price for wheat has fallen about 25% since March due to favourable weather conditions but is still 75% higher than the previous May.

Figure 5. Nearby CBOT Futures Price and Volume Traded for Wheat



Source: TFC Commodity Charts http://tfc-charts.w2d.com/chart/CW/M

Table 3. World Supply/Demand Indicators for Wheat (million tonnes)

	03-04	04-05	05-06	06-07	07-08	08-09
Supply						
Beg Stocks	166.35	132.39	150.76	147.50	124.05	110.02
Production	554.42	626.83	621.30	592.00	606.40	656.01
Imports	100.79	109.45	110.15	112.33	107.31	114.59
Use						
Feed	96.16	105.43	111.40	105.76	98.04	113.11
Non-feed	588.37	608.60	624.37	615.45	620.43	642.04
Exports	108.43	110.70	116.16	110.69	109.56	117.46
Ending Stocks	132.39	150.76	147.50	124.05	110.02	123.99
Stock/Use	22.5%	24.7%	23.7%	20.2%	17.7%	19.3%

Source: USDA Supply & Demand Review, May 2008

Production levels are projected to increase by approximately 10% in the 08-09 production year due to more area planted to wheat in response to the higher prices and better growing conditions globally (see Table 3). However, weather has not significantly reduced global production levels of wheat. It has been around 600 million tonnes for the past 4 growing seasons with some regional variation in the amount produced. For example, Australian supply was significantly reduced in the past two years due to drought and this had a major price effect since much of its wheat is sold on the world market.

Global wheat supply has fluctuated around 600 million MT for last 4 years. Weather issues in some exporting countries, such as Australia, pushed up prices in a tight world market.

While supply has remained relatively flat for most of this decade, global wheat utilization continues to increase. Tight supplies and high prices have reduced world wheat consumption in the last two crop years but projections are for a slight increase in the next season.

The combination of demand growing faster than supply has reduced stock levels to approximately 110 million tonnes in 2007/08, which is the lowest level since 1982. The lower stock levels in combination with the higher utilization amounts have pushed stock to use ratio to below 20%. The drawdown of wheat reserves is expected to be most pronounced in the major exporting countries which are also the leading stock holders (FAO, 2007).

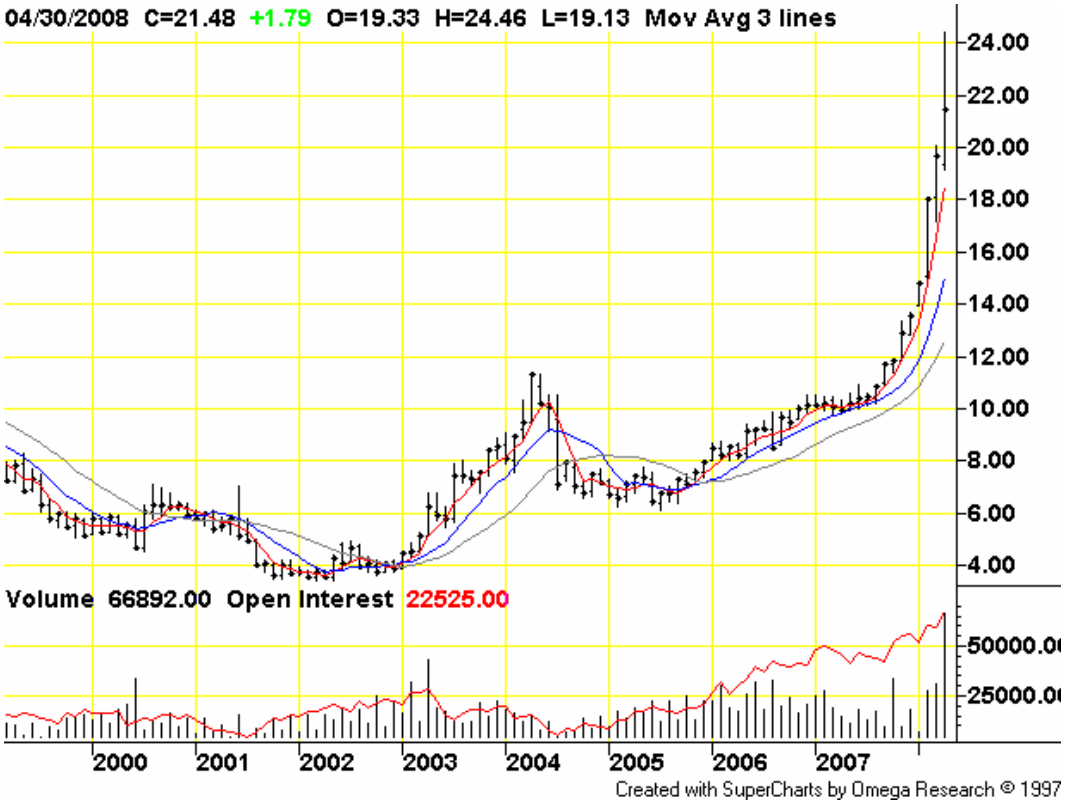
Flat supply and increasing demand has put stock levels for wheat at 30 year lows.

2.D. Rice

Rice was the last of the major crops to see a price jump. The FAO All Rice Price Index (1998-2000=100) rose 9% in 2006 and 17% in 2007 with some of the latter increase due to a depreciation of the US dollar in which international rice prices are denominated (FAO, 2008). However, prices surged in the first quarter of 2008 and the index rose to 184 in February and 216 in March (see Figure 6). The price hike this spring reflects a long term tightening in supplies that was exacerbated by restrictions put on sales by major rice exporters. Since a relatively small volume of the total rice supply/use is traded on the world market, the hoarding by exporters can have a significant impact on the world price.

As with the other crops, the price increases are associated with tightening stocks due to supply not rising as fast as demand. Production has been flat over the last 3 crop years as adverse weather lowered yields and supply did not increase to the extent anticipated (see Table 4). Planting and production of rice is projected to increase by 2% in the upcoming crop year in response to high prices and government incentives to lower input costs in many countries.

Figure 6. Nearby CBOT Futures Price and Volume Traded for Rice



Source: TFC Commodity Charts http://tfc-charts.w2d.com/chart/RI/M

Global stocks for rice have not changed significantly over the last several years raising concerns/questions around the reasons for the dramatic price increase.

Table 4. World Supply/Demand Indicators for Rice (million tonnes)

	05-06	06-07	07-08	08-09
World Balance (milled basis)				
Production	424.3	428.7	429.3	
Trade	29.2	29.9	30.5	
Total Use	418.3	425.9	429.2	
Ending Stocks	105.5	106.8	107.6	
Stock/Use	24.8%	24.9%	24.8%	

Source: FAO, Rice Market Monitor, May 2008

The demand for rice has increased over time due to slight increases in the per capita consumption, which is now at 57 kg/person, and increases in global population.

Stock levels have increased slightly over time. The stock to use ratio has been approximately 25% over the last several crop years, which implies that there is sufficient rice to cover almost 3 months of consumption (FAO, 2007).

A small percentage of the total volume of rice produced is traded on the world market (5-7%). Consequently, the price established on this market is sensitive to changes from major importing/exporting countries.

3. The Drivers of Crop Price Increases

The recent surge in crop prices has been attributed to a variety of factors ranging from climate change on the supply side to biofuels on the demand side. Understanding the forces contributing to the unprecedented spikes in food prices can help design policies to alleviate malnutrition, to improve predictions of future demand for agricultural commodities and of subsequent shifts in international production patterns, trade flows, and price levels. In this period of rapid technological development and changing economic and social conditions, making accurate predictions can be difficult, but failure to do so may result in research that addresses yesterday's needs. Investigation of the causes of the current rise in grain price and their implications needs to consider critical analysis of the real world situation. For example, predictions based on economic growth should also be complemented by consideration of the rate of population growth, the rate of urbanization, structural changes in demand, consumers' food habits and other relevant influences as might arise from migration and other external factors.

In this Section we provide a brief review of the major drivers affecting crop prices. It begins with an assessment of changes in supply, which have been the major cause for previous price spikes. This is followed by a discussion of two long-term demand changes: growth in developing countries and in biofuel mandates. The Section ends with a description of potential short-term financial market behaviour that may have contributed to the rapid rise in price.

3.A. Supply Plateaus

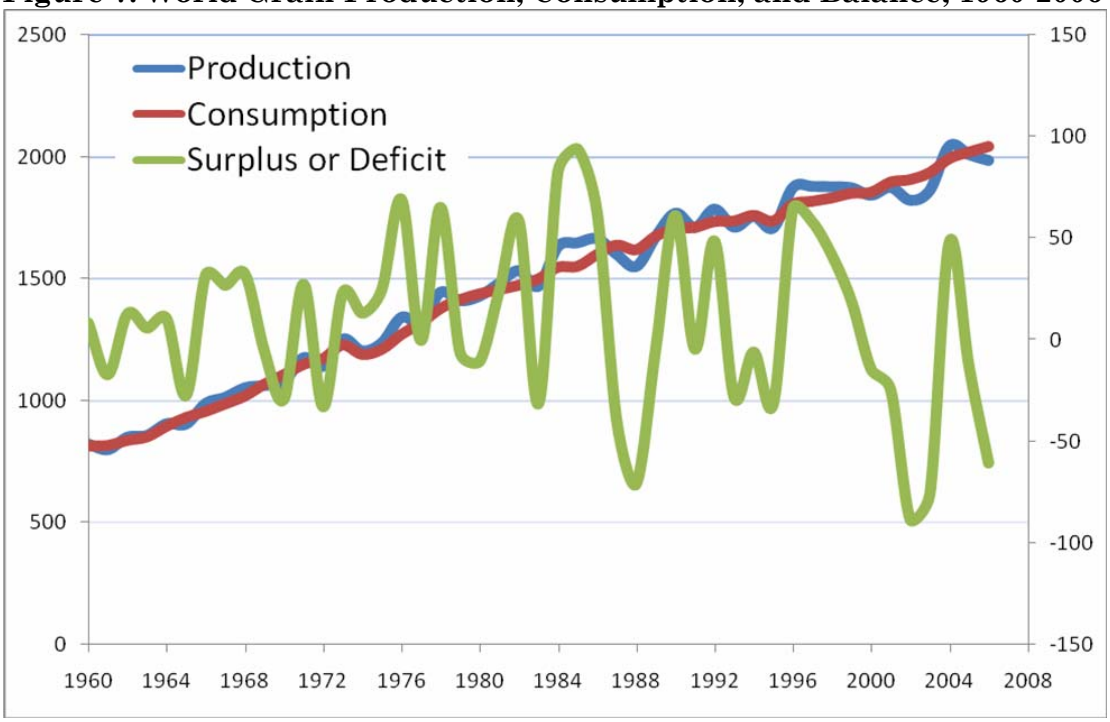
The demand and supply indicators for each of the crops analyzed in Section 2 suggest that supply has not fallen sharply enough in any one year to have triggered the spikes in prices (Figure 1). Instead, the price increases have come at a time of relative abundance.

World cereal production did drop by 4% in 2005 and 7% in 2006 due largely to declines in Australia and, to a less extent Canada (FAO, 2008). The decline in production due to adverse weather did have an impact on cereal prices in 2006 but the rate of decline was much lower than the rate of increase in price and did not affect all crops. Production increased to record levels in 2007 in response to high prices and aided by favourable weather conditions. However, the supply increases have not matched the increases in demands and stock levels have continued to fall as noted in Section 2.

The annual growth rate in global production of grains and oilseeds was 2.2% between 1970 and 1990 but dropped to 1.3% since that time with future projections around this recent rate (FAO, 2008). Most of the increase is attributable to increases in yield as the area harvested as increased only marginally over this time period. As will be noted below, this aggregate supply increase is below the increase in demand (Figure 7).

Production is at near record levels for most crops but the rate of yield increase has slowed over time.

Figure 7. World Grain Production, Consumption, and Balance, 1960-2006

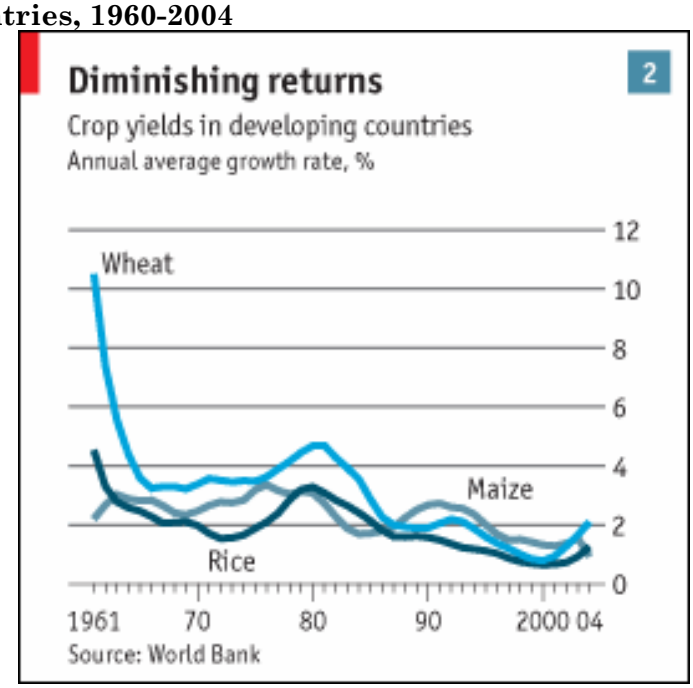


Sources: Data is compiled by Earth Policy Institute from United States Department of Agriculture, Production, Supply & Distribution, www.fas.usda.gov, updated 12 June 2006. (Secondery Axis: surplus or deficit)

Adverse weather conditions and lagging productivity resulted in a second consecutive drop in global average yield for grains and oilseeds. This has only occurred 3 other times in the last 37 years..

The declining rate of increase in yield (Figure 8) is due in large part to a significant reduction in the amount invested in public agricultural research and extension. The amount spent on agriculture by developing countries as a share of total public spending has dropped in half since the prime of the Green revolution in the late 1970s (Economist, 2008). While the slack has been picked up by the private sector for major crops such as corn and soybeans in the developed world, there has been no replacement for other crops or regions. The cutback was justified in part by the surpluses and associated low prices for many agricultural commodities making it cheap to buy imports and/or unprofitable to invest. In addition, industrial rather than agricultural growth was increasingly viewed as the engine for economic gains. The decline in agricultural investment is viewed as the major reason for the plateau in supply.

Figure 8. Rate of Increase in Yields of Corn, Wheat and Rice in Developing Countries, 1960-2004



Source The Economist, April 17, 2008
http://www.economist.com/world/international/displaystory.cfm?story_id=11049284

The plateau in supply is associated with a decline in public investment in agricultural research and extension. While the public support has been replaced by private companies for some crops in western agriculture, it has not in the developing world.

The recent increase in crop prices will increase future production but the supply response is price inelastic. A number of studies estimate an increase in agricultural supply of 1-3% when prices increase by 10%. The sticky response is due in part to the biological nature of agricultural production which means supply cannot be immediately altered.

Supply cannot respond immediately to the price increase due to the annual nature of crop production.

The extent of future supply increases may be further constrained by the volatility in the market and rising input costs. Greater price risk lowers the rate of investment and the ability to manage increasing price risk has been limited (see Section 6.2). Fertilizer and energy costs have increased faster than crop prices. Since the higher crop prices are becoming capitalized into land values (see Section 6.4), profit margins may not change significantly for many farmers and thus future supply growth is limited.

3.B. Developing Country Demand

3.B.1. Population: More people, more staple food grain

Over the past six decades, the world has experienced an increase in population and demographic composition, with significant influences on the economy in many ways; the world population rose from about 2 billion in 1930 to about 6.5 billion people in 2007. The annual increase in population is considered to be about 75 million, with most of the increase in China and India (Table 5). In 2008, the two most populous countries, China and India, have between them more people (~ 2.49 billion) than the world had in 1930. Together, Asia, Africa and Latin America now contain almost five-sixths of the world population; and that proportion is still rising, because many countries in those regions have relatively high rates of population growth (Table 6).

One way population growth dynamics influences the economy is through the pressure it puts on the demand for staple food and other products. For example, the use of more grains for bread, tortillas, chapattis, and noodles is linked to the growth in the world's population. Table 5 indicates, over the period 1970-2004, that there is a modest rise (3%) in global per capita consumption of grains, reflecting the slowing of population growth. However, cross-country comparisons show that per capita total grain consumption grew by 11% for the US, 64% for China, 5% for India and 4% for Canada over last 35 years. Note that most of the growth in per capita grain consumption in some of these countries is attributed to the animal feed sector (Table 7). In China, for example, the proportion of grain fed to animals has risen from 8% in 1970 to approximately 28% which is in tandem with the economic growth of the country. However, in India, despite the significant growth in population, the rise in per capita consumption of grain (i.e., 5%) is not as high as China. These figures and their structural composition indicate that, it is not possible to forecast future world food demand by simply multiplying today's per capita consumption by the projected number of people. In addition to the sheer population growth, one must take into account the likely impact of economic growth on changes in dietary preferences, especially the likely increase in high-value diet (e.g., meat) consumption. The shift in patterns of consumption is better explained by the growth in income.

Population growth has slowed over time so the increase in price is due to other demand factors.

Table 5: Trend in Population (billions) and Per Capita Domestic Grain Consumption Total (in kilograms), Feed, Food, Seed and Industrial Uses

Year	World		U.S.		China		India		Canada	
	Pop	Grain	Pop	Grain	Pop	Grain	Pop	Grain	Pop	Grain
1970	3.696	289	0.210	791	0.830	176	0.554	160	0.021	955
1975	4.073	292	0.220	617	0.927	201	0.620	156	0.023	897
1980	4.442	319	0.230	801	0.998	236	0.688	160	0.024	983
1985	4.843	320	0.243	813	1.070	262	0.766	172	0.025	916
1990	5.279	318	0.255	796	1.155	270	0.849	187	0.027	914
1995	5.692	310	0.269	908	1.219	287	0.935	177	0.029	1001
2000	6.085	304	0.284	884	1.273	292	1.021	178	0.030	1037
2004	6.389	299		882		288		168		996
2005	6.464		0.298		1.315		1.103		0.032	
2008	6.691		0.306		1.339		1.151		0.033	

Sources: http://earthtrends.wri.org//searchable_db/static/363-4.csv
http://earthtrends.wri.org//searchable_db/static/2299-8.csv

Table 6: Population (Growth Rate)

Year	World	U.S.	China	India	Canada
1970-75	1.94	0.94	2.21	2.24	1.27
1975-80	1.73	0.95	1.48	2.08	1.15
1980-85	1.73	1.03	1.38	2.12	1.05
1985-90	1.72	1.00	1.53	2.07	1.39
1990-95	1.51	1.07	1.08	1.93	1.12
1995-00	1.34	1.05	0.88	1.75	0.93
2000-05	1.21	0.97	0.65	1.55	1.00
2005-10	1.14	0.92	0.58	1.40	0.86

Source: http://earthtrends.wri.org//searchable_db/static/449-4.csv

Table 7: Grain Fed to Livestock as a Percent of Total Grain Consumed

Year	World	U.S.	China	India	Canada
1970	39.0	80.5	8.0	0.9	77.8
1975	37.7	75.3	8.5	1.3	76.9
1980	39.1	74.4	13.3	1.7	75.5
1985	39.5	71.1	15.8	1.9	74.2
1990	39.0	68.5	18.8	2.5	74.0
1995	36.6	64.3	23.1	2.9	79.7
2000	37.3	65.9	27.8	4.4	73.0
2005	37.0	59.8	28.3	4.4	72.9
2007	35.5	49.9	28.5	4.7	68.3

Source: http://earthtrends.wri.org//searchable_db/static/348-8.csv

3.B.2. Increase in Income (per capita): more money, more meat, and more feed grain

Several developing countries have experienced rapid economic growth in recent years (see Table 8 for example), resulting in increased consumer purchasing power and changing diet preferences from grains and other staple crops to high-value commodities, such as meat, dairy, fruits, vegetables, and fish (Tables 5-8). Per capita income growth for many developing countries has been larger and is projected to continue to be larger than most developed countries (see Tables 8a and 8b). The income growth has significant impacts on diet and subsequently the demand for agricultural products. For example, in South Asia, economic growth of 5.5%per year is projected to decrease the annual per capita consumption of food rice (cereal) by 4 percent between 2000 and 2025, while the consumption of milk and vegetables is expected to jump by 70 percent, and by 100 percent for meat, eggs, and fish. The rise in the demand for meat, in turn, boosts the demand for grains to feed to animals (see Table 11)[2].

Table 8a: Income Levels and Growth by Regions, 1995-2020

Region	Annual Income Growth Rate (%)	Per capita income level	
	(1995 – 2020)	1995	2020
Sub-Saharan Africa	3.40	280	359
Latin America and Caribbean	3.59	3,590	6,266
West Asia and North Africa	3.83	1,691	2,783
Southeast Asia	4.44	1,225	2,675
South Asia	5.01	350	830
East Asia	5.12	984	2,873
Developing Countries	4.32	1,080	2,217
Developed Countries	2.18	17,390	28,256
World	2.64	4,807	6,969

Source: IFPRI IMPACT simulations, 1999, http://pdf.dec.org/pdf_docs/Pnach738.pdf

Table 8b: GDP Per Capita, Constant US Dollars (Growth Rates in brackets)

Year	World	U.S.	China	India	Canada
1970	3314 (2.2)	18150 (-0.9)	122 (16.1)	209 (2.8)	12737 (1.2)
1975	3596 (-0.9)	19803 (-1.2)	146 (6.8)	215 (6.7)	14691 (-0.1)
1980	3981 (0.0)	22568 (-1.2)	186 (6.5)	223 (4.3)	16598 (0.8)
1985	4158 (2.0)	25264 (3.2)	290 (12.0)	260 (3.5)	17945 (3.8)
1990	4565 (1.2)	28263 (0.7)	392 (2.3)	317 (3.7)	19274 (-1.3)
1995	4758 (1.4)	29942 (1.3)	658 (9.7)	372 (5.7)	19862 (1.9)
2000	5241 (2.8)	34599 (2.5)	949 (7.6)	453 (2.3)	23220 (4.3)
2005	5647 (2.3)	37267 (2.2)	1449 (9.5)	588 (7.7)	25064 (1.9)
2008					

Sources: http://earthtrends.wri.org//searchable_db/static/640-5.csv
http://earthtrends.wri.org//searchable_db/static/641-5.csv

[2] For example, a pound of chicken requires nearly 2 pounds of corn and soybeans meal, a pound of pork requires 5 to 7 pound s of feed; a pound of beef requires 8 pounds of feed.

Income growth in China and India has been 3 times the global average over the last decade.

The demand increases stemming from rising per capita income is particularly evident from China and India. Average per capita growth in GDP has been approximately 10% in China over the last two decades. In the early 1990s, the average Chinese consumed 35.16 kg and 13 kg of meat a year in urban and rural areas, respectively, as compared to more than 32 kg and 22.31 kg in 2006 (Tables 9 and 10). The proportion of calories consumed from meat has risen from 6% in 1970 to 21% in 2002 in China. The increase in spending on diets high in animal products is correlated with the increase in average income.

Per capita meat consumption in China has increased by 2.5 times over the last 20 years but is still one-third of Canadian consumption levels.

Table 9: Per Capita Annual Purchases of Major Commodities of Urban Households - China

Item	1990	1995	1999	2000	2005	2006	Ratio
Grain	130.72	97.00	84.91	82.31	76.98	75.92	0.58
Fresh Vegetables	138.70	116.47	114.94	114.74	118.58	117.56	0.85
Edible Vegetable Oil	6.40	7.11	7.78	8.16	9.25	9.38	1.47
Pork	18.46	17.24	16.91	16.73	20.15	20.00	1.08
Beef and Mutton	3.28	2.44	3.09	3.33	3.71	3.78	1.15
Poultry	3.42	3.97	4.92	5.44	8.97	8.34	2.44
Fresh Eggs	7.25	9.74	10.92	11.21	10.40	10.41	1.44
Aquatic Products	7.69	9.20	10.34	11.74	12.55	12.95	1.68
Milk	4.63	4.62	7.88	9.94	17.92	18.32	3.96
Fresh Melons and Fruits	41.11	44.96	54.21	57.48	56.69	60.17	1.46
Nuts and Kernels	3.21	3.04	3.26	3.30	2.97	3.03	0.94

Source: National Bureau of Statistics of China:
http://www.stats.gov.cn/tjsj/ndsj/2007/indexeh.htm

Table 10: Per Capita Consumption of Major Foods by Rural Households in China

Item	1990	1995	2000	2005	2006	Ratio
Grain (Unprocessed)	262.08	256.07	250.23	208.85	205.62	0.78
Wheat	80.03	81.11	80.27	68.44	66.11	0.83
Rice	134.99	129.19	126.82	113.36	111.93	0.83
Soybeans	N/A	2.28	2.53	1.91	2.09	0.92
Fresh Vegetables	134.00	104.62	106.74	102.28	100.53	0.75
Edible Oil	5.17	5.80	7.06	6.01	5.84	1.13
Vegetable Oil	3.54	4.25	5.45	4.90	4.72	1.33
Meats, Poultry and Processed Products	12.59	13.42	18.30	22.42	22.31	1.77
Pork	10.54	10.58	13.28	15.62	15.46	1.47
Beef	0.40	0.36	0.52	0.64	0.67	1.67
Mutton	0.40	0.35	0.61	0.83	0.90	2.24
Poultry	1.25	1.83	2.81	3.67	3.51	2.81
Eggs and Processed Products	2.41	3.22	4.77	4.71	5.00	2.08
Milk and Processed Products	1.10	0.60	1.06	2.86	3.15	2.86
Aquatic Products	2.13	3.36	3.92	4.94	5.01	2.35
Sugar	1.50	1.28	1.28	1.13	1.09	0.72
Liquor	6.14	6.53	7.02	9.59	9.97	1.62
Fruits and Processed Products	5.89	13.01	18.31	17.18	19.09	3.24

Source: National Bureau of Statistics of China
http://www.stats.gov.cn/tjsj/ndsj/2007/indexeh.htm

Table 11: Per Capita Meat Consumption (kg/person) and Grain Fed to Livestock as a Percent of Total Grain Consumed (in brackets)

Year	World		U.S.		China		India		Canada	
	Meat	Grain	Meat	Grain	Meat	Grain	Meat	Grain	Meat	Grain
1970	24.80	39.0	105.90	80.5	9.00	8.0	3.60	0.9	96.50	77.8
1975	25.50	37.7	101.80	75.3	10.60	8.5	3.60	1.3	96.90	76.9
1980	28.10	39.1	108.10	74.4	14.60	13.3	3.70	1.7	100.90	75.5
1985	29.10	39.5	109.90	71.1	19.20	15.8	4.10	1.9	100.10	74.2
1990	31.20	39	112.80	68.5	25.80	18.8	4.60	2.5	95.90	74.0
1995	36.10	36.6	117.80	64.3	39.00	23.1	4.70	2.9	97.40	79.7
2000	38.60	37.3	122.00	65.9	49.90	27.8	5.00	4.4	107.10	73.0
2002	39.70		124.80		52.40		5.20		108.10	
2005		37.0		59.8		28.3		4.4		72.9
2007		35.5		49.9		28.5		4.7		68.3

Sources: http://earthtrends.wri.org//searchable_db/static/193-8.csv;
http://earthtrends.wri.org//searchable_db/static/348-8.csv

The Indian economy has grown at an annual rate of approximately 6 percent since 1980 (Table 8b), ranking India among the fastest growing economies. Rapid per capita income growth is now the major force behind the emerging transition of Indian agriculture and policy. In India, the share of the population in poverty is declining, and a significant, relatively affluent, middle class has emerged.

Indian food consumption patterns have diversified significantly since the 1980s. Consumption of fruits, vegetables, edible oils, and animal products is rising much faster than that of wheat and rice, staple grains in the Indian diet (see Table 12). Both urban and rural Indians have started consuming more pulses, milk and milk products, edible oils, meat, egg and fish and vegetables, although not at rates comparable to those in China. With increase in income, people in general have started moving towards consumption of superior food items in rural as well in urban areas. Despite traditional vegetarian dietary preferences, the growth of the poultry and egg industries is evidence that the expansion of meat and feed demand will play a role in the transformation of Indian agriculture, as it has in other developing countries.

Increases in income for lower income households mean more calories and more protein are consumed.

Table 12: Per Capita Food Consumption in India, 1988 - 2000

	Rural			Urban		
	1987/88	1999/00	Ratio (00/88)	1987/88	1999/00	Ratio (00/88)
Rice	89	88	0.98	69	67	0.97
Wheat	58	29	0.50	56	54	0.96
Other Cereals	32	16	0.50	10	5	0.48
Total Cereals	179	157	0.88	134	125	0.93
Pulses	12	11	0.93	13	12	0.94
Dairy	41	51	1.26	55	68	1.24
Edible Oils	4	6	1.43	7	9	1.25
Meat/Fish/Eggs	11	19	1.76	24	35	1.44
Vegetable and Fruits	85	124	1.46	139	185	1.33
Processed Food	5	19	3.90	10	27	2.75

Source: Chatterjee et al. (2007) https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=NZAE2007&paper_id=72Table 4.

The trends and the positive correlation between economic growth and change in food consumption patterns in China and India are consistent with Engel's Law, which states that for a given change in income, low income consumers make bigger changes in food expenditures than do higher income consumers.

The trends and the positive correlation between economic growth and change in food consumption patterns in China and India are consistent with the well established Engel's Law which states that for a given change in income, low income consumers make bigger changes in food expenditures than do higher income consumers. For both countries, with the change in per capita consumption patterns, demand for grains consumed directly as food has decreased and it is expected to decrease further in the near future with increase in the level of income.

The increases in the income of developing economies such as China and India are a reason for the increase in the prices of most major commodities, not just crops.

Urbanization in developing countries is also changing the pattern of global food demand due to changes in tastes and lifestyles. In addition to rising incomes, a steady growth in urbanization is stimulating demand for a more diverse array of foods, including fruit, vegetables, edible oils, milk, eggs, and poultry meat in developing countries. Demand for these products is now outpacing demand for traditional staples food (Tables 9, 10 & 12). To this end, in forecasting food demand patterns over the long run in economies undergoing rapid structural transformation and urbanization, it is important to investigate the influence of changes in tastes, lifestyles, occupations, and marketing systems on food demand. Urbanization may lead to a shift in food demand due to 1) availability of a wide range of food, 2) exposure to a variety of dietary patterns from foreign countries 3) a preference for convenience (less time to prepare), among other things.

The depreciation of the US dollar has enhanced the purchasing power and thus the demand of the growing economies since commodities are priced on the US dollar.

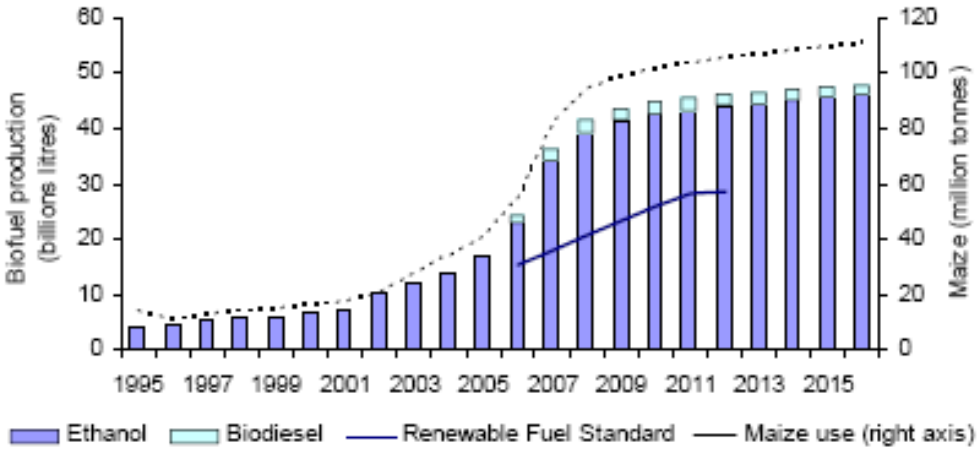
3.C. Biofuels

3.C.1. Production Levels

World ethanol production had increased to a record level of 60 billion liters in 2007 with approximately 40% coming from the United States (Steenblik 2007). Ethanol production in the United States has grown from about 175 million gallons (665 million liters) in 1980 to 6.5 billion gallons (24.7 billion liters) in 2007 (Figure 9). The United States is now the largest fuel ethanol producer in the world, having recently surpassed Brazil, which produced about 5 million gallons (about 19 billion liters) in 2007. Ethanol production in Canada has also expanded rapidly over the past 5 years, but the total production level is still small, by comparison, reaching about 211 million gallons (about 800 million liters) by 2007 (Figure 11). Canada was fifth largest national fuel ethanol producer by 2007.

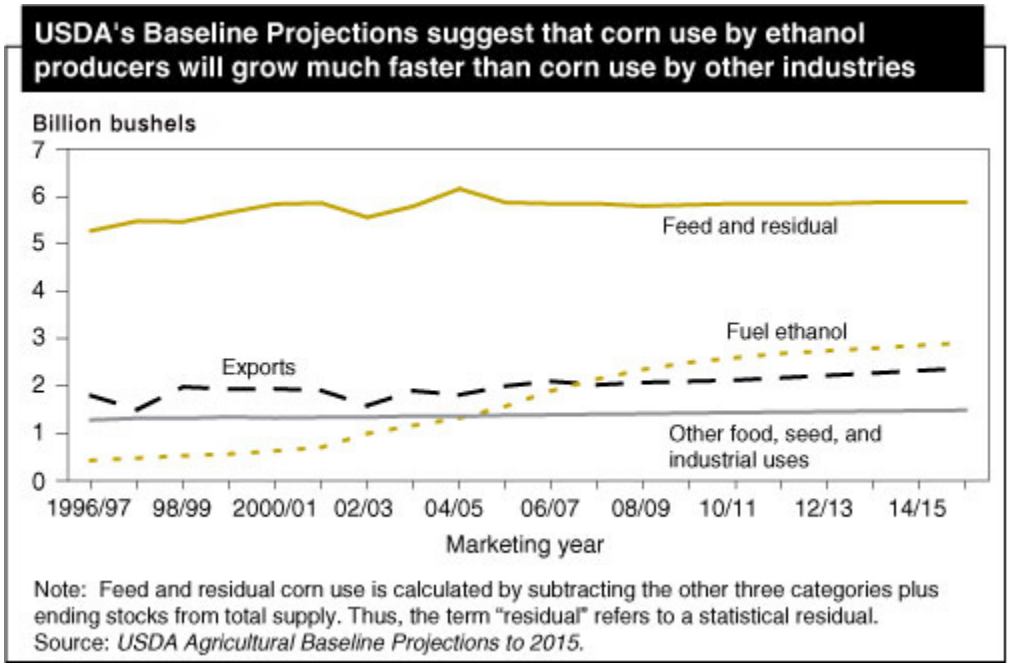
Global ethanol production has tripled in the last several years. Projections are for another 4-fold increase in the next 15 years.

Figure 9. US Ethanol and Biodiesel Production and Corn Use, 1995 to 2016



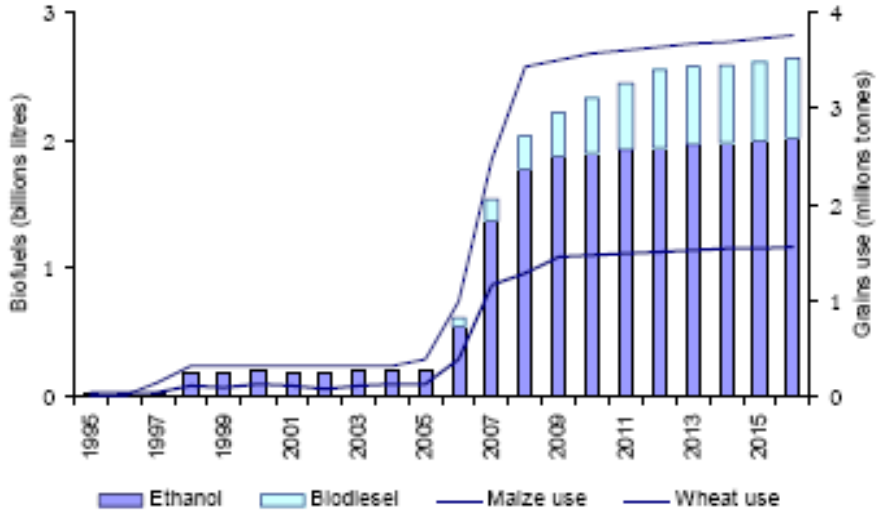
Source: OECD and FAO, *OECD-FAO Agricultural Outlook 2007-2015*, Paris, 2007.

Figure 10. Projected Uses of US Corn, 1995 to 2016



Sources: http://www.ers.usda.gov/AmberWaves/April06/Features/Ethanol.htm

Figure 11. Canadian Ethanol and Biodiesel Production and Corn Use, 1995 to 2016



Source: OECD and FAO, *OECD-FAO Agricultural Outlook 2007-2015*, Paris, 2007.

The National Biodiesel Board reports on the rapid expansion in US biodiesel production which has gone from 75 million gallons (285 million liters) in 2005 to about 250 million gallons (63 million liters) in 2006 and to 450 million gallons (1.7 billion liters) in 2007. In comparison, the European Biodiesel Board reports that EU biodiesel production reached about 1.65 billion gallons (6.27 billion liters) in 2006, of which about 55% was produced in Germany. Canada produced 59 million liters of biodiesel in 2006 but construction of additional commercial biodiesel production facilities is underway in Canada (Steenblick 2007). For example, the Canadian Bioenergy Corporation is developing a 225 million liter per year facility near Edmonton

Using an ethanol yield per bushel of corn of 2.65 gallons of ethanol per bushel of corn, the implicit corn use of US ethanol production was about 66 million bu in 1980 and had increased to 2.4 billion bu by 2007. Out of an annual national corn crop of 10 to 12 billion bu, US ethanol production was using about 20% of the US corn crop by 2007. Elam (2008) estimates that US ethanol production capacity will exceed 9 billion gallons (34.2 billion liters) by mid-2008.

Current mandates and energy prices will result in approximately one-third of the US corn crop used for ethanol.

The current primary rationale for ethanol policy in the United States is that ethanol production will reduce demand for imported oil. For Canada and Mexico, however, as net oil exporters, this national security rationale does not have much relevance, although Mexico is an importer of secondary petrochemical products. As in the case of the greenhouse gas reduction rationale, the imported oil argument hinges on the net energy gains (or losses) realized with grain-based ethanol production, and is subject to the same criticism below. Pimental has recently estimated that ethanol production from corn in the United States uses 30 percent more energy than is present in the ethanol. Hill *et al.* have recently concluded that ethanol production from corn in the United States generates 25 percent more energy than it consumes, although almost all of the net gain is attributed to the energy credit estimated for the dried distillers' grains, a byproduct of ethanol production. Olar *et al.* summarize a number of studies on net energy estimates for ethanol. They conclude that there is a slight upward trend in these values for more recent estimates, but the variability of available estimates is quite high. Sopuck also summarizes estimates of net energy balance for corn-based ethanol production and also presents his own estimates. His summary of nine previous studies, which includes two sets of results produced by Pimental, gives an average positive net energy balance of about 1,100 Btu per liter. Sopuck's own estimate is about 5,500 Btu per liter.

The primary motivation for biofuel support in the United States is national security. It is hoped that biofuels will reduce reliance on foreign energy.

Several practical factors contribute to the variability of estimates of the net energy balance of ethanol production from corn, in addition to the analytical problems that we discuss below. First, corn yield is influenced by weather, disease, insects, and operator error. This means that there is variability in output from any given combination of land, fuel, seed, fertilizer, and pesticide products applied to a particular stand of corn. Depending on growing conditions, a given level of fossil fuel input results in a range of corn, and hence corn energy outputs.

Second, corn is grown using a wide range of production systems, systems that vary, among other ways, in the level of fossil fuel used. There is no provenance provided with each bushel of corn that arrives at the ethanol plant documenting the nature of the production system used to produce that corn. So no one really knows what energy inputs have been applied. So these inputs are estimated or assumed. And there continues to be controversy about estimates of inputs used in corn production. For example, extension personnel in Ontario have claimed for some time that farmers are applying fertilizer at rates that exceed the profit maximizing level of nitrogen use. On the other hand, aggregate data on total nitrogen use and nutrient budget calculations suggest that the quantity of nitrogen removed in the form of grain corn, at a provincial level, is reasonably close to balanced with total nitrogen fertilizer inputs. Depending on which data one uses, the net energy balance from corn-based ethanol in Ontario would be quite different.

A third factor has to do with the treatment of byproducts from ethanol production. Some of the most recent estimates reporting small positive energy balances from ethanol produced from corn charge some of the corn production energy inputs against the byproducts. In fact, the magnitude of the positive energy balance is approximately equal to this byproduct attribution. Economically, this is problematic. Ethanol and the byproducts are joint products. Production economists have long recognized that allocation of production costs over joint products in a non-arbitrary way is not possible. Some arbitrary rules have been developed, such as cost allocation based on share of revenue. If we used 2007 relative prices for Dried Distillers' Grains (DDGs) and Ethanol, assuming an ethanol yield of 10.26 liters of ethanol per bushel of corn (2.7 US gallons), which would be worth about $6.75, assuming a price of $2.50 per gallon, and DDGs output of about 17 lbs. (7.7 kg) per bushel of corn input, which would be worth approximately $0.62 at current prices, this would result in 91 percent of the corn energy budget being allocated to the ethanol and nine percent to the DDGs. But this ratio may overstate the share of revenue derived from DDGs in the future as ethanol capacity expands putting downward pressure on DDG prices. In any case, our 91 percent to nine percent ratio is a much lower energy input allocation than has been used in studies that have found a net energy gain from ethanol.

In addition to the net energy balance question, the limited capacity of available cropland in the United States, to say nothing of the opportunity cost of the feed and food grain uses of grains currently grown on that cropland, caps potential import replacement at a relatively low level. And even projected growth of ethanol production in the United States would not put much of a dent in oil consumption. US

gasoline consumption in 2004 exceeded 500 billion liters. Even doubling current US ethanol production would only constitute about six percent of 2004 gasoline consumption. Hill et al. have estimated that if all US corn and soybean acreage was devoted to ethanol and biodiesel fuel production, this would meet only 12 percent of gasoline and six percent of diesel fuel demand.

3.C.2. Role of Incentives

Table 13 summarizes and compares the main policy measures used to promote ethanol production and consumption in Canada, the United States and Mexico. Support has been converted to $/liter units to facilitate comparison. Several interesting points of comparison between Canada and the United States can be seen. First, federal support for ethanol seems to play a more significant role in the United States, as well as in Mexico, than it does in Canada compared to state and provincial support, respectively. The main exception is Minnesota, which looks more like a province than a state. Second, provincial commitments to ethanol are more broadly distributed in Canada than appears to be the case in the United States, where support is highest in midwestern grain producing states. Ironically, Canadian grain producers have already received substantial benefits, in the form of higher grain prices, as a consequence of US ethanol policy. Recent Canadian policy initiatives, by virtue of the small share of the North American corn produced in Canada, are likely to have such small additional price effects.

Profitability of ethanol depends on the price of energy (output) and corn (input). A price of $120 for crude oil can support a corn price of $4.

Apart from comparative support levels, this brief summary of biofuels policies in the NAFTA countries illustrates several important points. First, the ongoing expansion and even the existence of a corn-based ethanol industry are contingent on government support. The matrix of policies at the federal, provincial, and state levels is complex and dynamic. Second, the policy rationale for supporting ethanol has changed frequently since 1978. Ethanol has been promoted on environmental, economic, and geopolitical grounds. Third, the dramatic increase in ethanol production over the past two or three years has galvanized critics of current policy and challenged virtually all aspects of the rationale for government involvement in the biofuels market.

Corn represents over 70% of the operating costs for ethanol.

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Table 13 Comparison[3] of ethanol support policies in Canada, The United States and Mexico[a]

	Canada[b]		Mexico	United States	
Category of Support	**Federal**	**Provincial**	**Federal**	**Federal**	**State[c]**
Import Duties	$0.09/liter[d]	Not Applicable	$0.63/liter[e]	$0.142/liter	Not Applicable
Excise Tax Exemptions and Income Tax Credits	$0.09/liter	Alberta $0.081/liter British Columbia $0.13/liter Manitoba $0.30/liter[f] Ontario $0.132/liter[g] Quebec $0.18/liter Saskatchewan $US 0.135/liter	Not contemplated in Bioenergy Law	$0.134/liter	Illinois[h] $0.079/liter Iowa $0.003/liter California $0.079/liter Indiana[i] $0.03/liter
Capital Grants or Concessional Loans	Ethanol Expansion Program[j] up to $0.03/liter	Ontario Ethanol Growth Fund up to $US 0.09 per liter of capacity	Ad hoc support from Federal Agricultural Infrastructure Fund		
Operating Grants	2007 Budget $0.09/liter[k]	Alberta $US 0.126/liter Ontario up to $US 0.099/liter			Minnesota $0.053/liter Texas $0.053/liter Wisconsin $0.053/liter
Blending Requirements	5 percent by 2010	Alberta British Columbia Manitoba 8.5 % in 2005 Ontario 5% in 2007, rising to 10% by 2010 Quebec Saskatchewan	No target given, but government will make effort to use blended fuel		Minnesota ten percent

[3] Source: Fox and Schwedel (Forthcoming)

[a] Data in this table were derived from various sources, including Walburger et al.; Koplow; MacDonald; and various government press releases.
[b] A US$ to C$ exchange rate of C$1.00 to US$0.90 was assumed.
[c] Reported calculations are for the ten largest ethanol consuming states.
[d] Scheduled to be phased out in 2008 and replaced with an equivalent "incentive payment."
[e] Refers to denatured ethanol from countries where no trade treaty exists. Imports from Canada and the US are duty free as long as they are not sugar-based ethanol which has benefited from the Sugar Reexport Program.
[f] In Manitoba, fuel ethanol is exempted from a C$0.20/liter excise tax and, in addition, the excise tax on ten percent blend fuel is also reduced by C$0.015/liter on the gasoline portion. Since, in a ten percent blend, nine liters of gasoline are mixed with each liter of ethanol, the reduction in provincial excise tax is C$0.20 per liter for the ethanol exemption plus C$0.135 for the tax reduction on the gasoline in the blended fuel, for a total exemption of C$0.335/liter. The exemption on the ethanol portion is scheduled to be reduced to $0.135/liter from 2007 to 2010 and to $0.09/liter from 2010 to 2013.
[g] The exemption has been replaced by a provincial blending requirement.
[h] Illinois reduces the sales tax on E10 and above blends from 6.25 to five percent. If the retail price of gasoline is $2.50 per gallon inclusive of sales tax at 6.25 percent, then this would fall to $2.47/gallon at a five percent tax rate. The $0.03/gallon reduction is gained for having 0.10 gallons of ethanol, so the tax reduction is $0.30/gallon of ethanol, or $0.079/liter.
[i] State income tax credit.
[j] Calculations available from the authors on request.
[k] Replaces federal excise tax exemption in 2008.

3.B.3. Environmental Debate

Kerr and Loppacher have claimed that the major policy motivation for ethanol policy in the EU, Brazil, Canada, and the United States has been to correct for the market failures associated with the use of petroleum fuel. If this view is correct, then this would place ethanol into a category of environmental goods, which are subject to different trade disciplines than, say, agricultural or industrial goods. This claim, however, is often made by assertion. Increasingly, critics of the ethanol industry have raised environmental concerns about the current and projected scale of ethanol production within North America and even globally, implying that ethanol's status as an environmental good is contentious.

The claimed environmental benefits of ethanol have several dimensions. One aspect is the claim that ethanol production reduces greenhouse gas emissions. Another aspect is that ethanol is a cleaner burning fuel than gasoline in terms of non-greenhouse gas emissions. A third dimension of the claimed environmental benefits of ethanol has to do with its ability to replace MTBE as a fuel ingredient. All of these claims, however, are controversial.

The claim of reduction in greenhouse gas emissions from ethanol use is closely related to analysis of the net petroleum displacement achieved from ethanol use. If vehicle fuel consists of a 10 percent ethanol blend, then every gallon of a blended fuel reduces petroleum use by some amount. The magnitude of the reduction in petroleum use depends on several factors. Using corn as the feedstock for ethanol production means that the petroleum used directly and indirectly to produce the corn, as well as the fossil fuel energy used to process that corn into ethanol, as well as energy used in the transportation of ethanol must be taken into consideration. Of course, indirect energy use occurs in the petroleum supply chain as well. Many studies, several of which we referred to above, have been conducted attempting to estimate the net effects of ethanol production on oil use in the transportation system. These studies have produced a range of estimates that range from a reduction in overall oil use to an actual increase in oil use when ethanol is used as motor vehicle fuel. These estimates remain controversial and convergence has not yet been achieved.

Our explanation of the range of estimates of net energy balance is that comparisons of the net energy balance of ethanol versus petroleum-based gasoline face an unresolvable problem of infinite regress. Early advocates of ethanol claimed that every liter of ethanol used replaced 0.66 liters of petroleum-based gasoline, when adjustments are made for Btu (British thermal unit) content. Critics of ethanol responded that oil was used in the production of the corn that went into the ethanol and that an oil-equivalent of coal or natural gas was used to generate the electricity used in the ethanol plant so these oil or oil-equivalent inputs should be charged against the ethanol to produce a net oil displacement figure. But ethanol proponents countered that oil is used in the production and transportation of oil as well, so that should be counted. But, pursuing this line of reasoning, oil was used in the production of the tractors that are used to grow the corn. And oil is used to fuel the iron ore freighters that delivered the ore to the steel plants that made the steel that

went into the tractors that were used to produce the corn. Of course, being consistent, this indirect oil consumption should be charged against the oil rigs, that are also made of steel, that extract the oil from the oil fields. And then there is the fuel that is used by the employees of the tractor factory, the steel plant, the oil refinery and the ethanol plant to drive to work. Should that be counted? As with other so-called life cycle analyses, there is no non-arbitrary stopping point for this type of analysis. So any physical estimate of net energy displacement with ethanol has to choose some arbitrary stopping point.

In any case, as a means of reducing greenhouse gas emissions, ethanol use seems to be a high cost means of reducing those emissions. Henke, Klepper, and Schmitz estimated costs of greenhouse gas reduction in the range of €200 to €1,000 per metric ton of CO_2 equivalent, which is far more expensive than readily available alternatives. Forge reports Natural Resources Canada estimates that vehicle fuel using ten percent ethanol produced from corn generates three to four percent lower greenhouse gas emissions compared to conventional fuel. Forge projects that national use of ten percent ethanol blend fuel would reduce Canada's greenhouse gas emissions by one percent.

Another aspect of the claim of environmental benefit is that ethanol is an alternative to MTBE in the formulation of gasoline. MTBE has been phased out through a combination of regional bans on its use and the expiration of a legislative shield from liability for its use. Johnson and Libecap's discussion of the history of the debate over the relative environmental merits of ethanol versus MTBE, however, suggests to us that discerning the truth on this issue is not easy.

Finally, assessment of the environmental effects of biofuels needs to take into account the impacts of increased plantings on marginal land and/or additional water use requirements, both domestically and internationally. The issue of environmental damage and sustainability, for example, is of particular concern for the production of biodiesel from palm oil which has been associated with the clearance of forested lands. An inappropriate choice of crops and technologies can result in negative environmental effects.

There are increasing concerns about the net environmental impacts of biofuels, particularly with regard to the conversion of non-farmland and the release of carbon sinks.

While public pressure on biofuels are likely to continue if crop prices remain high, there will be support for renewable fuels made from cellulosic technology.

3.B.4. Linkage between Corn and Energy Prices

The link between oil prices, biofuel policy and food and feed grain prices has focused world attention on agriculture and the world food system to a level not seen since the 1970's. Various characterizations have been made of critical linkages. Edward P. Lazear, chairman of President Bush's Council of Economic Advisors, has stated that ethanol production has only accounted for between 2% and 3% of the overall increase in global food prices. The International Food Policy Research Institute, on the other hand, estimates that increased biofuel demand accounted for about 30% of the increase in grain prices between 2000 and 2007. Bruce Babcock, director of Iowa State University's Center for Agriculture and Rural Development, in recent congressional testimony, estimated that eliminating US government support for ethanol would decrease the price of corn by only about 13%. In a recent working paper, he revised this estimate to 14.5%.

In addition to a pull effect from ethanol on corn that may have contributed to up to 30% of the increase in the price of corn, there is also an indirect effect due to crude oil. As the price of a barrel of oil rises, the demand for substitute products such as ethanol increases. This in turn increases the demand and consequently the price for corn. Babcock has estimated that a crude oil price of $120 per barrel will support a corn price of $4 per bushel without any ethanol mandates or incentives.

Corn price is now linked to energy prices. Increases in crude increase the demand for substitutes such as ethanol and thus the demand for biofuel feedstocks. Corn price does not have an effect on energy price.

3.D. Financial Markets

The tightening of stock levels in all commodities due to demand growing faster than supply is a long-term phenomenon that justifies an increase in crop price. The dramatic jump in price suggests that there are short-term factors accelerating the price movement. Speculation, hoarding, and hysteria have all contributed to the increased level and especially the volatility of prices.

Market conditions have made commodity markets an attractive option for investors. Money has flowed from the equity market to real estate and now to commodity markets based on expected returns. Low interest rates and a depreciating US dollar have further spurred investment. Low interest rates mean low returns for savings accounts such as GICs or treasury bills which are an alternative investment option. In addition, the cost of holding commodities decreases with lower interest rates so the demand increases. Demand is further pushed up by the falling US dollar on which most commodities are priced. The decline makes the commodity less expensive to consumers outside the US and thereby increases the demand (Helbling, Mercer-Blackman and Cheng, 2008).

Another potential link between macroeconomic conditions and commodity prices is through the influence of monetary policy. Jeffrey Frankel, Professor of Economics at the Kennedy School of Government, of Harvard University and a member of the Council of Economic Advisers during the Clinton administration, has long advocated that expansionary money supply has led to an increase in commodity prices.

Investment funds have flowed from the equity market, to real estate and now to the commodity markets. In periods of financial uncertainty, investors shift to real assets.

The volume of activity in the CBOT for the major crops is shown by the red line at the bottom of Figures 2-5. The dramatic increase in the number of contracts traded mirrors the increase in price. The simultaneous increase in investor interest and prices is given by some as evidence that the activity has pushed price above that implied by the underlying supply and demand fundamentals and increased the price volatility.

Whether speculative activity causes higher prices and volatility or whether high prices (supply-demand fundamentals) attract speculative positions, depends partially on the form of speculation. Investors in agricultural commodity futures markets consist of commercial traders, who are hedging in the futures market to manage price risk, and noncommercial traders, who are speculating to make a profit. The speculators are necessary for the functioning of the futures market. If a farmer or commercial elevator wants to protect their current price positions and hedge their risk of price dropping, they need a speculator to assume that risk and take an offsetting position in the market. The increased liquidity provided by speculators allows the market to function thereby shifting risk from those who don't ant to hold it to those who do, enhancing the efficiency of the price discovery mechanism, and reducing, rather than increasing, the variability of price.

Commercial speculation is necessary for the proper functioning of a commodity futures market.

Michael Masters in a recent submission to the US Senate Committee on Homeland Security and Government Affairs noted the distinction between traditional speculators and index speculators. The former have always been an integral part of the commodity futures market while the latter is a relatively new component that entered after the stock market fall of 2002. The amount of money invested in commodity index funds has risen from $13 billion at the end of 2003 to $260 billion in March 2008 (Masters 2008). In terms of crop markets specifically, Masters (2008) notes that index speculators purchased over 2 billion bushels of corn on the CBOT over the last 5 years.

According to Masters, index commodity funds do not behave like traditional speculators, who bet on the price rising or falling based on market information, but rather are passive investors. Pension plans and hedge funds are index speculators that allocate part of their investment portfolio to commodity futures. The amount invested is determined as a share of the total funds available and not by the price.

The volume of activity in crop futures on the Chicago Board of Trade mirrors the increases in commodity prices. The direction of causation is open to debate.

Table 13: Selected Agricultural Commodities Futures Markets Open Interest, 2008

	Long (Demand Side, %)			Price Increases	Dollar Value of Open Interest (in million US$)	
Commodity	Physical Hedgers	Traditional Speculators	Index Speculators	2003 -08	2002	2008
Corn	41	24	35	134	5435	37,427
Soy Oil	46	22	32	199	1,441	8,868
Soybeans	30	28	42	143	4,883	37,399
Wheat CBT	17	20	64	314	1,836	19,742
Wheat KC	37	32	31	276	1,304	6,253
Feeder Cattle	17	53	30	34	540	1,818
Lean Hogs	18	20	63	10	602	4,465
Live Cattle	13	24	63	23	2,670	8,764

Index speculators buy futures and roll their positions forward by buying calendar spreads in contrast to traditional speculators who buy and sell future positions (Masters 2008). The result is that liquidity is decreased with commodity index funds and that the allocation to a commodity futures increases with price thereby accelerating the rate of price increase. The increase in long positions (buy) on the futures market and the matching of index fund investment with price spikes provides an argument for the role of index speculators in the dramatic rise in crop and other commodity prices. It may also affect the inter-year price spreads in commodity prices.

Concerns over the role of these institutional investors have led to moves that will limit speculative positions. Despite the likely changes affecting commodity index funds from the Commodity Futures Trading Commission (CFTC), many feel the relationship between the level of their investment and commodity prices does not imply causation. Luskin (2008) in a recent Wall Street Journal article notes that much of the growth in commodity index fund assets is associated with rising prices (reverse causality). In addition, not all commodity sectors (i.e. livestock and steel) have risen as would be implied by general commodity index fund investment.

According to Luskin (2008), index funds are buyers and sellers in equal proportion once their long (buy) position is established. While their initial purchase will push

up price as will occur when any stock is bought is made, these initial positions are rolled over into longer-term contracts upon expiration and so do not act as further drivers of demand (Luskin 2008). It should be noted that the index funds- just like traditional speculators- never take ownership of the underlying commodity nor do they store any of the commodity for future sale. Hence, commodity index funds may have had an effect on crop prices but the extent of the impact and its duration is open to debate.

There has been much less discussion of hedge fund operators who can take both short and long positions in the commodity futures markets, often relying on technical analysis to trigger their trades. It seems reasonable to assume these funds can influence the intra-day and seasonal price volatility of futures markets.
In addition to financial investors made up of traditional and index speculators on the CBOT, speculators in the form of individual consumers/producers and governments can influence the cash market. The rice market has been particularly affected by hoarding behaviour. While the stock-piling at the micro-level contributed to a panic atmosphere, the decisions by major exporting countries to prevent the foreign sale of rice pushed price up dramatically (see Section 5.A). The amount of rice traded on the world market is around 5% of the total produced so the reduction in supply resulting from the export bans can have large price effects in a thin market. Subsequent decisions by some of these countries to relax the trade bans have dampened prices as expected.

Hoarding behaviour by national governments has also occurred in the wheat market. Aside from the countries that banned wheat exports such as Ukraine (see Table below), foreign buyers began stockpiling wheat in response to food riots. Rather than purchase one or two months' supply at a time, larger orders were made regardless of price and mills scrambled to fill these requests (Faiola, 2008). Panic buying aided by a weak US dollar contributed to the rapid price spike in the wheat market early this year.

Speculative behaviour by commercial investors and supply restraint policies by exporting governments are transitory factors that do not lead to permanent crop price increases but have accentuated the peaks.

Table . Supply Restraint Policies by Exporting Countries in 2007

Export Policy	Country Example
Subsidies	Eliminated by China on grains and grain products
Taxes	Argentina (wheat, corn, soy), Russia (wheat), Kazakhstan (wheat), Malaysia (palm oil)
Restrictions	Argentina (wheat), Ukraine (wheat), India (rice), Vietnam (rice)
Bans	Ukraine (wheat), India (wheat), Egypt (rice), Cambodia (rice)

Source USDA (2008)

4. Projected Crop Prices

The OECD-FAO Agricultural Outlook for 2008-20017 was released on May 29, 2008 and concluded that crop prices will continue to be high. The surge in prices experienced recently and described in Section 2 are unlikely to be sustained due to changes in the financial market and a boost in supply as farmers respond to the higher prices. However, the demand fundamentals discussed in the previous Section will continue. The biofuel industry will continue to use a greater amount of crops as feedstock and the rise in income from developing countries will continue to push food demand upwards. Thus, the growth in demand and supply will be similar and global stock levels will continue to be tight with small unexpected changes in consumption or production having large impacts on prices.

The permanence of the price increase depends upon which causal factors dominate:

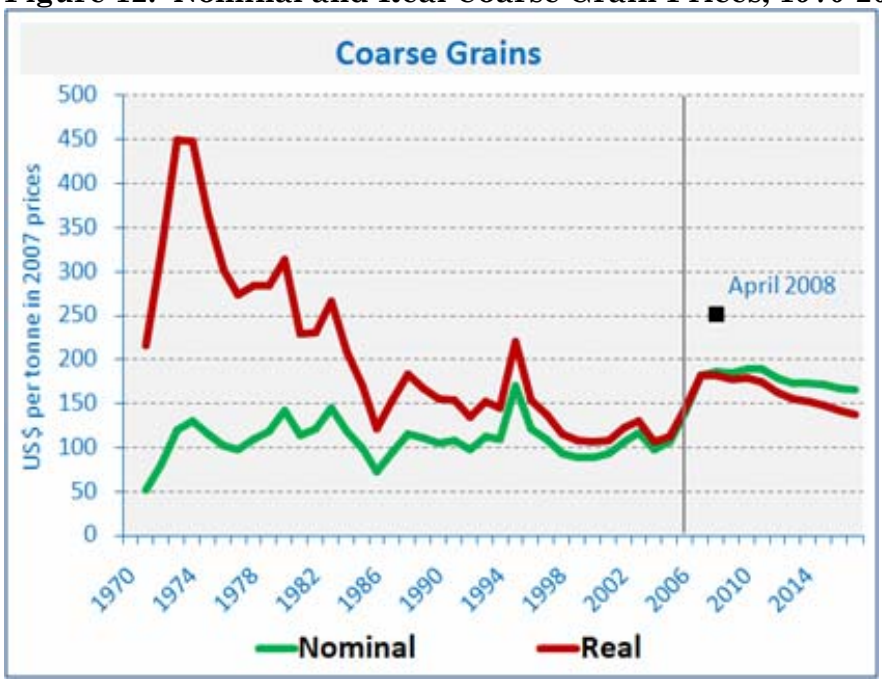
- Weather-related supply shocks, exchange rate changes, speculator investment levels are transitory factors that create a blip in price.
- Income growth, biofuel consumption and slowing supply growth are structural changes that would imply a more permanent price increase.

The OECD-FAO projected prices are illustrated in Figures 12-15 for corn, oilseeds, wheat and rice respectively. There are two points to note from the projections. First, there is a permanent increase in the prices from the levels in the early part of the decade but lower than the spikes within the past 6 months. Second, the prices today are at a record level in nominal terms but still below well the highs of the early 1970s when expressed in real terms by adjusting for inflation

Crop prices are projected by OECD-FAO to stabilize over the next year at levels higher than before the price climb but lower than current peaks.

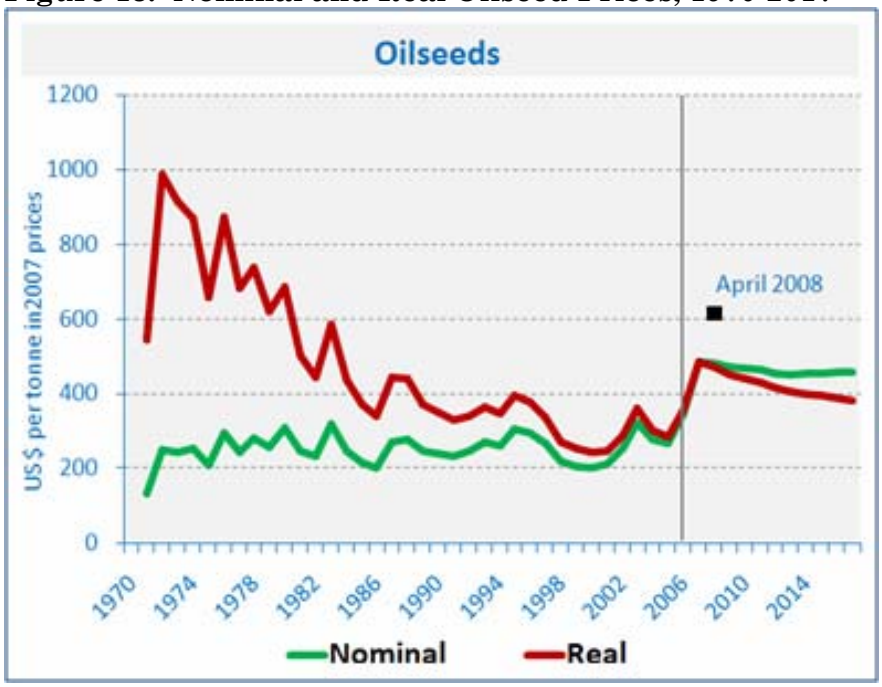
Increasing input costs will not affect crop price in the short run as farmers are price takers.

Figure 12. Nominal and Real Coarse Grain Prices, 1970-2017



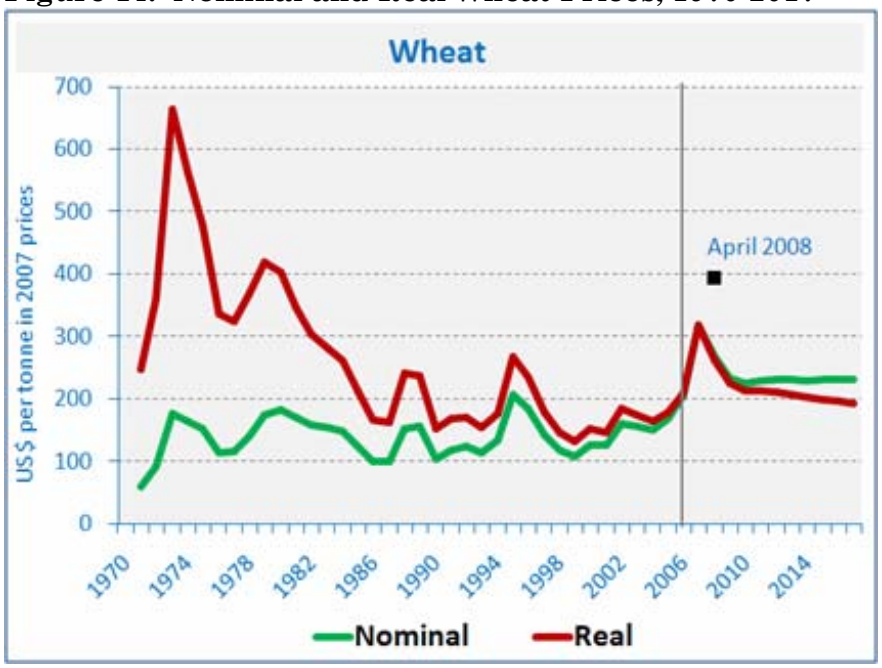
Source: OECD FAO
http://www.agri-outlook.org/pages/0,2987,en_36774715_36775671_1_1_1_1_1,00.html

Figure 13. Nominal and Real Oilseed Prices, 1970-2017



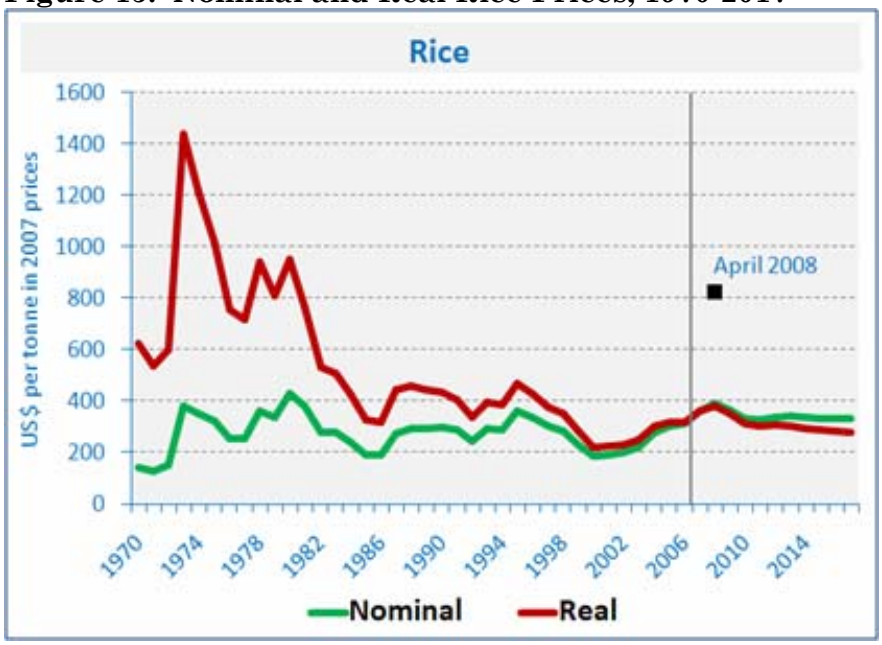
Source: OECD FAO
http://www.agri-outlook.org/pages/0,2987,en_36774715_36775671_1_1_1_1_1,00.html

Figure 14. Nominal and Real Wheat Prices, 1970-2017



Source: OECD FAO
http://www.agri-outlook.org/pages/0,2987,en_36774715_36775671_1_1_1_1_1,00.html

Figure 15. Nominal and Real Rice Prices, 1970-2017



Source: OECD FAO
http://www.agri-outlook.org/pages/0,2987,en_36774715_36775671_1_1_1_1_1,00.html

5. Effect on Food Prices

The increase in crop price does not necessarily translate into a direct increase in food price. Understanding the distinction between crop price and food price is important in knowing why there have been dramatic effects in certain regions of the world, particularly by the urban poor in developing countries that are significant crop importers, while Canadian consumers seem unaffected.

The global differences in food inflation stemming from rising crop prices and the sensitivity of consumers to those changes are due to two factors:

1. the share of the food dollar that goes to the farmer; and
2. the share of disposable income allocated to food.

Farm value is the share of a food dollar that goes to the farmer. The USDA estimates that farmers get about one-fifth of the money spent on food across all products in the US (Table 14). The total marketing bill includes not only the value of raw agricultural commodities produced by farmers but also the services provided by food processors, manufacturers, wholesalers, retailers, and foodservice providers. The largest share of the marketing bill is represented by labour.

The farmer share of the food dollar is approximately half of what was in the 1950s. The decline represents the additional services required to transform the raw agricultural commodities into the food products desired by consumers. Increases in income combined with shrinking household size and more women in the labour force have meant more services are demanded. People eat out more now and, when they do eat at home, they do not want to spend very long cooking. So it is pre-chopped and pre-cooked, and all that convenience is done beyond the farmgate.

Table 14. Components of Food Marketing Bill in the United States, 2006

Component	Percent	Billion dollars
Farm value	***19.0***	***163.2***
Labour	38.5	341.0
Packaging	8.0	70.5
Transportation	4.0	35.2
Energy	3.5	33.5
Profits	4.5	39.7
Advertising	4.0	34.9
Depreciation	3.5	31.5
Rent	4.0	37.6
Interest	2.5	23.9
Repairs	1.5	13.5
Business taxes	3.5	31.0
Other costs	3.5	25.2
Total	100	880.7

Source: ERS, USDA http://www.ers.usda.gov/Data/FarmToConsumer/marketingbill.htm

Table 15. Farm Value of Individual Food Products, US 2000

Food Product	Farmer Share
Milk, ½ gal.	34
Cheese, natural cheddar, 1 lb.	29
Frozen Orange juice conc., 12 fl. oz.	33
Frozen Broccoli, cut, 1 lb.	12
Frozen Corn, 1 lb.	7
Canned Corn, 303 can (17 oz.)	22
Apple juice, 64-oz. bottle	18
Sugar, 1 lb.	27
Flour, wheat, 5 lbs.	19
Peanut butter, 1 lb.	22
Potato chips, regular, 1-lb. bag	8
Bread, 1 lb.	5
Corn flakes, 18-oz. box	4
Corn syrup, 16-oz. bottle	3

Source: ERS, USDA http://www.ers.usda.gov/Data/FarmToConsumer/pricespreads.htm

The farm share varies by food product and reflects the degree of further processing after the commodity leaves the farm gate. The farmer share of beef is approximately 45% but can be as low as 4% for a cereal like Corn Flakes (see Table 15).

Approximately one-fifth of the domestic food dollar goes to the farmer. This farm value has dropped over time with more services provided beyond the farm gate. Consumers eat out more and, when they do eat at home, want food that requires little preparation.

The reason for the difference in farmer share by food product for a domestic consumer can be extended to explain the farm value for food in a developing country. Poor households in a less developed country will purchase much of their food closer to the raw form and to the source of production. The result is that in a developing economy, the farmer share of the food dollar will be upwards of 50% since it is the basic staple that is bought. For these consumers, there is little distinction between crop price and food price.

The other factor influencing the impact of rising crop prices on consumers is the share of household income spent on food. This percentage is a common indicator of a country's standard of living. Comparisons across (and also within) countries shows the share of income spent on food declines as income rises. The relationship, also known as Engel's Law, implies that food is a basic necessity and must be purchased first. As income increases, the amount spent on food increases but the rate of increase declines. Instead, a greater proportion of disposable income is spent on non-food items.

The lower the share of disposable income spent on food, the higher the standard of living.

Canadians spend approximately 10% of their income on food in contrast to approximately one-quarter for countries such as Mexico and China and around half for the poorest countries (Table 16). Euromonitor International's annual per capita food spending data (not including food away from home) for 67 countries found the share of expenditures spent on food was 12% in high-come countries and 42% in low-income countries and that the corresponding per-capita food spending was over $2,100 and less than $200 respectively (Frazao, Meade and Regmi 2008). The share in high income countries such as Canada would be significantly lower if it were not for the increasing amount being time spent on food away from home. For example, Canadians spend approximately one-third of their food budget on restaurant meals (AAFC 2008)

There are also similar differences in the food expenditure share within countries that has implications for potential rising food prices domestically. For example, households with income less than $30,000 spent around one-third of the income on food while those with earnings above $70,000 spent one-tenth (Frazao, Meade and Regmi 2008). The difference in monthly household food spending between these two groups of $450 is due mostly to spending on food away from home. The highest income households spend nearly half of their food budget on food away from home, which is nearly double the share among the lowest income households (Frazao, Meade and Regmi 2008).

This background on the farmer share of the food dollar and the share that food represents of household income provides the basis for understanding the effect of rising crop prices on food inflation which we will now examine in the following sub-sections for developing countries and then for Canada.

Food inflation is high for low income countries with a high farmer share of the food dollar.

Table 16. Expenditures on Food by Selected Country, 2006

Country	Share of Household Expenditures	Per Capita Expenditure (US$)
United States	7.2	2,204
Canada	9.3	1,994
France	13.9	2,776
Argentina	20.1	667
Mexico	24.5	1,296
Brazil	24.7	721
China	27.8	207
Russia	31.4	1,029
India	33.4	141
Nigeria	40.7	168
Pakistan	41.5	18
Sudan	62.8	-

Source: ERS, USDA
http://www.ers.usda.gov/briefing/cpifoodandexpenditures/data/2006t.htm

Table 17. Percent Changes in the CPI and Share of Food in CPI for Selected Countries, Feb 2007 to Feb 2008.

Country	Total CPI	Food
Guatemala	8.0	11.6
Sri Lanka	19.4	25.5
India	4.6	5.8
Indonesia	6.8	11.4
Pakistan	10.6	18.2
Egypt	9.5	13.5
Kenya	15.4	24.6
Bangladesh	10.3	14.2
China	8.0	23.3
OECD	3.4	5.1
United States	4.1	5.8
Canada		0.4

Source: FAO (2008) http://www.fao.org/fileadmin/user_upload/foodclimate/HLCdocs/HLC08-inf-1-E.pdf

5.A. Developing Countries- The Silent Tsunami

The price spike noted in Section 2 for the major crops has pushed up food inflation in developing countries but not to the same extent as the increases in world prices for the commodities. The inflation rate is still significant in certain regions with the effects largest on developing countries where the share of food in the consumer price index is large. In low income Asian and sub-Saharan African countries, grains account for over 50% of the diet and so any increases in the price of grain will be reflected in the food budget for these countries.

The average increase in the food component of the consumer price index rose by 13.5% for developing countries between February 2007 and February 2008 (FAO, 2008). This was larger than the overall CPI and particularly in countries like China where food contributed about 90% of overall inflation (IFPIR, 2008). Food inflation was also greater than the general inflation rate in OECD countries, 5.1% versus 3.4%. The significantly smaller food inflation rate in developed countries is due to the smaller share of the food dollar going to farmers and the greater processing involved in the final food product consumed.

The impact of rising food inflation in the developing world varies across population groups and countries. At the household level, the hardest hit will be the poor, particularly those in cities and the rural landless. The World Bank estimates that over 1 billion people live on less than $1 per day, which is the benchmark of absolute poverty, and that another 1.5 billion live on $1-$2 per day. While there have been reductions in the number of food insecure people over the last decade due primarily to economic growth in Asia, food inflation rates of 30% are projected to push 100 million people into absolute poverty thereby wiping out the gains of the past 10 years (World Bank, 2008).

The effect of food and energy inflation on a poor household living near the absolute measure of poverty is illustrated in Table 18. The poorest household will spend between 50-70% of its disposable income on food and most of its food budget is spent on staples (high farm share of food dollar). A 30% inflation rate for food and energy will reduce the amount available for items such as education and health from $0.30 to $0.07. Rather than keep the food expenditure constant, the household would likely reduce caloric intake and a shift to a less-balanced diet with fewer meats and vegetables. The resulting malnutrition and misery inflicted on the world's poorest from food inflation has been referred to as a "silent tsunami" since it is a pervasive problem affecting a large number people globally rather than a famine in a specific region associated with drought or civil war, which has been a measure of past food crises.

Table 18. Effect of 30% Food and Energy Inflation on Poor Household

	Before	30% Food & Energy Inflation
Available Funds	1.00	1.00
Expenses		
Food	0.60	0.78
Energy	0.10	0.13
Non Food	0.30	0.07

The deterioration in diets due to higher food prices can be a short-term problem but there could be several consequences that may jeopardize the ability to escape poverty in the long-term. The declining nutritional status of pregnant women and young children could affect the ability to learn and earn an income in the future (von Braun 2008). In addition, von Braun notes the loss in purchasing power may result in fewer children being educated (particularly females) and the sale of productive assets, both of which will reduce the long term earning potential of the household.

The impact of rising food prices does depend on whether the household is a net buyer or seller of food. The welfare of semi-subsistence farmers that sell part of their produce can be improved through higher farm sales. Such success stories are occurring in Vietnam and Thailand whose poor farmers are enjoying higher revenues from the sale of their rice. In contrast, the poor in both rural and urban areas tend to be net consumers of corn in Central American countries where corn is a staple of their diet.

Food inflation hits hardest the rural landless and the urban poor in developing countries that are net importers of staples.

The differential impact from rising food prices at the household level can be extended to the country level. Net importing, low-income countries are the ones hardest hit by rising crop prices. Countries that depend on imports for more than 40% of their grain consumption and have high levels of chronic hunger include Eritrea, Niger, Liberia, Haiti, and Botswana. The food gap, which is the amount of

food needed to raise per capita consumption to 2,100 calories, is projected to widen by 8% from a 30% increase in food prices with the effects largest in the previously listed countries and Latin America, which rely heavily on imports of grain (Rosen and Shapouri, 2008).

The rising food prices not only affect the diet of the population but also the macroeconomic stability of the net-importing, low-income countries. The cost of aggregate cereal imports for those countries increased by over 50% between 2006-07 and 2007-08 (FAO, 2008). The rising food import bill is projected be 3% of the GDP for these countries and will increase the current account deficit by at least this amount (FAO, 2008). The widening deficit will impact a number of other variables such as the exchange rate and financial stability. Particularly vulnerable countries include Liberia, Niger and Zimbabwe.

The wide-spread effects of food price inflation have prompted social unrest over the past year in 30 countries, 22 of which are in Africa. Despite the number of protests, there has been less political impact than expected as the only government to fall has been in Haiti (Economist, 2008).

Projected food inflation will erase the gains made in reducing the number of people in absolute poverty. It can also have long term effects on the earning potential of the poorest.

In response to the social unrest or in order to prevent it, governments around the world have implemented a variety of programs. Consumer prices have been buffered to an extent through price controls in many countries or the issuance of ration cards (i.e. Egypt and Pakistan). Import restrictions have been lifted or input subsidies given to farmers in an effort to increase local supply. Some exporting countries in an effort to control domestic prices have exacerbated the price rise in the world market by restricting supply. For example, Kazakhstan and Russia placed an export tariff on wheat while Argentina did so for a number of agricultural goods. A number of rice exporting countries, such as Egypt, India, China, and Indonesia, banned the selling of rice outside their borders which contributed to the unprecedented spike in rice prices.

Since a large portion of the budget is spent on food, increases in food prices can severely impact the well-being of the household; severe enough to cause rioting.

The policy responses to the global food security issues stemming from rising food prices can be categorized into those that meet immediate needs to prevent suffering and increase food supply and those that meet long term needs to increase the capacity and resiliency of the food system, particularly in developing countries. The suggested responses from IFPRI, IFAD, WFP and the FAO can be summarized as:

Immediate needs

1. Emergency aid and social protection
    - Food or cash transfer targeted to the most vulnerable (i.e. children)
2. Improving trade policies
    - Remove export restrictions to reduce prices and volatility
3. Stimulate food production in short-term
    - Promote supply through access to inputs such as seed, fertilizer, and credit for farmers

Long term needs

1. Stimulating agricultural investments
    - Increase agricultural research/extension and rural infrastructure
    - Supporting the use of GMO crops
2. Complete the WTO Doha Round
3. Invest in social protection
    - Expand support for safety nets for most vulnerable

5.B. Canada

Despite media reports of a crisis in world food prices and in contrast to the effects felt by the urban poor in developing countries, consumers in Canada generally and Ontario specifically, have not yet seen significant changes in their cost of food. The consumer price index (CPI) for food increased only 1.2 % from April 2007 to April 2008 while the CPI for all items increased by 1.7% (Statistics Canada, 2008). Food purchases from stores increased by only 0.9%. The latest figures for June indicate food prices have risen by 3% led by a 12.3% increase in the price of bakery products.

A number of factors contribute to the moderation of retail food prices in Canadian grocery stores. Some of these factors are structural which suggests that we will not expect to see the scale of increases in family food prices in Canada that have been experienced in other countries. Others are more transient which suggests that we can expect some increase in total cost of food moving forward.

Canadians are less sensitive to increases in the cost of crops as the farmer share of the food dollar is much smaller and most consumers spend a smaller proportion of total income on food than consumers in less developed countries. While these two components mean food inflation spurred by rising crop prices will be less than developing countries, Canada's food prices have increased less than those of other developed countries (see Table 18). There are several factors which have moderated the increase in total household food cost for Canadians.

> Increases in crop prices have a minimal effect on food prices at the retail level due to the small share of the food dollar associated with crops such as corn.

a) Composition of Diet

The Canadian diet is diversified which buffers the impact of grain price increases. The diet is also more processed meaning that commodity ingredient costs are a smaller proportion of total food cost. The processing effect can be seen in the CPI of specific bakery products. The CPI for flour and pasta products increased 38% and 23% respectively year over year. Bread increased 17% whereas biscuits (cookies) and breakfast cereals actually decreased by 0.8% and 0.4% respectively despite the increase in the cost of grain ingredients.

An Agriculture and Agri-Food Canada Report estimates that Canadians spent $41.6 billion in grocery stores on food (AAFC, 2008). The immediate price pressure on grains is limited to a relatively small proportion of the total spend in the short run. Prices of dairy and poultry products will likely increase as higher feed and energy costs are reflected in cost of production formulas. Beef and pork prices have been very low over the past year but there are indications the prices will come up over the next 18 months.

> Food inflation is evident for products such as flour where the crop represents a significant input cost.

Table 19. Share of Total Grocery Spend for Selected Products - 2006

Product	Share of Total Spent
Dairy	20.0%
Fresh Meat and Poultry	17.2%
Fresh Produce	14.6%
Frozen Foods	9.6%
Baked Goods	11.5%
Soft Drinks and Bottled Water	4.6%
Snacks	3.4%
Breakfast Foods	2.6%
Baking Needs	1.4%
Dry Pasta	0.5%

Source: Agriculture and Agri-Food Canada

b) Appreciation of Canadian Dollar

The significant appreciation in the Canadian dollar has also moderated the total price for food. Fresh fruits and vegetables imported from the US have gone down in price. The CPI for oranges, for example, decreased by 27%. On the other hand, prices of fruits and vegetables increased by 4.1% in the US over the same period (UD Dept of Labor, 2008). Apples and other fresh fruit which are available from Canada for parts of the year also fell in price but not to the same level as imported produce. This moderating effect on food retail prices from the rise in the Canadian dollar will not continue as no further significant appreciation is expected.

c) Retail Grocery Competition

The CIBC report highlights that retail grocery competition has also moderated food price increases. Wholesale food prices have seen more significant increases than those in retail. Retail chains have been fighting for market share with expanded capacity but this is expected to cool as profits have been poor. As increases in wholesale prices are reflected in retail stores, Canadian consumers can expect to see increases in the cost of food.

The appreciation in the Canadian dollar and competition at the retail grocery level has dampened food inflation. These factors are transitory.

It is clear that some of the factors that have cushioned the increases in food prices will not continue to have that effect. We can expect that Canadian food prices will increase somewhat over the next while. The Canadian dollar has stabilized and may fall back. It is not expected to appreciate further.

The price of supply managed commodities have typically tracked general price inflation but the cost of production formulas will quickly reflect the higher energy, feed and other input prices. Thus, we can expect increases in the price of dairy and poultry products.

The year over year increase in the CPI for gasoline rose by 26% between June 2007 and June 2008. The rise in energy prices will have a ripple effect through the food sector was 8% and there are indications that energy prices will continue to rise. Commodity prices for beef and pork are also expected to improve somewhat which will also likely be reflected in retail prices. Retail grocery competition is also expected to cool and past (and future) increases in wholesale food prices and rising wage bills could be more completely reflected at the retail level.

There are clearly factors such as the composition of the basket of food purchased and degree of processing that suggest that the overall increases in food prices will not be as large as in some developing countries but it is reasonable to expect that Canada will see increases in line with those of other western nations.

Food inflation is expected to increase in the next year due primarily to increases in energy that will increase the cost of most goods.

6. Implications for Ontario Agriculture

6.A. Producer Margins

Producer margins for corn are calculated for 2005 and 2008 in Table 20. The yield was assumed the same for both years (137 bushels/acre) but with average prices of $2.30 for 2005 and $5.00 for 2008. The operating expenses are from OMAFRA's on-line enterprise budgets with updates for fuel and fertilizer from Ken McEwan of Ridgetown College. Land expenses are not included.

Two points are clear from the budget in Table 20. First, net margins have increased considerably due to the doubling of corn prices. Losses were likely in 2005 before land and labour were included while margins above $200 per acre are now possible in 2008. Second, the cost structure has risen in 2008 by approximately 50%.

Fuel and fertilizer price increases have pushed operating costs up by 50%.

One implication from the increasing margin is the likelihood that the returns become capitalized into the fixed asset, which in the case of corn is land. Land rental values have increased significantly in Ontario reflecting the higher returns to crop production. The net result is that the current profits will become captured in land values and the industry is left with the same margin but with a higher cost structure. The same small margin but with higher costs could leave the sector vulnerable to any crop price declines in the future. Those most vulnerable would be those purchasing landing at the elevated prices and then experiencing a collapse in commodity and thus asset prices.

Higher returns become capitalized into asset values so the major beneficiaries in the long run are land owners.

A higher cost structure makes the sector more vulnerable to declines in revenues, particularly for those purchasing land at the higher prices..

Table 20. Enterprise Budget for Corn, 2005 and 2008 ($ per acre)

	2005 [a]	2008
Revenue		
Yield (137 bu) * Price ($2.30 for 2005 and $5.00 for 2008)		
Total Revenue	315.10	685.00
Operating Expenses		
Seed - 30,000 kernels	53.4	61.90
Fertilizer - 28 kg/ac MAP 11-52-0	12.55	31.12
Fertilizer - 32 kg/ac Muriate of Potash 0-0-60	9.35	12.94
Fertilizer - 66 kg/ac N (236 kg/ac of 28-0-0 U.A.N.)	41.45	107.43[b]
Herbicide - annual grass and broadleaf weeds	34.70	38.40
Herbicide - burndown		-
Tractor and Machine Expenses - Fuel (18 L) and lubricant	13.70	24.59 [b]
Tractor and Machine Expenses - Repairs and maintenance	16.60	16.95
Marketing fees ($0.40/tonne)	1.20	1.40
Crop insurance	16.45	14.10
Custom work (fertilizer appl., mixing & delivery)	9.00	9.00
Custom work (pesticide application)	9.00	9.00
Trucking ($7.00/tonne)	18.00	24.35
Drying (17.70/tonne, 8 points)	49.90	61.55
Land rent	??	??
Operator labour (self or hired)	10.85	12.95
Storage ($2.06/tonne/month x 4 months)	21.45	28.70
Interest on operating	8.55	14.70
Total Operating Expenses	333.65	469.08
Net Return	-18.55	215.92

Source: http://www.omafra.gov.on.ca/english/busdev/facts/pub60.htm#grain

[a] 2005 costs from John Molenhuis, OMAFRA.

[b] Fuel and fertilizer costs based on discussions with Ken McEwen of Ridgetown College and are not the values given on the above website.

6.B. Risk Management

Futures and options markets have long provided a way to, directly or indirectly through grain elevators, lock in the price of a crop as it is planted, eliminating the risk that prices will plummet before it is harvested. With these risk management tools, grain elevators could afford to buy crops from farmers in advance, sometimes a year or more before the harvest. However, the futures and options markets provide risk management and price discovery functions only if they expire at a price that roughly matches prices in the cash market. In periods when grain futures are expiring at prices well above the cash-market price, futures markets are less reliable as a hedging tool. Since the futures price is supposed to be a benchmark price discovery tool around the world, such anomalies create uncertainty about which price accurately reflects supply and demand.

The grain market, for whatever reason, has experienced levels of volatility that are well above the average levels over the last quarter-century (Figures 16 and 17) making the derivative markets less predictable and therefore more costly as risk management (hedging) tools for producers, grain elevators, and processors alike. The historical annual average volatilities for corn and wheat were 32.4% and 32.5% for 2007, respectively, which are well above the average since 1980 (Figure 16). Under such circumstances grain farmers or elevators can end up owing more money on their futures hedge than the crops are worth in the cash market. For this reason, the premiums (the costs) for trading options used by grain farmers or grain elevators to hedge against falling prices rise with volatility. Note that premium for other risk management tools such as crop insurance may also rise with the level of volatility.

Because of the rising grain prices volatility and the rising hedging costs (due in part to margin calls and a lack of credit for financing margin calls), some small and midsized elevators have been forced to close. Other grain elevators are coping with the volatility and higher hedging costs by refusing to buy crops in advance from farmers, barring the most common way farmers lock in prices. In response to the changing market conditions, for example, large elevators such as Cargill (AgHorizons) have recently stopped offering contracts to farmers in some areas unless farmers could deliver grain to the elevator within 60 days. With small and midsized elevators disappearing, and big grain elevators refusing to buy crops in advance from farmers because of costly hedging and uncertainty, farmers have to follow and trade in the futures markets themselves an option which may not be feasible.

To this end, the rising grain prices along with the rising grain price volatility and the anomalies between futures and cash prices have far reaching implication for grain farmers' and elevators' ability to hedge against plummeting grain prices using futures and options, forward/basis contracts, minimum price contracts and other price risk management tools. These developments may have important public policy implications and may call for a search for alternative ways of managing commodity price risk in order to protect farmers' net income resulting from potential unfavorable price swings.

Figure 16: Historical Annual Average Price Volatility[4] for Major Grains and Oilseeds (1980–2007)

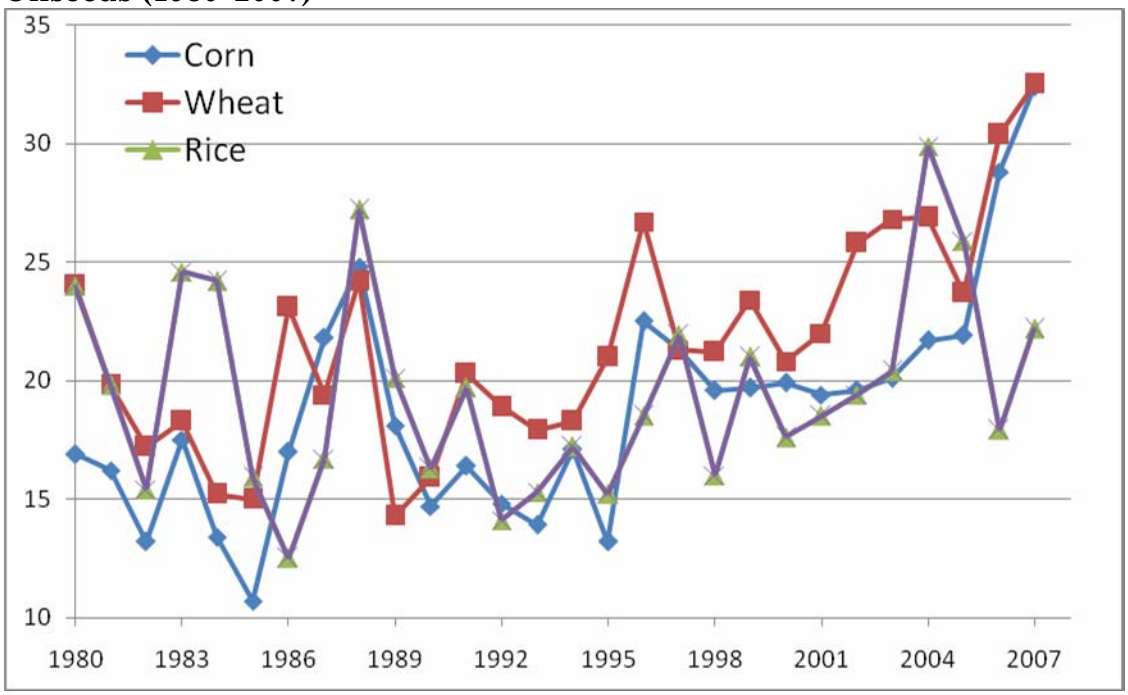
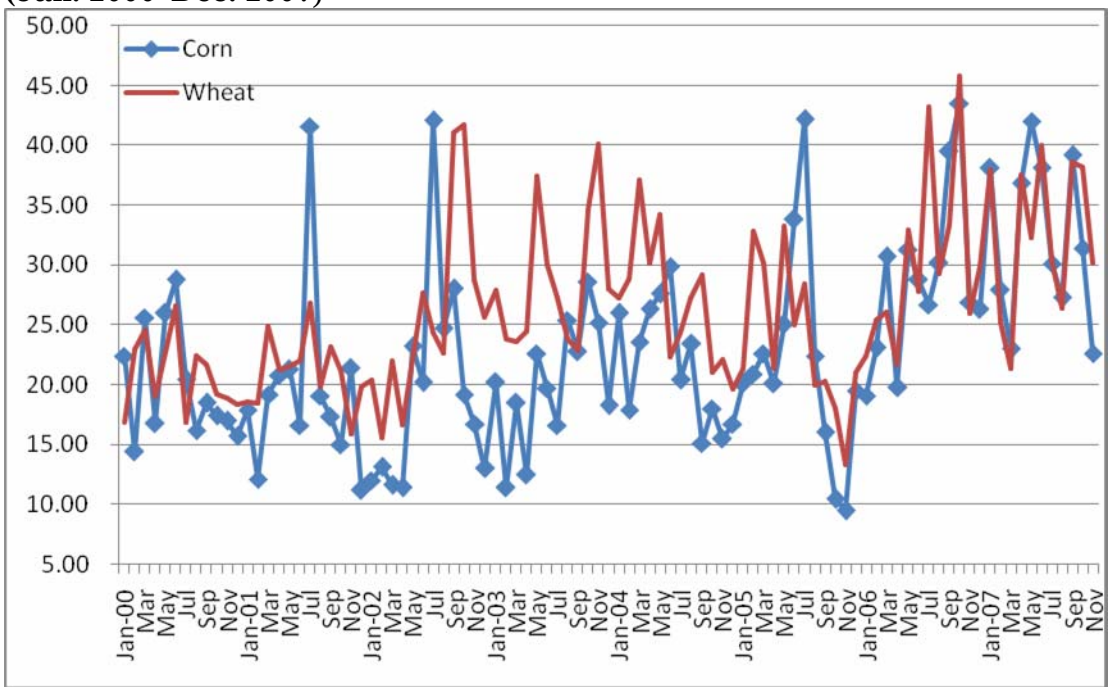


Figure 17: Historical Monthly Average Price Volatility for Corn and Wheat (Jan. 2000–Dec. 2007)



[4] Volatility is measurement of the change in price over a given period. It is often expressed as a percentage and computed as the annualized standard deviation of the percentage change in daily price (CBOT, 2007).

6.C. Lessons from the 1970s and 1980s

While nominal prices are reaching record levels for many crops, real prices are still well below the peaks attained in the early 1970s (see Figures 11-14). Two major crop failures in 1972 and 1974 reduced world grain supplies significantly and a number of countries experiencing shortages entered into the world market, most notably the Soviet Union. World food demand was buoyed further by rising energy prices, which provided enhanced purchasing power for some of the less developed countries.

Expectations of continued high earnings from agriculture were soon capitalized into the price of land and also into the judgment of lending institutions. The projected continual increase in asset prices provided these institutions with adequate security on the majority of loans extended. The increased demand for loans and the competition among the banks led to liberal lending policies based on collateralized values rather than repayment capacity. Debt levels followed the growth in asset values rather than at a rate dictated by the growth in ability to pay from current earnings.

Fortunes for the agricultural sector changed in the early 1980s. Grains and oilseed prices began to fall sharply as export demand growth slackened with a global economic recession and supply reached record levels in response to the high past prices. As the same time, expenses were rising sharply, particularly interest rates. Money supply was restricted in an effort to control inflation and, when combined with a stimulative fiscal policy, record high nominal and real interest rates in late 1982 resulted. Given the debt loads assumed in the 1970s, the resulting higher debt servicing costs in combination with lower revenues had a detrimental effect on farm cash flow. Mortgages, often at variable rates, could not be serviced from the reduced margins. Many farms were forced to declare bankruptcy and the remaining ones experienced a large drop in equity. This time period in the early to mid 1980s was referred to as the Farm Financial Crisis.

There are lessons that can be learned from the boom and bust periods of the 1970s and 1980s that may enhance the ability of the farm sector and government to adjust. Based on a review by Weersink and Turvey (1989) at the end of the Farm Financial Crisis, the following are issues to consider as agriculture enjoys the current boom period.

1. The agricultural sector is inherently volatile. There will always be variations changes in supply due to the biological nature of production and there will be similar shifts in demand as the market place becomes more global.

2. Demand and supply are price inelastic so any shock will have significant price effects potentially for an extended period.

3. Farmers respond to price incentives.

4. There is a danger in assuming aberrant conditions will last. Neither recessionary periods nor exceptional prosperity can continue forever.

5. Agricultural land must maintain its real earning growth in order to maintain its price level. The expectation of growth in the rate of capital appreciation (or depreciation) has a multiplier effect on land value in relation to its rental return.

6. Focusing on cash flow and debt servicing ability rather than asset values and net worth when making financial/lending decisions lowers financial risk.

7. Volatility places more emphasis on means to reduce financial risk such as enterprise choice, diversification, insurance, and leasing.

8. The likely growth in farm land values places more emphasis on alternative institutional arrangements for land occupation and use, and this requires re-defining the family farm to emphasize the management control rather than the ownership through sound tenure arrangements.

9. Alternative financing mechanisms should be developed to reduce risk. Financing tools developed in the last cycle to match variable returns to debt servicing costs including commodity price-based mortgages and shared appreciation mortgages should be re-considered.

10. Short-term government policy to deal with high levels of financial stress will not alleviate the pressures if the fundamental problem is excessive debt.

11. The financial wellbeing of farm families is no longer dictated by the provisions of an individual commodity program but is vulnerable to changes in domestic macro and foreign markets.

6.D. Domestic Policy

6.D.1. Safety Net Impacts

Farm safety nets are designed to both increase average farm income during periods of low returns and reduce the variability in those returns. The surge in grains and oilseed prices impacts both the average and variance in returns for different sectors of Ontario agriculture and thus can impact the design and payouts from income support programs. While a complete analysis of the consequences of recent market developments is beyond the scope of this study, some preliminary observations on potential effects are offered.

As discussed in section 6.A, producer margins are increasing so the long term average on which payouts may be based will also increase. Given the higher moving average, a sharp drop in commodity prices would greatly increase governments budget exposure to the sector. If the safety net program is margin-based, then the potential for exposure is greater given the increase in input costs and the small probability of a sharp drop in crop prices. Budget exposure in margin based programs will increase even more rapidly in cost-of-production based schemes.

Higher average margin increase the long-term average on which future payouts from stabilization programs are based.

Farm income variability affects the economic well-being of farmers because it can threaten the viability of the farm business and can hamper the farm household's ability to service debt, maintain consumption and build reserves for future needs. While producers can hedge on futures markets, or make forward contracts to manage variable prices, the cost and availability of derivative strategies are becoming of increasing concern when markets are very volatile as discussed in section 6.B. The importance of public mechanisms to absorb some of the market risk increases during such volatility but also means the cost to the government will also increase.

Increasing volatility in the market increases the need for stabilization programs but also the budget exposure to the government funding the program.

The discussion on safety nets thus far has been focused on the grains and oilseed sectors which have enjoyed the upturn in their output prices. In contrast, the higher crop prices have meant higher feed costs for livestock farmers, who are suffering through low red meat prices. The financial pressures on margins for all beef and hog farmers have been compounded in Ontario by the appreciating Canadian dollar and the lack of slaughter capacity. Safety need issues in the short term are focused on the livestock sector rather than the grains and oilseeds sector. The long term viability of the livestock sector, with or without safety nets is a policy implication that deserves further study.

Safety nets in the near term will be focused toward the red meat sector which is facing low output price and rising feed costs. The sustainability of the sector is threatened by an appreciating Canadian dollar and shrinking slaughter capacity..

6.D.2. Biofuel Policy

A consequence of the media attention surrounding the food crisis is the desire to find the underlying cause of the problem and associated solutions. An easy target is biofuel policy. As described in Section 3.3, biofuels has taken a significant amount of feedstock out of the food production system and shifted it to the making of ethanol and biodiesel. Rather than being the panacea that would provide solutions for problems ranging from low farm income to terrorist threats, biofuels are now cast in some quarters as a pariah behind resource degradation and malnutrition. Biofuels are struggling for public support in the food versus fuel debate.

Public support for biofuel initiatives are likely to continue to falter. The dramatic rise in crop prices reduces the pressures to increase farm income levels through local demand shifts. National security interest is the primary reason for continued public support for biofuels in the US. This is not an issue in Canada since we are an oil exporter rather than importer and not subject to the same pressures as the US. Given the mixed evidence on the environmental benefits of renewable fuels, public pressures will continue if crop prices remain high.

There are other reasons, however, for bioproduct development within Ontario. One is the "learning by doing" associated with getting involved in the technology early. In the future, cellulosic technology will replace the starch-based means of producing ethanol. Using the whole plant rather than just the grain will increase the efficiency of the process and consequently use less land, and less productive land. The impacts on the food system from biofuels will be further reduced as the feedstock shifts from food crops, such as corn, to non-traditional crops, such as switch grass and jatropha, which can be grown on marginal land. Being involved with first-generation technology will aid in the transition to the second-generation cellulosic technology.

A second reason surrounds specialized bioproducts that rely on Ontario-crops rather than biofuels relying on homogeneous feedstocks. The government support for the biofuels, particularly in the US, has helped push up grain and oilseed prices by up to one-third (see section 3.C). This would have occurred regardless of any Canadian efforts. Local basis can be aided by the amount of transportation costs if bioproduct use increases Ontario demand past local supply so that Ontario becomes an importer of grains and oilseeds. However, the primary means by which a premium could be garnered for crop farmers are if bioproducts are developed that require crops with specialized attributes. The identity preservation system in Ontario provides local farmers with a comparative advantage in supplying bioprocessor with crops of the desired quality. Bioproducts policy focused on these niche opportunities could provide premiums for local farmers and upstream economic opportunities.

6.E. Policy Response and International Institutions

For the past 50 years agriculture in the developed world could be described by the following stylized facts: 1) the declining real price of agricultural output; 2) the movement of labour out of primary agriculture; and 3) low measured returns to resources employed in agriculture. As a result, almost all developed countries provide considerable support and protection to the agricultural sector to correct for perceived market failures and to transfer income to a sector that appears to be chronically plagued by low returns. The result of these market trends and policy responses has given us a 21st Century agriculture, in the developed world, that is highly capital and energy dependent. It has also given us an agricultural sector that has grown dependent on the transfer of funds from taxpayers and consumers to underpin farm incomes and asset values. For a brief period in the mid-1970's the world faced rapidly rising primary commodity prices that exacerbated inflation and briefly changed the policy debate from "farm" to "food" policy. We appear to have entered another such period although opinions are mixed as to whether we have moved to higher plateau, or whether it is a temporary spike in prices similar to the one in the 1970's.

The policy situation for agriculture in the developing world differs greatly from that in the developed world. First, while consumers in the developed world spend 10-15 percent of their incomes on food it is not uncommon for food expenditures to reach 50 percent in the developing world. Second, primary agriculture in the developing world remains labour intensive. Third, most developing countries have to cope with a large fraction of their population that can be characterized as the "urban poor". As a result, agricultural policy in developing countries has often involved explicit or implicit taxes on primary agriculture with the revenue being used to fund food subsidies for the urban poor.[5]

While it is impossible to summarize world agricultural policy in two paragraphs and the reader can no doubt think of exceptions the descriptions given above are useful in understanding the way international institutions have evolved and their role in the current food crisis.

6.E.1. The Role of the WTO

Beginning in 1947 the developed world began on a long but steady process towards multilateral trade liberalization under the auspices of the General Agreement on Tariffs and Trade (GATT). To a large extent agriculture was excluded from the liberalization process until the Uruguay Round of trade negotiations that began in 1986. The Uruguay Round of trade negotiations differed from previous Rounds by placing agricultural trade liberalization at the top of the negotiating agenda. Rich countries wanted an international agreement to improve market access and to put limits on export and domestic subsidies. For the most part developing countries shared in these goals although there was some concern for the least developed food

[5] Not all policy interventions will generate revenue, e.g. an export ban.

deficit countries that might face higher import prices as a result of the agreement. After eight years of difficult negotiations the UR was brought to a close with an Agreement on Agriculture (AoA) that put limits on domestic and export subsidies, provided some additional market access but more importantly put in place a framework for future trade liberalization. The Uruguay Round also resulted in the creation of the World Trade Organization (WTO) and the first round of trade negotiations under the WTO was launched in 2001 (Doha Development Agenda (DDA)). Again, agriculture figured prominently in the negotiations with developing countries feeling the disciplines on rich country agricultural policies introduced in the AoA had done little to open markets for developing country agricultural exports. Developing countries were looking for considerably larger concessions from the developed world during the DDA. The "pillars" (or major targets) of the agricultural negotiations contained in the AoA were maintained in the DDA; namely, 1) export competition; 2) domestic support; and 3) market access.

Why is all this ancient history important? It is important because the WTO sets the rules for trade among countries. As the rule setting body it would seem reasonable to expect the WTO to specify how nations are allowed to react during a "food crisis". As will be discussed below the WTO does have rules governing what members must do when they impose trade restrictions in response to higher world market prices but these rules are very weak and impose few constraints on what a member is allowed to do. This outcome could only result from two possible conditions: 1) member nations could not agree upon appropriate rules; or 2) most members did not think it was important to have any rules. Given 50 years of declining farm prices we suspect that not many members considered rules to govern trade during high price periods to be an important item on the negotiating agenda.

Before turning to a discussion of the "rules" it is useful to document the policy instruments we are talking about and what their role has been in the current market situation.

The typical trade and domestic policy instruments such as tariffs, export subsidies, market price supports, and deficiency payments have the effect of: 1) lowering world market prices; 2) raising prices for protected producers and lowering them for foreign farmers; and 3) making domestic prices more stable and world market prices less stable.

When world prices increase it is a signal that producers should produce more and consumers should restrict consumption. For the most part the policy instruments mentioned above are not a problem in this "high price" environment because domestic counter-cyclical price/margin support policies will typically "disengage" as prices go up, or in the case of a tariff amplify the price increase.

In a high price environment it is a different set of policy responses that are problematic. Perhaps the most extreme policy response is an export ban. Export bans on rice by several major rice exporters resulted in world rice prices increasing more than they would have in the absence of the bans. In addition, the announcement of an export ban by a significant exporter is a signal of a food shortage and can result in panic buying and hoarding both in the home country and

abroad, making a bad situation even worse. Why would a traditional exporter ban exports? Generally, it is to make the commodity available to the urban poor at a lower price and to save tax dollars where consumption of the commodity is subsidized. Unfortunately, it sends a negative signal to producers in the home country and can result in smuggling from a country where exports are restricted to one where they are not. Export restrictions are partial bans and have the same market effects as a ban but the negative effects are somewhat muted.

Export taxes can also be used to restrict exports and from a taxpayer's perspective have the advantage of raising revenue. Many developing countries use export taxes to provide "effective protection" to their domestic processing industries. Brazil has imposed an export tax on soybeans for years to encourage the processing of soybeans in Brazil, and the export of oil and meal rather than beans. Still, when export taxes are raised to 65 percent as Brazil did on soybeans it has much the same effect as an export ban.

Another policy response often used by developing countries in a high price environment is to lower applied tariffs.[6] In most situations the unilateral lowering of an applied tariff would be applauded. Unfortunately, when it is done when world prices are high it results in more consumption and less production in the home country, causing world prices to increase even more. Perhaps this would be a small price to pay if the applied tariff remained at the new lower rate, but WTO rules allow the importer to raise its applied tariff when prices moderate – again sending exactly the wrong market signal when world prices decline. Again an importer can use changes in its applied tariff to mute world price signals.

The FAO conducted a survey of 77 developing countries and discovered that about 50 percent had reduced tariffs in response to higher food prices, 55 percent used price controls or consumer subsidies to reduce they transmission of world prices to domestic consumers and 25 percent imposed some type of export restriction. Only 16 percent of the countries took no policy action. On average only about one-third of world price changes have been allowed to pass-through to domestic producers and consumers.

6.E.2. WTO Rules on Export Prohibitions and Restrictions

What are the current WTO rules governing a countries response to higher world market prices? This turns out to be a fairly complicated question. The starting point is Article XX (part (i) and (j)) of GATT 1994 *General Exceptions*[7] which states that as long as the measures concerned do not result in "arbitrary or unjustifiable discrimination among countries, or a disguised restriction on trade" countries are allowed to restrict exports. In addition, Article XI (part 2(a)) of GATT 1994 *General*

[6] The level of bound tariffs is what is negotiated in the WTO but many developing countries apply tariffs well below the bound rate. Countries are allowed to adjust their tariffs as long as they do not exceed their bound level.
[7] Although Article XX is now a part of GATT 1994 it is the original Article XX.

Elimination of Quantitative Restrictions[8] allows export restrictions in the case of food shortages. The URA added some weak reporting requirements but even these did not apply to developing countries.

There is an opportunity to strengthen the rules on export restrictions during the DDA. In fact, in Canada's initial negotiating position on agriculture announced in August 1999 indicated that it would seek agreement on rules to effectively discipline export taxes and export restrictions on agricultural products. Canada argued it would seek "a ban on the inclusion of food aid and feedstuffs in national security trade embargoes; and a ban on export restrictions that would reduce the proportion of the total supply of an agricultural product permitted to be exported compared to the proportion prevailing in a previous representative period." Still in a WTO background document prepared in early 2001 it was noted that only five countries had explicitly mentioned export restrictions in their negotiating proposals.

Chairman Falconer's *Revised Draft Modalities for Agriculture* tabled on 19 May 2008 (Version III was tabled July 10) represents the outcome of nearly seven years of negotiating activity during the Doha Round and what most observers feel is close to the final negotiated text. Section V (c) deals with *Export Prohibitions and Restrictions*. The new rules would augment Article 12 of the URA by adding provisions that would require Members to[9]:

- Eliminate any existing prohibitions and restrictions in foodstuffs and feeds under Article XI.2 (a) of GATT 1994 by the end of the first year of the implementation period.
- Any new prohibitions and restrictions under Article XI.2 (a) should not normally last more than 12 months.
- Members should notify the Committee of Agriculture within 90 days of the measures coming into force, and the Member should provide the reasons for introducing and maintaining the measures.

Essentially, the notification requirements contained in the AoA would be strengthened and the restrictions time limited but the use of export prohibitions and restrictions would remain largely unconstrained.

Why should this matter to Canada? Canada is one of the most trade dependent countries in the world. As such, it is in our best interest to have food importers turn to the international market to meet their food security needs rather than pursuing import substitution policies. Nothing destroys an importers faith in the international marketplace more than an exporter who slams the sales door shut during periods of tight supplies. The developed countries of the world should pledge not to use export prohibitions, restrictions, embargoes or export taxes on food.

How to deal with export prohibitions and restrictions from the perspective of a developing country is more difficult. It is useful to break the discussion into

[8] Although Article XI is now a part of GATT 1994 it is the original Article XI.
[9] The author's have paraphrased the exact text.

developing country food exporters and developing country food importers. For a developing country food exporter high commodity prices hurt the urban poor however from a macroeconomic perspective the terms of trade are likely to in the exporters favor and the government might be able to afford the higher cost of short-run food subsidies for the urban poor. The situation for the developing country net food importer is considerably more desperate because not only do they face the cost of feeding the urban poor but also declining terms of trade. In an environment of rapidly rising food prices and declining terms of trade; printing money is often the only policy option, followed by inflation, political unrest and self-sufficiency policies.

The WTO needs to develop export restriction policies that would apply to developing countries that would discourage "beggar-thy-neighbor" policies, most likely by binding and reducing export taxes and through some sort of "sharing" agreement.

The negotiations in the DDA have also resulted in a new set of rules that would apply to food aid. The primary purpose of the new rules is to discourage countries from using food aid as a disguised export subsidy – supplying large quantities of food aid during periods of low international prices and restricting the supply of food aid when prices are high. There is also agreement that Members should move towards providing untied cash-based food aid and food should be purchased from local sources whenever possible.

When high prices or natural calamities result in starvation and political unrest in the developing world emergency food aid is the best short run response. However, over a longer time frame it is important to have in place international rules that allow the market to function to help alleviate food shortages rather than making them worse. Given Canada's trading position we have a huge stake in getting these rules right. Although them future of the Doha Round is unclear there is still time to make a start on developing better rules for export prohibitions, restrictions and export taxes that would serve the world better in times of shortage.

7. Summary of Key Findings

- Production is at near record levels for most crops, but the rate of yield increase has slowed over time.

- With productivity growth faltering and demand robust, the 2008/09 expected stock to use ratio of 12.6% will be the lowest since 1973.

- The decline in agricultural investment is viewed as a major reason for the plateau in supply, and the extent of future supply increases may be further constrained by the volatility in the market and rising input costs. [While the public investment/support has been replaced by private companies for some crops in western agriculture, it has not in the developing world.]

- Low stock levels make prices during the growing seasons particularly sensitive to weather conditions as noted by the jump in corn prices during June from the wet conditions in US Midwest and their fall in July due to favourable conditions.

- Supply cannot respond immediately to the price increase due to the annual nature of crop production; supply increases will also be constrained by rising input prices and market volatility.

- Income growth in China and India has been 3 times the global average over the last decade. Per capita meat consumption in China has increased by 2.5 times over the last 20 years but is still one-third of Canadian consumption levels. The increases in the income of developing economies such as China and India are a reason for the increase in the prices of most major commodities, not just crops.

- The depreciation of the US dollar has further enhanced the buying power of China and India since commodities are priced on the US dollar.

- Global ethanol production has tripled in the last several years. Projections are for another 4-fold increase in the next 15 years. Approximately one-third of the increase in corn prices is attributable to ethanol demand. Canadian ethanol policy has minimal impact on crop prices since the price is set on the world market.

- Corn is now linked to energy prices but the reverse is not true. Increases in crude oil increase the demand (and price) for substitutes such as renewable fuels, and subsequently increase the demand (and price) for feedstocks. A crude oil price of $120 per barrel will support a corn price of $4 without government incentives/mandates.

- The volume of contracts traded on the Chicago Board of Trade mirrors the increase in price for grains and oilseeds but correlation does not imply causality. Speculative activity by investors and export restrictions by some governments have accentuated the peaks in price but do not create a permanent shift upwards.

- The permanence of the price increase depends upon which causal factors dominate:
  a) Weather-related supply shocks, exchange rate changes, speculator investment levels are transitory factors that create a blip in price or
  b) Income growth, biofuel consumption and slowing supply growth are structural changes that would imply a more permanent price increase.

- Since the demand increases from biofuels and growing economies are not temporary, the gap between demand and supply will not narrow considerably and global stock levels will continue to be tight. Thus, crop prices are projected by the OECD, FAO and other organizations to stabilize over the next year at levels higher than before the price climb but lower than current peaks.

- In poor countries, since a large portion of the budget is spent on food, increases in food prices can severely impact the well-being of the household – severe enough to cause rioting.

- In Canada, increases in crop prices have a minimal effect on food prices at the retail level due to the small share of the food dollar associated with the basic commodity components of crops such as corn. The farmer share of the food dollar is now around 20% on average and is approximately half of what was in the 1950s. The decline represents the additional services required to transform the raw agricultural commodities into the food products desired by consumers. Thus, a doubling of all agricultural prices would lead to a 20% increase in food prices. The relative impact of such a food inflation rate is less than in developing countries since Canadians spend about one-tenth of their disposable income on food.

- The appreciation in the Canadian dollar and competition at the retail grocery level has dampened food inflation – but these factors are transitory. Food prices are likely to increase in the future but more due to rising energy and labour costs than rising crop prices.

- The rising grain prices along with the rising grain price volatility and the anomalies between futures and cash prices have far reaching implication for grain farmers' and elevators' ability to hedge using futures and options, forward/basis contracts, minimum price contracts and other price risk management tools. These developments may have important public policy implications and may call for a search for alternative ways of managing commodity price risk in order to protect farmers and processors.

- Biofuel policy will continue to come under public pressure while crop prices remain high. While Canada cannot justify support for the primary reason justifying the US incentive system for biofuels (national security interests), it may be justified by "learning-by-doing" as second-generation cellulosic technology is near. Of more importance is distinguishing between biofuel and bioproduct policy. The latter can take advantage of Ontario's identity

preservations system for crops if new bioproduct technology requires crops with specific quality attributes that can be delivered by Ontario farmers under their IP system.

- The potential pressures on farm safety net programs needs further analysis. Increasing average margins and greater volatility suggest budgetary outlays may increase.

- Another issue requiring further analysis is the impact of higher crop prices on the livestock sector, other crop sectors, and the processing sector of Ontario agriculture. Higher feed prices in the midst of low output prices faced by the Ontario red meat sector are compounded by an appreciating Canadian dollar and shrinking local slaughter capacity.

- The WTO needs to develop and implement rules to eliminate the use of export embargos, prohibitions and export taxes by developed countries to curtail their use in developing countries.

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