Farm Foundation®

Issue Report

What's Driving Food Prices in 2011?

July 2011

Preface

Three years ago Farm Foundation, NFP asked Purdue University economists Wallace Tyner, Philip Abbot and Christopher Hurt to review the literature and provide a comprehensive assessment of the major factors driving commodity and food prices. Our objective was to cool the heated rhetoric in the food-versus-fuel debate, which had been rising right along with the prices of corn and oil.

Today, although the rhetoric seems to be lower, prices of oil and commodities, including corn, soybeans and wheat, have again approached the levels of 2008. In addition, policy makers today are focused on a national debate over fiscal policy—a debate that encompasses the future direction of food, agricultural and energy policies. Farm Foundation commissioned the current paper to provide a comprehensive, objective assessment of the forces driving commodity and food prices. A major question was whether the forces at work today are the same as or different from those of 2008. Our goal is to provide public and private decision makers with an objective assessment of the forces driving commodity prices, as well as offer some insights into the impacts on policy options.

Now, as in 2008, the full story behind rapid increases in commodity prices is not a simple one. Many of the factors driving prices remain the same but play out in different ways—including biofuel demands, exchange rates and weather. As concluded in 2008, one simple fact stands out: economic growth and rising human aspirations are putting ever greater pressure on the global resource base. As with the earlier work, this report does not attempt to attribute the proportion of the price increases among the different drivers. Rather the focus is on understanding the nature and interactions of the respective factors.

In an environment of higher and more volatile commodity and food prices, as well as budget constraints, policy makers and society are faced with difficult choices about fundamental elements of food, agricultural and energy policies. We hope that the information provided in this report will strengthen the ability of all stakeholders to address some of the most critical public policy issues facing the world today.

Neilson Conklin

President

Farm Foundation, NFP

What's Driving Food Prices in 2011?

Philip C. Abbott

Christopher Hurt

Wallace E. Tyner

We authors are agricultural economists on the faculty at Purdue University. Abbott works in international trade and macro factors. Hurt works in analysis of commodity markets. Tyner is an energy and policy economist most recently specializing in biofuels policies. We each brought a unique perspective to the table, and have learned from each other through many long conversations on the food price topic. We believe the final product reflects the insights gained through working as a multi-specialist team.

This paper was prepared by the authors for Farm Foundation, NFP. We are indebted to Mary Thompson for many useful editing suggestions. Helpful comments from Neil Conklin, Vern Eidman, Derek Headey and Peter Timmer are greatly appreciated. The authors are solely responsible for the content of this paper.

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Executive Summary

Agricultural and other commodity prices have increased again in 2011. Is this a rerun of the 2008 price spikes, or are the underlying drivers and mechanisms different this time around? Answering this question has been the fundamental objective of this paper.

We have identified five key issues that are important elements of the agricultural commodity price story:

- *Two big, persistent demand shocks.* Biofuels demands, particularly for corn, and Chinese soybean imports have increased in recent years and remain at high levels. Both the size and persistence of these shocks affect market outcomes.
- *Greater market inelasticity.* More inelastic agricultural markets mean prices are both higher in response to demand shocks and are now more volatile. Combined effects of different components leading to greater inelasticity have a bigger impact than each component would separately.
- *Weather and stocks.* Poor harvests due to weather are more important in 2011 than in 2008. Price increases are now more consistent with low stocks-to-use ratios.
- *Chinese policy.* Chinese trade and stocks policies, which vary across commodities, are critical factors conditioning the impact of income growth and dietary transition on world market outcomes. It is necessary to understand Chinese self-sufficiency to interpret world supply-utilization and stocks data. Being nearly self-sufficient in grains, the Chinese are largely disconnected from those world markets. That is not the case in soybeans, since the Chinese import most of their soybean requirements.
- *Macroeconomic factors.* While changes are not so dramatic in 2011, the dollar exchange rate remains weak and volatile. The exchange rate is also correlated with other macroeconomic factors—including worldwide economic growth—that influence the expected high level of agricultural commodity prices even if there are not production shortfalls.

Key lessons behind current commodity market events cut across these five issues. While we used these five issues to organize analysis in the paper, we highlight those key lessons here:

- Biofuels policy has brought about a large, persistent and non-price responsive demand for corn. The combination of mandates and blending limitations—the blend wall—set by the U.S. Environmental Protection Agency (EPA) regulations determine the corn demand for ethanol, regardless of the corn price. It took 27% of the 2010-11 corn crop to meet the demand for corn to produce ethanol, compared to 10% of the 2005-2006 crop. (Both numbers are adjusted for by-products used as feed.) Ethanol from corn has nearly reached the maximum mandated level, so while this demand will persist, it should not continue to expand.
- Income growth and dietary improvement have driven rapid growth in Chinese soybean imports, but stocks-building contributed to the surge in imports in the last three years. Stocks-building accounted for nearly 40% of the increase in Chinese soybean imports since 2008. China went from holding a very small stock of soybeans to an expected 23% stocks-to-use ratio in 2011. Given that level of stocks, it is expected that future import and demand increases will follow income growth, as they did prior to 2008.
- Land adjustments highlight why the two demand shocks are important, and why those shocks have spilled over to other commodities. Globally, the flexibility to expand area for high demand crops was composed of about 70% new area, and 30% displacing alternative crops. In the United States, where land area has been fairly stable, the new demands caused land to be reallocated away from other crops. The simplest way to express these demand drivers is to measure the change in acreage required to satisfy biofuels production and U.S. exports of soybeans to China. In 2005, 16.1 million acres were required to satisfy these two demands in the United States. In 2010, it took 46.5 million acres—an increase of 189%—to satisfy these two demands, or 29% of total U.S. corn and soybean harvested acreage. This shift contributed to lower production and much higher prices for commodities, such as cotton, that did not experience price spikes in 2008. Higher prices for other commodities now mean less opportunity for land reallocation.
- These events have played out in very inelastic markets due not only to biofuels polices and land reallocation

constraints, but to trade policy worldwide, persistent feed demand and tight stocks in some markets. Low stocks are an important factor contributing to greater inelasticity and signaling higher prices. Since 2008, higher feed prices have caused livestock producers and market prices for all livestock products—meat, dairy, eggs—to adjust, making them better able to weather current feed price increases. That means fewer livestock production capacity adjustments would be expected now and, therefore, more inelastic demand for animal feed components, such as corn and soybeans. As world prices increased in 2007 and 2008, countries altered trade policies to isolate and partially stabilize their domestic markets from the effects of high prices. While some of the extreme trade policy measures taken in 2007-08 have not yet been repeated in the current agricultural price run-up, international agricultural markets remain thin and volatile.

- Weather is more important this time, however, the big weather shocks in wheat and barley have been buffered by large stocks and past supply increases. Corn stocks were drawn down when U.S. yields dropped in 2010. Soybean stocks have remained tight as Chinese demand has surged. Rice stocks are adequate, so rice prices have not increased.
- Price differences across commodities suggest market fundamentals are critical to today's high prices. Rice and wheat prices are not near 2008 peaks, while corn and soybeans are.

Implications for the future

Much is riding on 2011-12 corn and soybean production. A return to normal yields barely allows the world to continue to meet trend consumption. In the absence of yields well above trend, it appears the tight world stocks situation for corn and soybeans cannot be overcome in one crop year. High prices will exist for two crop years or longer and then moderate to levels lower than 2011 peaks but higher than historic norms.

Are we in another boom/bust cycle? Historically, low stocks due to short periods of demand surge or production shortfalls have sharply increased prices, leading to a supply response that brings more land into cultivation. If, after several years, the demand surge does not persist and supply is permanently increased, there are long periods of low prices and narrow farmer margins.

This time, however, the demand surges from biofuels and Chinese soybean purchases appear to be persistent. While the demand shifts to date are expected to persist, the rate of increase in demand growth is expected to slow as corn biofuels mandates are reached and as China has built adequate soybeans stocks levels. This slowing of the demand surges may give world supply a better opportunity to catch up in coming years. Other events—such as additional demand growth, the degree of supply response, and macroeconomic variables—will all be important in determining how this cycle plays out.

Policy Issues

Biofuels: The United States currently uses both subsidies and mandates to encourage biofuels production, though the Renewable Fuels Standard (RFS) mandate is currently more important than the subsidy. One policy question: What happens if subsidies are reduced or eliminated or the mandate is changed? Under the most likely circumstances, changing either policy would have little near-term impact. Since most of the subsidy today is split between the blender and the consumer—not the producer—reducing the subsidy would have little impact on corn demand under most circumstances. Reducing the RFS would not have much impact as long as oil prices remain high because the production capacity already exists. The blend wall now constrains the impact of high oil prices on corn. Relaxing blending restrictions could lead to increases in biofuels demand for corn. If oil prices were lower, the impacts of subsidy and RFS changes would be significant.

U.S. Agricultural Policy: U.S. agricultural policy has primarily been a "policy of abundance," designed to reduce supply, restrict land use and increase demand to help increase and stabilize farm incomes. That policy developed because the United States has generally been blessed with the ability to produce more than could be consumed at profitable prices for producers. A shift to a "policy of shortage" would emphasize programs that stimulate supply and do not subsidize demand with taxpayer funds or political mandates.

Trade Policy: For trade liberalization to contribute to more stable world markets, large traders and large, self-sufficient producing countries need to follow more liberal, open trade regimes. Importers, as well as exporters, need to participate in that liberalization.

Introduction

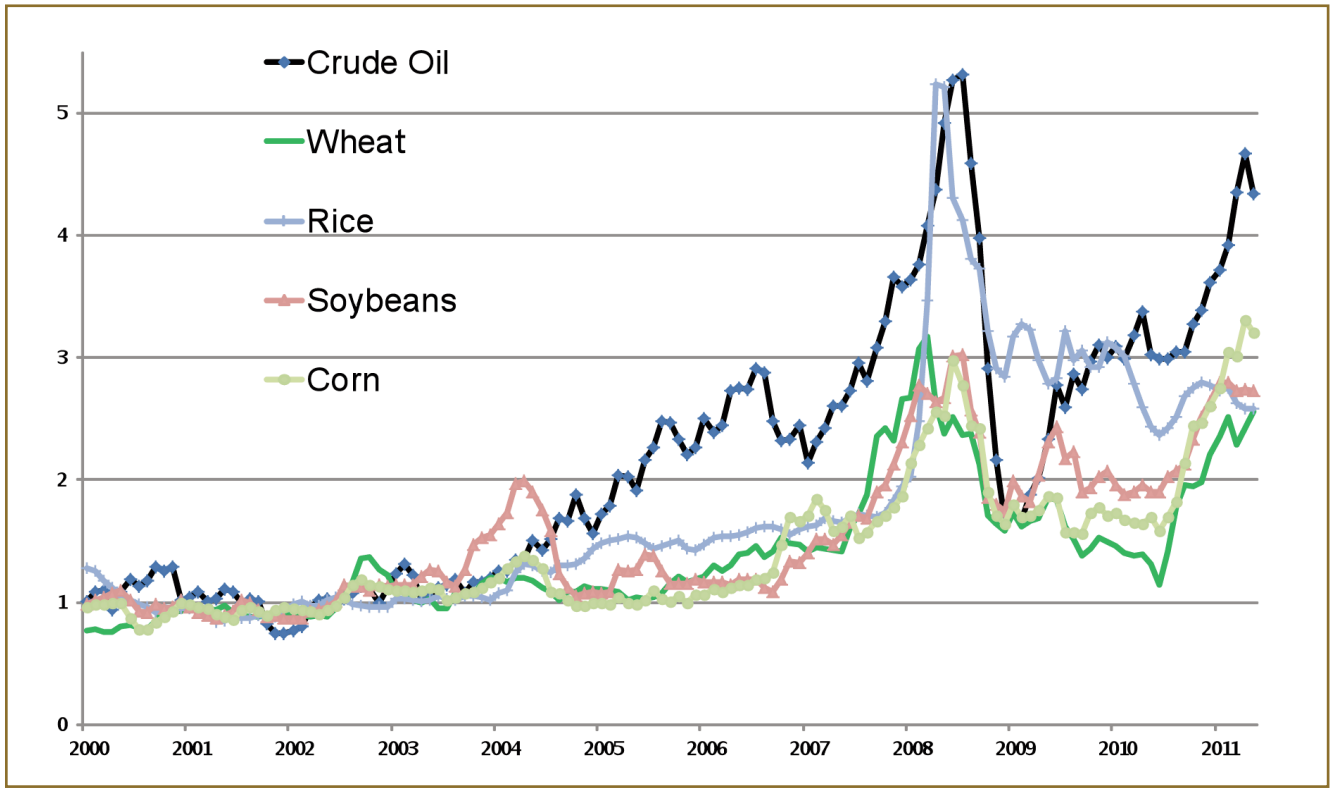
International agricultural prices have risen once again, with some commodity prices equal to or exceeding peaks seen in 2008. Figure 1, which shows monthly price indices from 2000 until May 2011, illustrates the recent evolution of prices and offers comparisons to the 2006-2008 food crisis period. It shows that corn prices have returned to the peak levels of June 2008. Soybeans have nearly returned to the 2008 peak, while wheat and rice prices are at about 65% of peak levels with somewhat different trajectories. Rice exhibited the most dramatic price spike in 2008. The price of rice fell but to levels still higher than in the 2000-2005 period, and is now slightly lower. Wheat prices fell dramatically after 2008, and have risen sharply in recent months.

Attention is focused on international commodity prices more broadly now because some agricultural commodity prices, notably sugar and cotton, have increased well beyond 2008 levels. One consequence is that summary indices, such as the IMF Food index shown in Figure 2, and similar indices reported by the FAO and World Bank, have reached levels achieved in mid-2008. In that earlier food price run-up, U.S. pork prices lagged increases in feed costs. Today, U.S. pork prices are running ahead of feed price increases. Relative changes in pork and beef prices remain smaller than changes in feed grain and oilseed prices.

While the dynamics of 2011 commodity prices are different from the 2006-2008 period, similar factors are partially responsible for the current price increases. In fact, the current increases may be a continuation of some of the events and circumstances that contributed to the earlier price increases. It is useful to first review the various factors driving the 2008 food price spikes, including those that remain controversial. Those factors are:

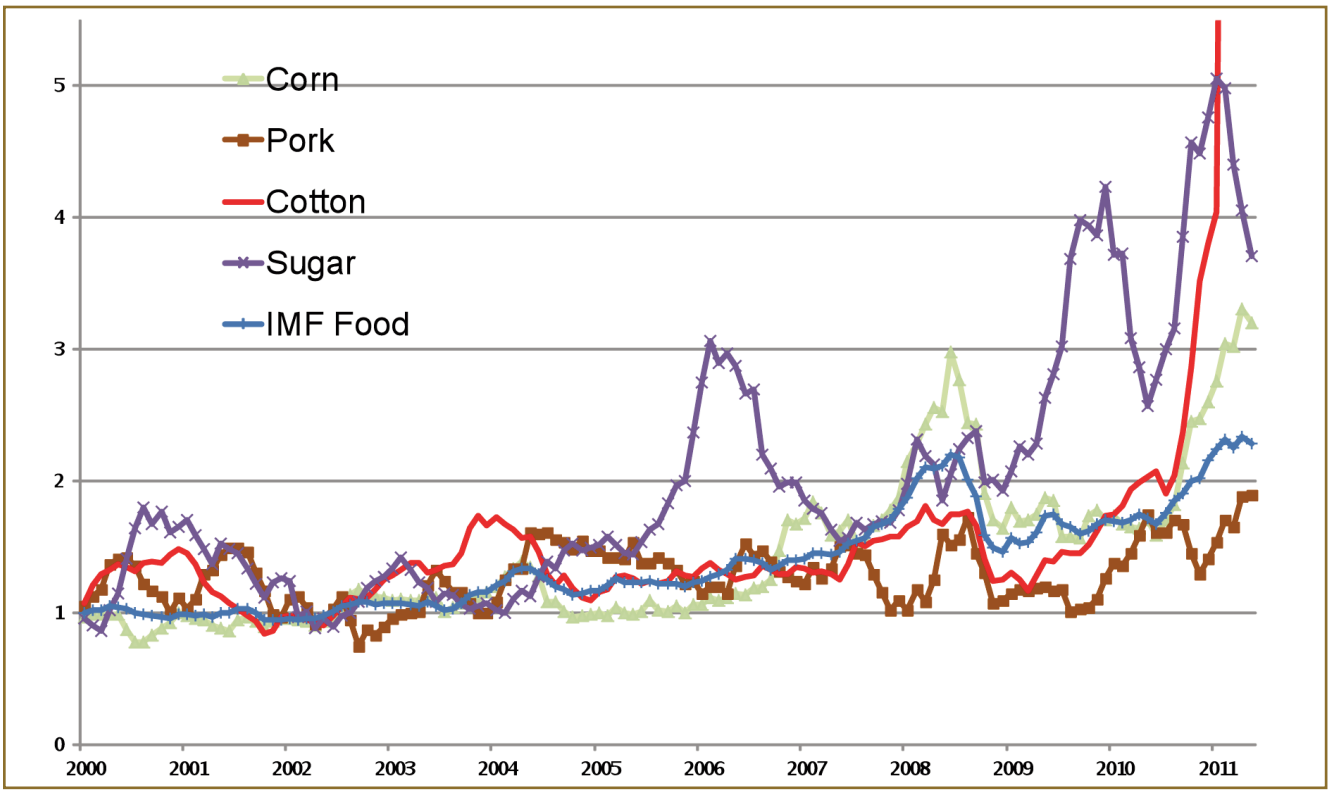
- Supply-utilization shocks—weather, production shortfalls, low stocks;
- Third-world income and population growth and resulting dietary transitions;
- Long-run production trends and declining investments in agricultural research;
- Biofuels and the link between corn and crude oil;
- Export restrictions and trade policy responses;
- Exchange rates and macroeconomic factors; and
- Financialization of commodities and speculation.

Figure 1: Monthly Agricultural Commodity Prices, 2000-2011



Note: Monthly commodity prices are expressed as an index equal to 1 on average in 2002.
Source: IMF, 2011

Figure 2: Monthly Food and Commodity Prices Indices, 2000-2011



Note: Monthly commodity prices are expressed as an index equal to 1 on average in 2002.
Source: IMF, 2011

Trostle (2008) explained in some detail the various possible causes of high agricultural prices and provides a timeline over which these factors matter. Headey and Fan (2010) reviewed the extensive literature exploring these explanations and the extent to which disagreement still persists.

While weather events, such as drought in Russia, are more important today than in 2008, accumulated stocks have buffered the effects on world wheat prices. Due to adequate supplies, rice prices are, in fact, below levels realized after the 2008 spike collapsed. Corn and soybeans are most strongly affected in the current price run-up. That commodity-specific stories differ suggests market fundamentals—not common macroeconomic factors—dominate this time. The two major drivers in 2011 are big, persistent demand shocks due to biofuels policies and demand and Chinese soybean imports. Occurring at the same time, these drivers have shifted the demand for basic agricultural products, had a major impact on supply and demand balances, and are causing major land adjustments. In the process, global land use has changed significantly. Market events play out in an economic environment that leads to more volatile prices as a result of several additional factors, including trade policy and macroeconomics. Our understanding of the drivers of world agricultural prices focuses on five issues: the persistent demand shocks, inelasticity in world markets, weather and stocks, Chinese policy, and macroeconomic factors. The following section examines each of those issues, as well as the short- and long-run consequences of high agricultural prices and implications for the future, including an assessment of whether the two key drivers will continue to be so important. Key policy debates that may affect agriculture and food security in the future are also considered.

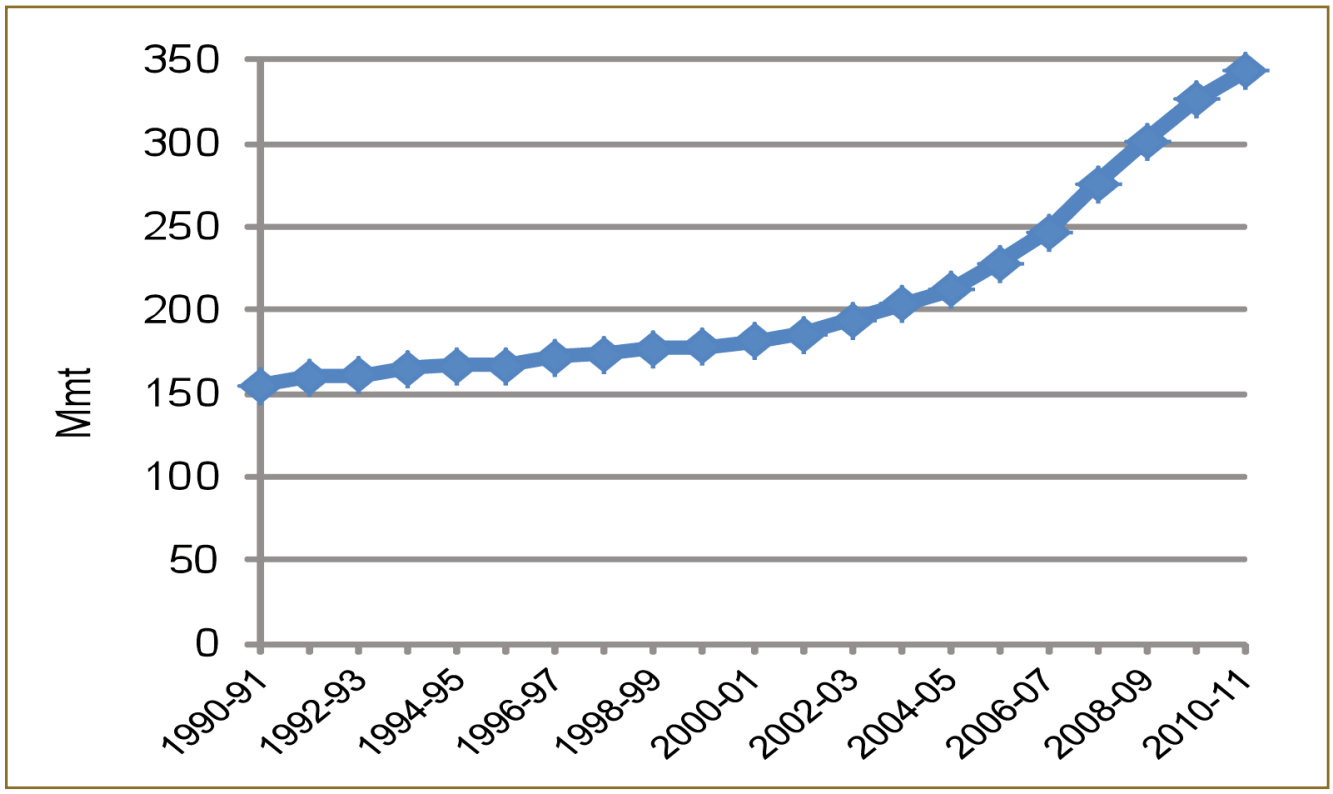
Five Key Issues behind High Agricultural Commodity Prices

Issue 1: Big, Persistent Demand Shocks: Biofuels and Chinese Soybeans

Biofuels

Worldwide there is rapid expansion of corn and vegetable oil use for fuel. Figure 3 shows how food, seed and industrial (FSI) use of corn has expanded rapidly in the past five to seven years. Since the 2005-06 marketing year, 88% or 115 million metric tons (mmt) of the growth in total world corn use has been in the FSI category, where ethanol production is placed.

Figure 3: World Corn Food, Seed and Industrial Use (mmt)



Source: FAS (2011) USDA PS&D online database

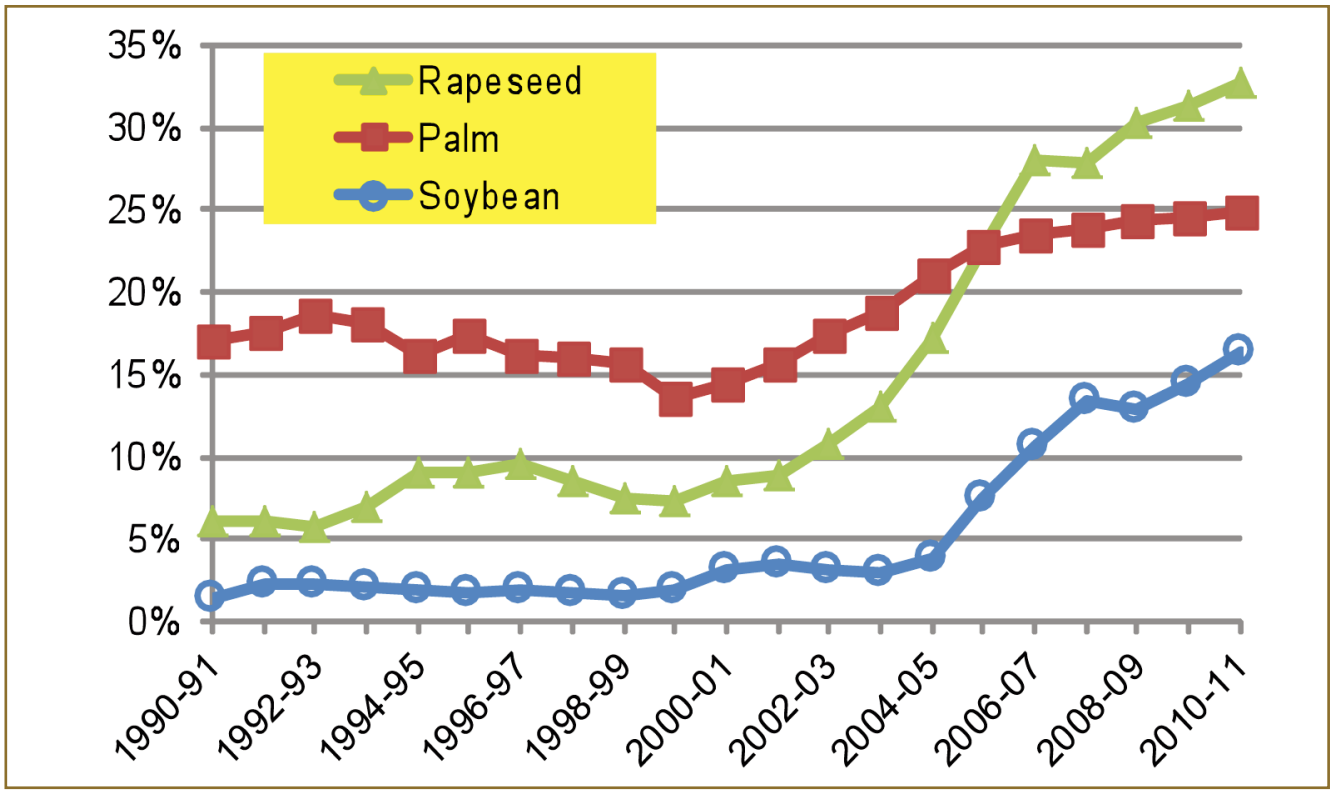
While world data does not allow a separation of ethanol production from other FSI categories, U.S. data does. Since 2005-06, total annual corn usage in the United States has increased by 2.23 billion bushels (56.6 mmt), and corn usage for ethanol has increased by 2.46 billion bushels annually (62.5 mmt)—more than the increase in total use. This increased use of corn just for ethanol in the United States was 48%—almost half—of the increase in corn use for the entire world over the following five years. (Note: Corn ethanol usage is calculated as 72.4% of the amount USDA shows for the category "ethanol and by-products."[1]) With mandated ethanol taking 27% of the corn crop (net of by-product credit), there is little doubt that biofuels play a role in the price level, as indicated by Wright (2011, pp. 50-51):

In the case of biofuels, the effect of this very large exogenous diversion ramped up over a few years, has been treated as if it were a relatively minor market disruption in several influential policy pieces. On the other hand, Runge and Senauer (2007), Mitchell (2008) and Abbott, et al. (2008 and 2009) were early papers that recognized the implications of sharp mandated increases in corn ethanol for corn prices.

The second large demand growth category has been the use of oilseeds—vegetable oils for biodiesel production, oilseed meals for livestock production and vegetable oils for human consumption. Figure 4 shows the increased use of oils for biodiesel and industrial usage. The percent of total world use going to industrial and biodiesel usage has increased sharply since the mid-2000s. Rapeseed oil has been used extensively for biodiesel in Europe. For the world, nearly 33% of total rapeseed oil is now used for industrial purposes, compared to 17% in 2004-05, a 5 million metric ton increase. Industrial uses of world soybean oil expanded to 16% by 2010-11 from just 4% in 2004-05, a nearly 6 million metric ton increase.

[1] The USDA World Agricultural Supply and Demand Estimates (WASDE) report provides corn use for a category called corn use for "ethanol and by-products." If corn and by-products are included together, USDA's estimates are that 14% of corn use in 2005-06 was for ethanol and 37% in 2010-11. We, however, separate out the corn used to produce those by-products which include distillers' grains, corn gluten feed, corn gluten meal and corn oil, depending on whether the plants are dry mills or wet mills and whether dry mills use fractionation. Here it is assumed that the corn use for production of just the ethanol alone is 72.4% of the amount specified by USDA for "ethanol and by-products." Thus it is assumed that 27.6% of the corn is used to produce the by-products, primarily feed. The calculation is based on dry mills producing distillers' grains representing 18 pounds from each 56-pound corn bushel with dried distillers' grains worth 86% of the value of corn. This is based on the average value of Iowa dried distillers' to Iowa corn-price-per-pound from January 2008 through April 2011 (USDA, Market News 2008-2011). Thus 18/56*.86*100 = 27.6%. While this is still an imperfect calculation, it attempts to adjust USDA's use of "corn and by-products" downward to account for by-products.

Figure 4: World Oils: Industrial Use as Percent of Total



Source: FAS (2011) USDA PS&D online database

Chinese Soybean Imports

The impact of growth in world oilseed use is also led by the continued surge in soybean use in China for livestock feed, human vegetable oil consumption and stock building in recent years (Figure 5). After 1997-98, China largely abandoned its soybean self-sufficiency objectives, concentrating on self-sufficiency in feed grains, wheat and rice. With continued increases in consumption, that has resulted in massive additional imports of soybeans. In just five years since 2005-06, annual Chinese soybean purchases have more than doubled—increasing by 29 mmt. This increase represents more than 90% of the increase in world imports.

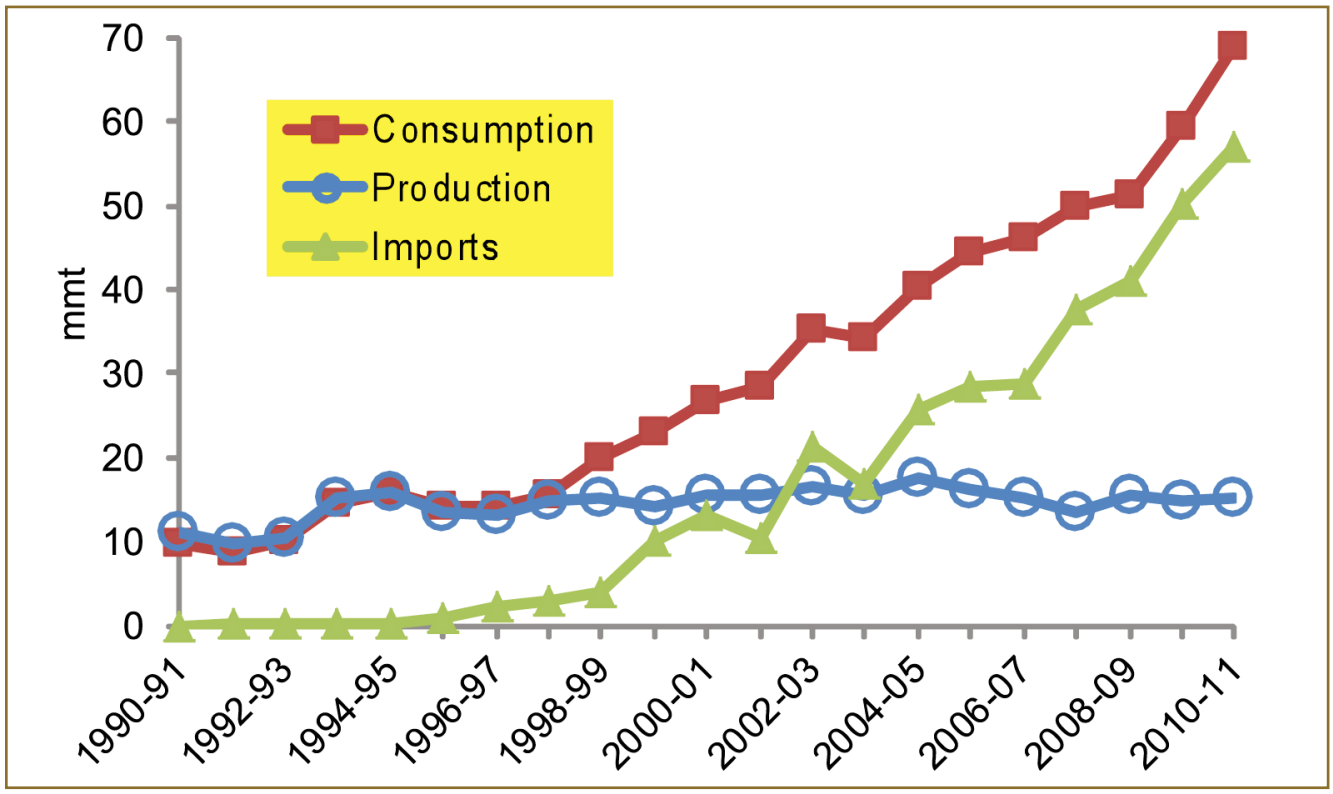
The recent surge in Chinese soybean imports is the consequence of stock-building, in addition to income growth and dietary improvement. The Chinese had not held large soybean stocks until recently, but in the last three years they have accumulated stocks that equal nearly 23% of use. Stock-building accounts for nearly 40% of the increase in Chinese soybean imports since 2008.

Land Use and Stocks

The dual demand surges from biofuels and Chinese oilseed needs are having a remarkable impact on the amount of U.S. land required to meet those needs. For U.S. corn and soybeans raised in 2005, 16.1 million acres of land were required to meet these two demands, or 11.0% of corn and soybean harvested acres (Figure 6). For the 2010 crop, corn ethanol (by-product adjusted) and Chinese soybean purchases from the United States required 46.5 million acres, or 29.4% of harvested corn and soybean acres. From the 2005 crop, 7.8 million corn acres were needed to meet the ethanol needs (by-product adjusted). That climbed to 23.7 million U.S. corn acres in 2010, an increase of 15.9 million. U.S. soybean exports to China required the production from 8.3 million acres of the 2005 crop, but 22.8 million acres of the 2010 crop—an additional 14.5 million acres. There were only minor changes in land available from a somewhat smaller Conservation Reserve Program (CRP) and modest reductions in hay acres. So in the United States, these new demands were met primarily from acreage shifting to corn and soybeans from wheat, other feed grains, cotton and other oilseeds.

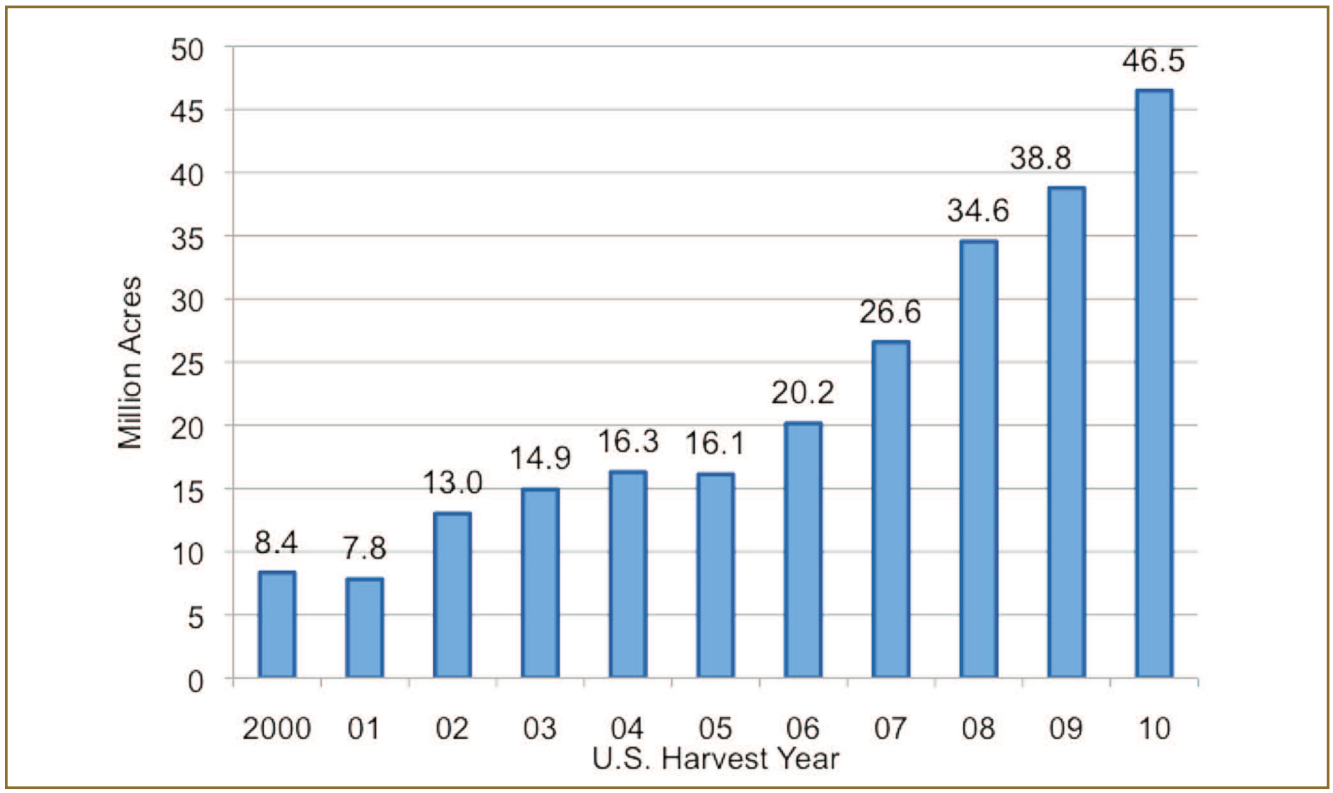
In addition, these new demands were also met by depleting U.S. stocks. U.S. corn stocks at the end of 2005-06 represented 64 days of use, and in 2010-11 are expected to be drawn down to the low level of 20 days. For soybeans, the same numbers were 57 days and 20 days, respectively (WAOB, June 2011). Clearly, these were large impacts on U.S. supply and demand balances, as well as on acreage and stocks.

Figure 5: Chinese Soybean Production, Consumption and Imports



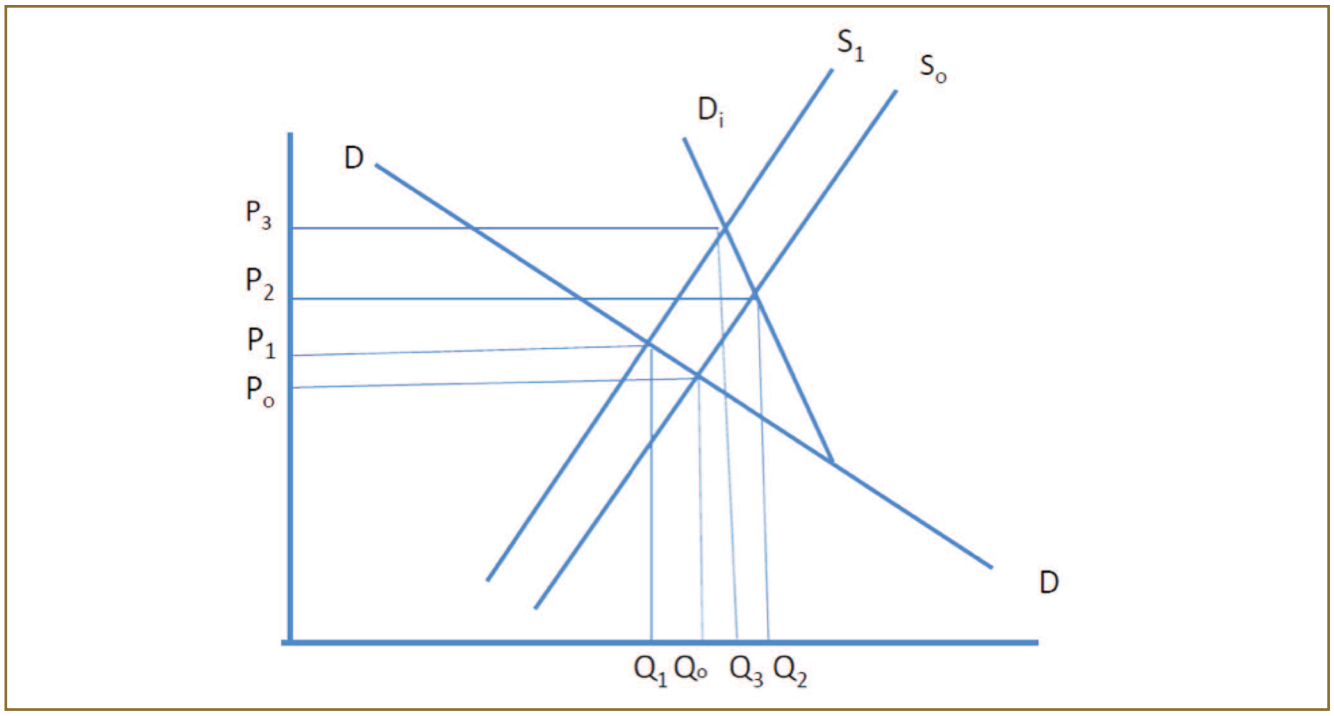
Source: FAS (2011) USDA PS&D online database

Figure 6: U.S. Acres Required to Produce Ethanol (by-product adjusted) & Chinese Soybean Purchases from the U.S.



Source: FAS (2011) USDA PS&D online database

Figure 7: Short-run Impacts of More Inelastic Corn Demand



Source: FAS (2011) USDA PS&D online database

The impacts were also large in world markets. With prices high for all crops, there are few alternatives to change cropping patterns. The Chinese demand for soybeans was also met by surges in production and exports from Latin America. More than half of Chinese soybean imports were sourced from Brazil, Argentina and Paraguay. Moreover, Brazil, Argentina and Paraguay increased land devoted to soybeans by more than 7 million hectares in 2009-10 and 2010-11 relative to land use just a few years earlier. Limitations to further land use adjustments both in the United States and globally are one factor contributing to the inelasticity that is characteristic of global agricultural markets.

Issue 2: Inelasticity

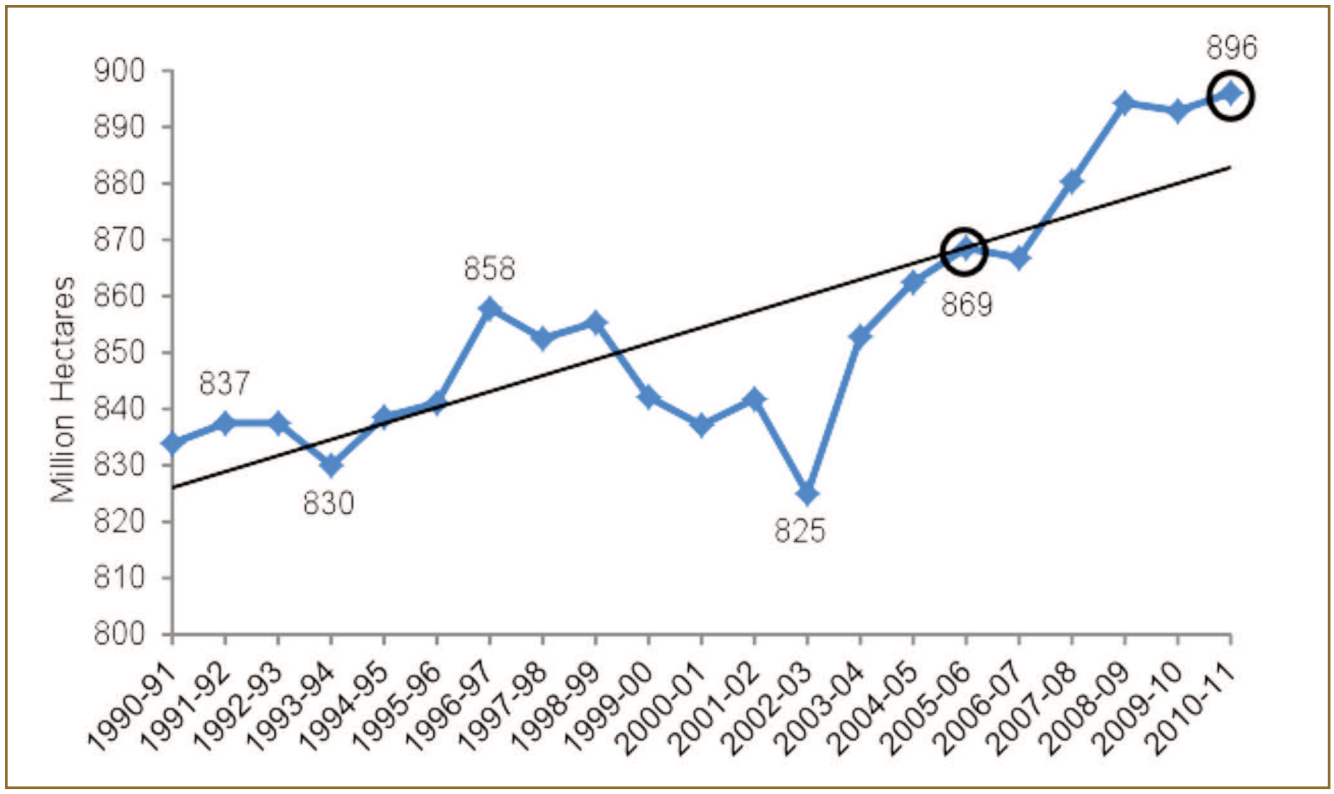
One of the critical mechanisms behind what is happening in agricultural commodity markets today is a reduction in elasticity, or price responsiveness of demand and supply. As demand becomes more inelastic, responses to any real or perceived supply shock become more volatile. Inelastic supply affects future price expectations and adjustment. The main sources of this inelasticity are:

- Tightness of land supply and limited reallocation possibilities,
- Biofuels policy constraints,
- Higher livestock prices contributing to persistent feed demands,
- Grain stocks and futures prices, and
- Trade policies that isolate national markets.

Figure 7 illustrates what happens to price in response to supply shocks as demand becomes more inelastic (Di). Any given supply shock (illustrated here as a leftward shift in the supply curve) results in a more exaggerated price response. Even without the supply shock, more inelastic and larger demand will result in higher prices and more of the commodity being produced (P2 and Q2 in Figure 7). This result has been seen in U.S. corn production as farmers responded to higher corn prices with more corn acreage and production. With the added supply shock (S1), quantity produced falls to Q3 because of the supply shock, but price moves even higher to P3. Supply shocks can be real or perceived and can be positive or negative. Demand shocks also can perturb the system. The important point is that the more inelastic is the demand curve, the more exaggerated market movements will be. Prices will be more volatile. The sum of the impacts of these different mechanisms is not linearly additive—that is, the sum of the impacts of these different mechanisms taken individually is greater than each factor considered in isolation.

With all these factors coming together, commodity demand has become much less price responsive, at least in the short run, than in previous years. Supply has also become more inelastic, impacting both price levels and price volatility.

Figure 8: World Harvested Hectares for 13 Major Crops



Source: FAS (2011) USDA PS&D online database

Land Supply More Inelastic

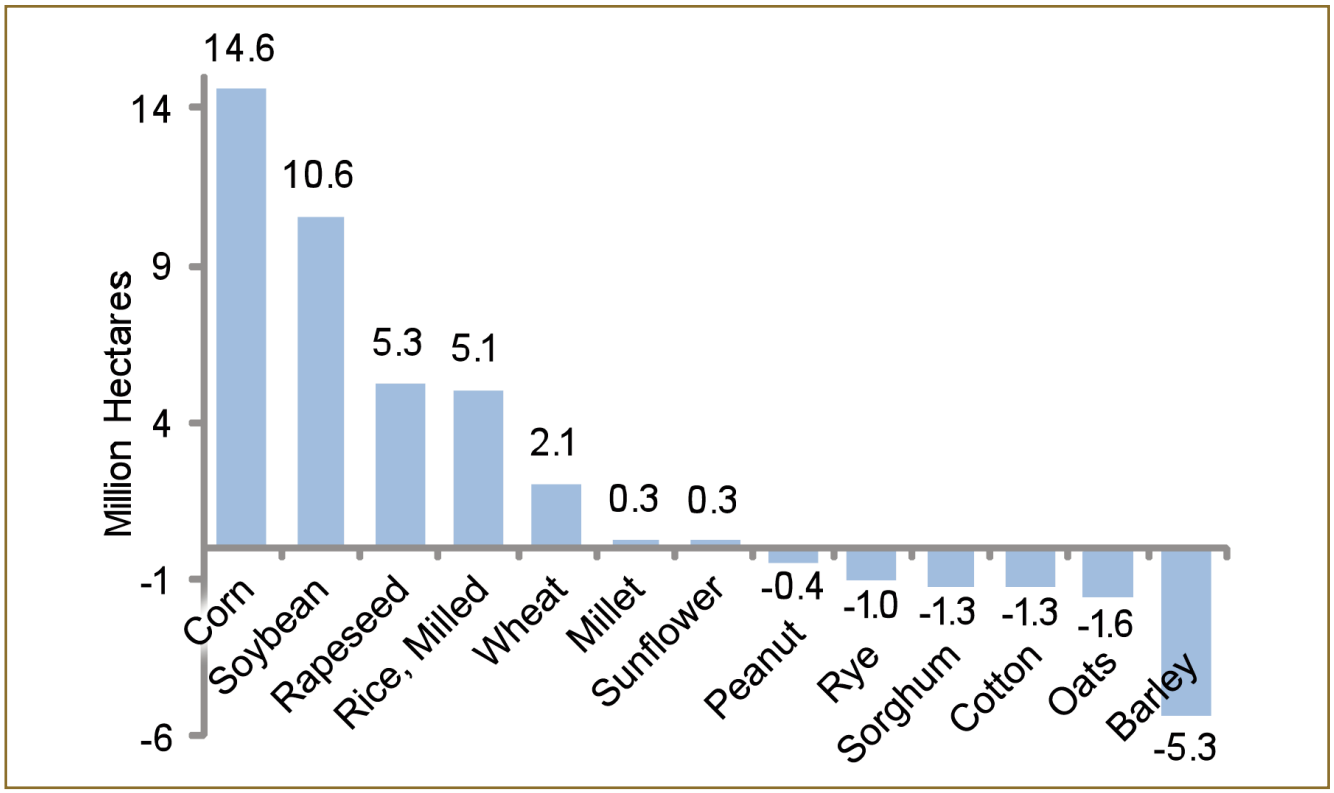
Land has become an increasingly limited resource in 2011 compared to 2008. The world's agricultural producers responded to new demands by bringing more land into production and shifting from low-demand growth crops to high-demand growth crops. How big are each of these effects? First, land area for 13 major world crops increased by 27 million hectares in the five years since 2005-06. This represents a 3% expansion of harvested area, with most of the land expansion occurring outside the United States (Figure 8). Twenty four of the 27 million hectare expansion was in six countries or regions: China, Sub-Saharan Africa, former Soviet Union, Argentina, India and Brazil (in order of importance). Acreage in the United States expanded by only 1.3 million hectares for these 13 crops.

Second, to meet growing demands, land was shifted to high-demand crops of corn, soybeans and rapeseed, an increase of 30.5 million hectares worldwide. Rice increased 5 million hectares as nation's encouraged expansion to reduce food insecurity (Figure 9).

How important was world area expansion compared to shifting from low-demand to high-demand growth crops? The seven major crops that had increases in area in the past five years totaled 38 million hectares (Figure 9). This was composed of 27 million new hectares coming into production and 11 million hectares shifting out of lower demand crops. Thus, the expanded area for high-demand crops was comprised of about 70% new area and 30% displaced alternative crops. For the world, new acres were a more important source of area expansion. In the United States, land area was fairly stable, thus shifting land from lower-demand to higher-demand uses was more important. As more land comes into production, the productivity of the new lands tends to be lower than previously cultivated land, thus reducing the elasticity of the supply response. In 2008, some crops, such as cotton, had surpluses and low prices that allowed flexibility to shift land out of those crops to high-demand crops. As area shifted to corn, soybeans and rapeseed to meet surging demand growth, and out of feed grains, cotton and other oilseeds, inventories of the latter crops tightened and prices surged.

This process of equating the marginal returns to land across all crops has resulted in high prices for many crops as land is the scare resource. Cotton is an example of how area and price adjustments have responded to the strong demand crops. By 2011, surging corn and oilseeds demand has largely absorbed all of the surplus land, equating high corn

Figure 9: Change in World Harvested Area for 13 Major Crops, 2010-11 versus 2005-06



Source: FAS (2011) USDA PS&D online database

and oilseed returns across other commodities that compete for the same land. As a result, cotton stocks have tightened significantly and prices have sharply exceeded 2008 highs. With many crop prices at high levels, there is now less flexibility to shift area.

Biofuels Policy Constraints

Because of biofuels policy, a high fraction of the demand for corn is fixed, regardless of corn price. The Renewable Fuel Standard established by the U.S. Congress in the Energy Independence and Security Act (EISA) of 2007, and known today as RFS2, effectively mandates 15 billion gallons of corn-based ethanol by 2015. The RFS level is a fixed quantity of ethanol and therefore a fixed or minimum quantity of corn that must be allocated to ethanol.

The other major issue faced by the ethanol industry is the blend wall. The standard blending rate for ethanol into gasoline is 10% (E10). The United States consumes about 138 billion gallons of gasoline each year. If that entire quantity could be blended at 10%, the maximum size of the market would be 13.8 billion gallons. Because of infrastructure and other blending issues, all the gasoline cannot be blended, so the effective blending limit is about 12.5 billion gallons.

Some ethanol is sold as an E85 blend, which over the course of a year is actually about 78% ethanol. The number of E85-dispensing pumps and E85 capable vehicles is quite small, and huge investments would be required to significantly expand the E85 market (Tyner and Viteri, 2010, Tyner, et al., 2010). For 2011, the RFS2 mandate is 12.6 billion gallons and the blend wall is about the same level—making the minimum and maximum consumption levels very similar. If the blend wall is not increased, it becomes the binding constraint and maintains ethanol consumption a bit higher than the E10 limit of 12.6 billion gallons. Both the RFS and the blend wall contribute to a more inelastic corn market.

Currently in the corn ethanol industry, the blend wall and the RFS2 are both at about the same level—12.6 billion gallons. Actual production in 2010 was 13 billion gallons, but 350 million gallons were exported. The exports were made possible by the high value of the Brazilian Real and high world sugar price, which led Brazil to produce more sugar and less ethanol. Essentially the United States displaced Brazilian exports in many parts of the world. If the blend level does not increase to 15%, the blend wall will remain the binding constraint. There is some potential for

E85 and other higher blends to grow, but it will be slow and not likely to fill the gap between the blend wall and the near-future RFS2 levels. If sugar prices and the Real remain high, U.S. exports could continue to be strong. This would constitute an elastic portion of the ethanol demand for corn; however, it would be much a smaller volume than domestic consumption.

High Livestock Prices and Persistent Feed Demand

In contrast to 2008, today's livestock industries will be less responsive in adjusting corn and soybean meal usage downward in response to high grain and oilseed prices. Livestock feed demand is expected to be more inelastic. In 2008 and 2009, the economic environment for animal industries was characterized by large financial losses, partially as a result of high feed prices that could not be passed on to consumers. Large financial losses eventually led to reduced production through some liquidation of herds and flocks. Lower production shifted supply downward, resulting in higher animal product prices. While there are differences among species in 2011, animal production operations are largely able to pay 2011 feed prices. Thus even higher prices of corn and meal will be required to force herd reductions in 2011. Consequently, some of the true impacts of the higher feed prices in 2008 on consumer prices of meats, dairy and poultry are just now reaching the world's consumers. In the United States, 2011 retail pork prices have risen 14% and beef prices 11% above 2008 levels.

Grain Stocks and Futures Prices

When stocks are abundant, much of the adjustment to supply or demand shocks is through changes in expected carry-out stocks. Traders will carry supplies into the next year rather than sell at even lower prices. Once stocks are expected to be depleted, they can no longer adjust, and carry-out stocks demand becomes very inelastic. Stocks-to-use ratios are therefore often used by traders to gauge market price expectations, and by analysts to explain how tight supplies are in a given year. Moreover, tight stocks make for less elastic markets, helping to explain spikes in prices. This contributes to the observation above that the effects of shocks on prices are not linearly additive, since two shocks may make for tight stocks when neither alone would.

One of the proposed explanations behind the 2008 commodity price spikes was very tight world grain stocks that had been falling since 2000 (Trostle, 2008; Abbott, Tyner and Hurt, 2008; Wright, 2011). Chinese stockholding complicates interpretation and relevance of world stocks. But when an appropriate measure of stocks-to-use is low, high prices are usually seen. A dilemma yet to be explained is why some prices seem high when stocks appear to be adequate.

In relating stocks-to-use ratios to market prices in the short run, expectations matter and vary over time. In the case of 2008 stocks data, expectations on the upcoming harvest when prices peaked were more pessimistic than the actual harvests that ultimately occurred.

High nearby futures market prices reflect the need to ration available supplies this year, whereas distant futures prices capture expectations in the coming years. The difference between nearby and distant futures prices creates incentives to increase or deplete stocks, depending on the sign. In the past, when there were production shortfalls, nearby futures prices would rise above distant futures prices, as is now the case with corn. In the cases of wheat and rice, distant futures prices now are above nearby prices, creating incentives to store, and limiting further near-term stocks adjustment in the face of seemingly high prices. While these stocks data are consistent with relative prices, distant futures prices suggest substantially higher long-run prices under normal stocks than was the case during most of the last decade.

International Trade

Another important mechanism by which countries adjust to production or demand shocks is international trade. Conventional wisdom has been that the international market faced by the United States is a more elastic demand component than its domestic market since lower-income foreign consumers would be more price sensitive. But the combination of trade policy interventions worldwide, intended to stabilize domestic markets, and other factors result in more inelastic world markets.

As world prices increased in 2007 and 2008, countries altered trade policies to isolate and partially stabilize their domestic markets from effects of those high prices. The most egregious measures—and most significant as a factor behind world price spikes—were export restrictions, especially for rice (e.g. Timmer, 2008; Mitra and Josling, 2009). Importers cut tariffs and taxes, drew from stocks, and even subsidized imports and consumption to isolate domestic markets from world prices (Demeke, Pangrazio and Maetz, 2008). The collective action of many importers to stabilize rather than to bear some of the adjustment burden required in world markets surely contributed to the inelasticity of those markets and so to the very high prices that occurred.

Table 1: World Trade and U.S. Exports from 2000 to 2011 (mmt)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
World Trade											
Corn	75.0	71.6	75.9	76.9	76.0	80.6	90.6	98.5	82.9	90.2	91.0
Soybeans	53.1	54.4	62.9	54.0	63.5	64.1	69.1	78.1	77.4	86.8	92.0
Wheat	99.9	106.2	103.4	100.6	110.0	111.7	113.9	113.4	136.9	133.6	125.4
Rice	22.2	26.1	26.5	25.0	26.1	26.5	28.4	29.9	27.2	28.1	29.6
US Trade											
Corn	49.3	48.4	40.3	48.3	46.2	54.2	54.0	61.9	47.0	50.5	48.3
Soybeans	27.1	28.9	28.4	24.1	29.9	25.6	30.4	31.5	34.8	40.9	41.9
Wheat	28.9	26.2	23.1	31.5	29.0	27.3	24.7	34.4	27.6	24.0	35.2
Rice	2.6	3.0	3.9	3.3	3.5	3.7	2.9	3.3	3.0	3.5	3.5

Source: FAS (2011) USDA PS&D online database

One noticeable effect of price-insulating trade policy by both importers and exporters is that both world trade volume and U.S. exports did not fall from prior year quantities in 2007 or 2008. Table 1 shows this outcome for wheat, rice, corn and soybeans. Record exports—in quantities, not just value—were realized for most of these commodities. This trade behavior reflects two factors. First, net import demands, as well as domestic demand, tend to be price inelastic, and supply in the very short run is very inelastic. Second, the trade policy responses taken mean domestic market participants are isolated from the full price changes occurring in world markets, further limiting import quantity adjustments.

Inelastic import demand and sustained world trade is only partially due to trade policy responses that isolate domestic markets. Imperfect transmission of world prices to domestic markets may be due to either policy changes or imperfect market integration. Urban consumer markets may also be better integrated with world markets than are rural markets and farm prices. Moreover, in many countries trade is still managed in some fashion by the government. Those public entities were likely to maintain imports or reduce exports in order to protect domestic food security. Panic buying was noted by some observers (e.g. Timmer, 2008; Fan, Torero and Headey, 2011) as some countries seemed to have increased rather than reduced imports in the face of high world prices. Often the state was involved in purchasing imports earlier than normal and, in some cases, purchasing greater imports than normal to be ready for future needs.

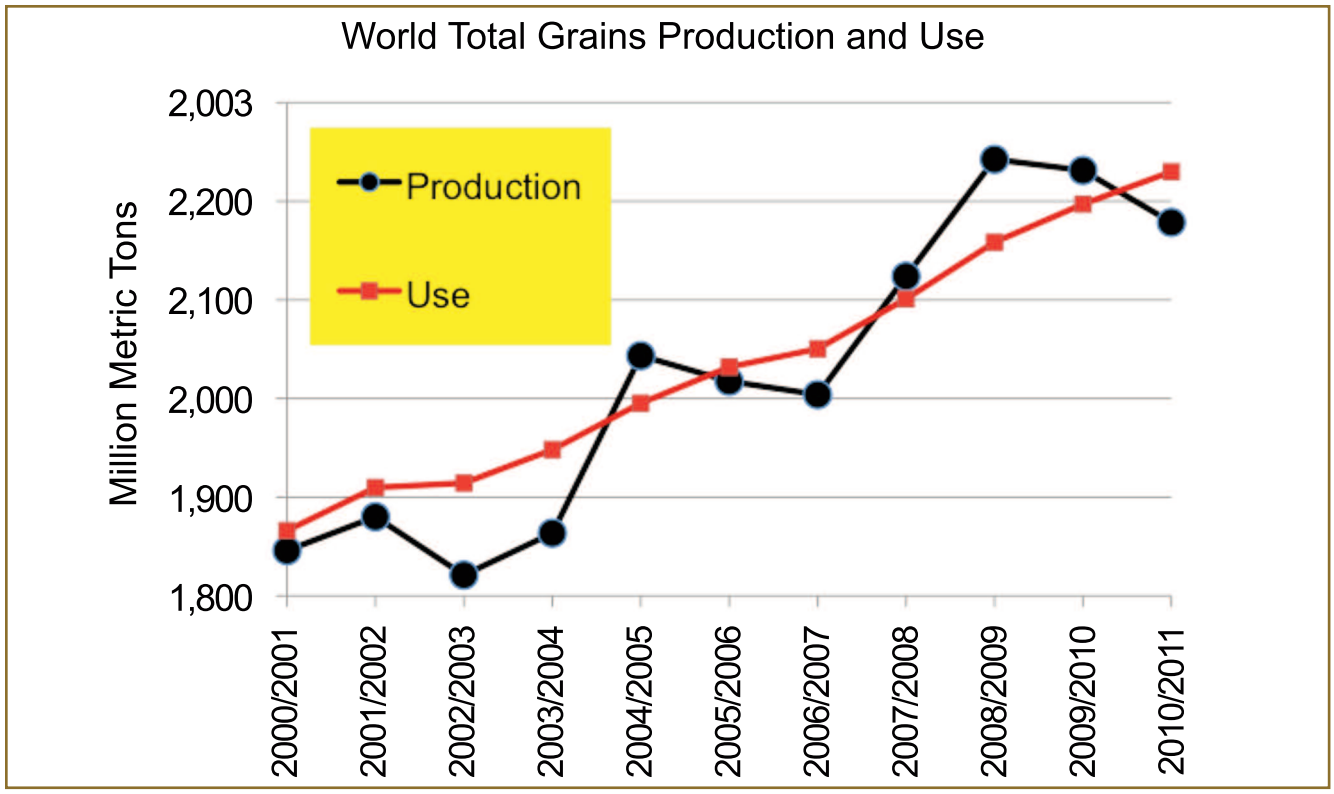
Trade policy responses are believed to be less important in the current period of rising international agricultural commodity prices than was the case in 2007-08. While some of the extreme trade policy measures have not yet been repeated in the current agricultural price run-up, the motivations behind trade policy mean international agricultural markets remain thin and volatile. While Russia banned wheat and coarse grains exports as a result of its recent severe drought, that ban did not spread as had the rice export bans. But countries that traditionally maintain self-sufficiency, notably China and India, continue to do so. Other importers are also likely to be limiting pass-through of high world prices. There is evidence of early importing and of actions by state traders to insure domestic supplies in the face of high world prices. Moreover, there is evidence that importers once again bought earlier in the season, as U.S. exports have increased on an accelerated schedule relative to past years (Trostle et. al, 2011). World trade is not falling as prices are rising.

Table 1 shows that world and U.S. trade outcomes expected in 2010-11 (WAOB, 2011) are similar to those in 2007-08 and are consistent with inelastic world markets. U.S. exports and world imports are rising in spite of high world prices. However, world wheat trade is expected to fall by about 8 million tons where weather problems resulted in shortages, and U.S. corn exports may fall 1 million tons due to expanding domestic industrial demand.

Issue 3: Weather and Stocks

Reduced production from adverse weather played an important role in reducing world inventories in 2010-11, and had a larger impact than in the 2008 price run-up. World total grain production dropped 2.3 % or 51 mmt in 2010-11 from the previous year (USDA), and use exceeded production by 53 mmt. By contrast, world production dropped by 40 mmt in the two short production years of 2005-06 and 2006-07, contributing to high prices in 2008 (Figure 10).

Figure 10: World Total Grains Production and Use



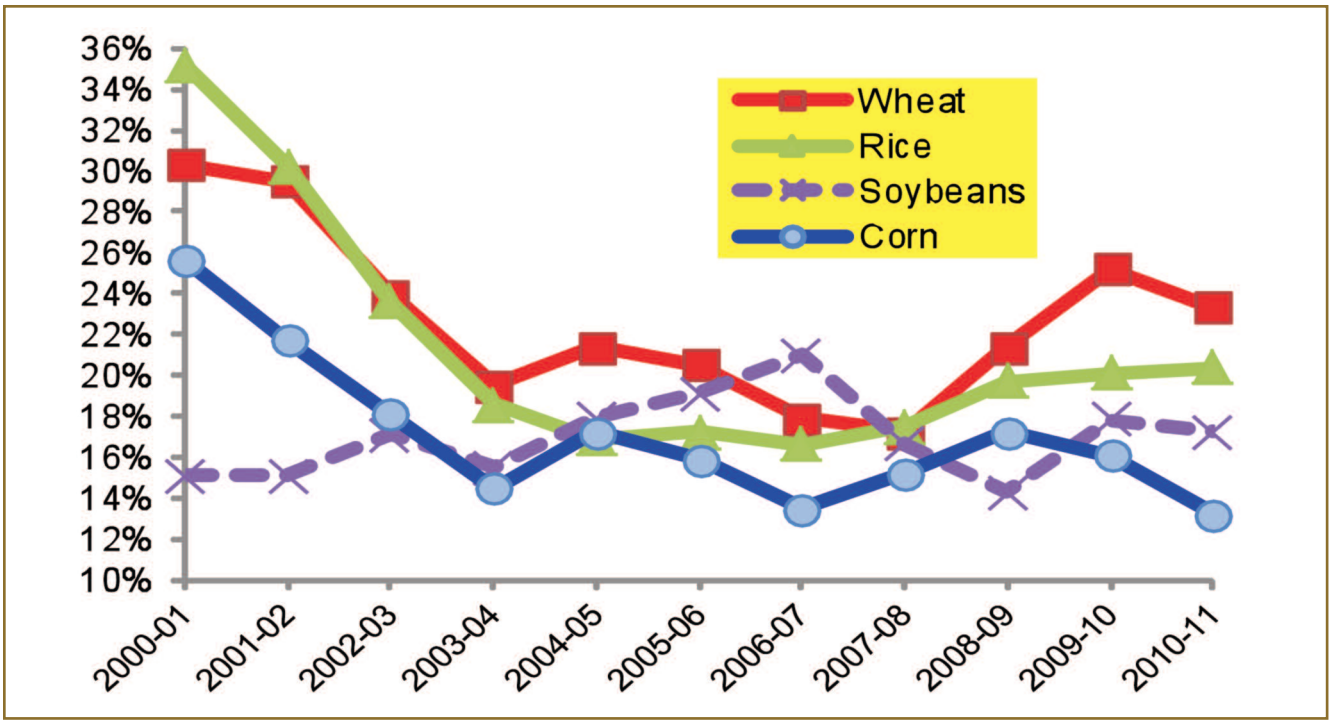
Source: FAS (2011) USDA PS&D online database

Table 2: Components of World Production During the Last Two Years

		Area	Yield	Production
		Mill.Hectares	mt/hectare	mmt
Wheat	2009-10	227.13	3.01	683.81
	2010-11	222.48	2.91	647.18
	% Change	**-2.0%**	**-3.3%**	**-5.4%**
Corn	2009-10	157.32	5.16	812.43
	2010-11	160.74	5.07	814.94
	% Change	**2.2%**	**-1.8%**	**0.3%**
Rice	2009-10	156.19	2.82	440.35
	2010-11	158.49	2.84	450.68
	% Change	**1.5%**	**0.9%**	**2.3%**
Soybeans	2009-10	102.22	2.55	260.22
	2010-11	103.50	2.52	260.97
	% Change	**1.3%**	**-1.0%**	**0.3%**

Source: FAS (2011) USDA PS&D online database

Figure 11: World Stocks-to-Use Ratios from WASDE



Source: FAS (2011) USDA PS&D online database

Table 2 shows data for world production of major grains and soybeans. The largest production losses in 2010-11 were led by a 37 mmt decrease in world wheat, the result of harmful weather in the Black Sea region, Canada and Australia. World wheat production dropped five percent. World barley production dropped 27 mmt, as about 10% of the acreage shifted to high-demand crops. Barley yields dropped 9%, primarily due to drought in Europe and the former Soviet Union, the same regions where wheat has been severely affected. While world corn production was up modestly, U.S. yields were 7% or 23 mmt lower than anticipated. With normal corn yields needed to meet rapidly growing needs, the shortfall caused extreme tightening of stocks. World soybean production was also negatively impacted as yields dropped 1%, primarily due to yield losses in Argentina, but world production was still up 0.3%. Rapid growth in use, i.e. Chinese imports, meant stocks tightened. Rice production was favorable with higher area and yields.

As shown in Figure 11, continued strong growth in demand and reductions in production mean world stocks-to-use levels tightened for most major crops in 2010-11, with the exception of rice.

Data for expected stocks in 2010-11 show significant differences among the major agricultural commodities.

Table 3 shows the relative changes in stocks levels over the past decade for the world, the United States, China and the world less China.

- In 2010-11 expected corn stocks are extraordinarily low both in the United States and for the world less China. Corn prices have exceeded the 2008 peaks. Reported stocks of corn in China remain high, distorting world stocks as a relevant measure.
- Soybean stocks are especially tight in the United States, where soybeans and corn compete for land. Since its suppliers have not historically held large stocks, China substantially increased its soybean stocks in both 2009-10 and 2010-11, contributing to its increased import demand. Once again, world stocks present a distorted picture. Soybean prices in 2011 reached about 90% of 2008 highs.
- Wheat stocks were high regardless of measure in 2009-10, allowing adjustment to severe production shocks in 2010-11. Hence, wheat prices reached only 65% of the 2008 peak.
- Rice stocks are reasonable, based on historical standards, increasing in almost all measures. Rice prices remain well below 2008 peaks.
- Record high prices for sugar and cotton in 2011 are consistent with expected low stocks. In 2008, when there were large stocks of cotton and sugar, prices did

Table 3: Stocks-to-Use Ratios in % for Corn, Wheat, Rice, Soybeans and Cotton

Crop Year	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Corn											
China	80.3	64.4	46.0	33.0	26.4	25.1	24.4	25.5	33.4	32.2	31.2
United States	19.5	16.3	11.4	9.4	19.8	17.5	11.6	12.8	13.9	13.1	5.4
World	25.6	21.7	18.1	14.5	17.2	15.9	13.5	15.1	17.0	15.8	12.5
World less China	13.0	11.8	11.0	10.2	15.2	13.9	11.0	12.9	13.5	12.3	8.3
Wheat											
China	82.8	69.5	56.5	40.3	37.6	33.5	36.8	35.9	43.1	50.4	54.4
United States	36.6	36.1	25.0	23.2	24.2	26.5	22.3	13.2	28.9	48.4	32.7
World	30.3	29.5	23.9	19.5	21.4	20.6	18.0	17.2	21.3	25.2	23.8
World less China	20.2	22.0	18.0	15.7	18.7	18.5	14.8	14.0	17.9	21.2	18.8
Rice											
China	68.3	57.2	45.8	33.0	29.7	28.5	27.9	29.3	28.8	30.0	31.4
United States	14.2	17.9	11.2	10.9	16.3	18.3	18.0	12.7	13.7	15.7	23.3
World	35.1	30.2	23.7	18.6	17.0	17.3	16.7	17.5	19.8	20.2	20.2
World less China	19.1	17.8	13.4	12.3	11.5	12.7	12.2	12.8	16.1	16.1	15.8
Soybeans											
China	18.2	7.3	12.6	6.1	11.6	10.2	3.9	5.5	14.6	22.2	22.6
United States	8.8	7.1	6.4	4.5	8.6	15.6	18.6	6.7	4.5	4.5	5.4
World	15.1	15.1	17.1	15.5	17.9	19.1	21.0	16.6	14.3	17.9	18.4
World less China	14.6	16.1	17.9	17.1	19.0	20.8	24.2	18.8	14.3	17.0	17.4
Cotton											
China	85.2	73.2	58.8	61.0	49.3	51.8	42.7	42.2	53.5	30.5	25.1
United States	39.7	39.5	27.8	17.0	25.9	26.0	52.1	53.9	38.3	18.9	12.0
World	42.2	44.4	37.2	36.9	42.4	38.7	39.0	37.9	44.0	28.8	28.6
World less China	31.6	36.7	30.7	29.3	39.9	33.8	37.5	36.0	39.9	27.9	30.2

Source: FAS (2011) USDA PS&D online database

not soar. Since then, land has shifted away from these crops, stocks have dwindled and 2011 prices have soared to record highs.

Issue 4: Chinese Policy

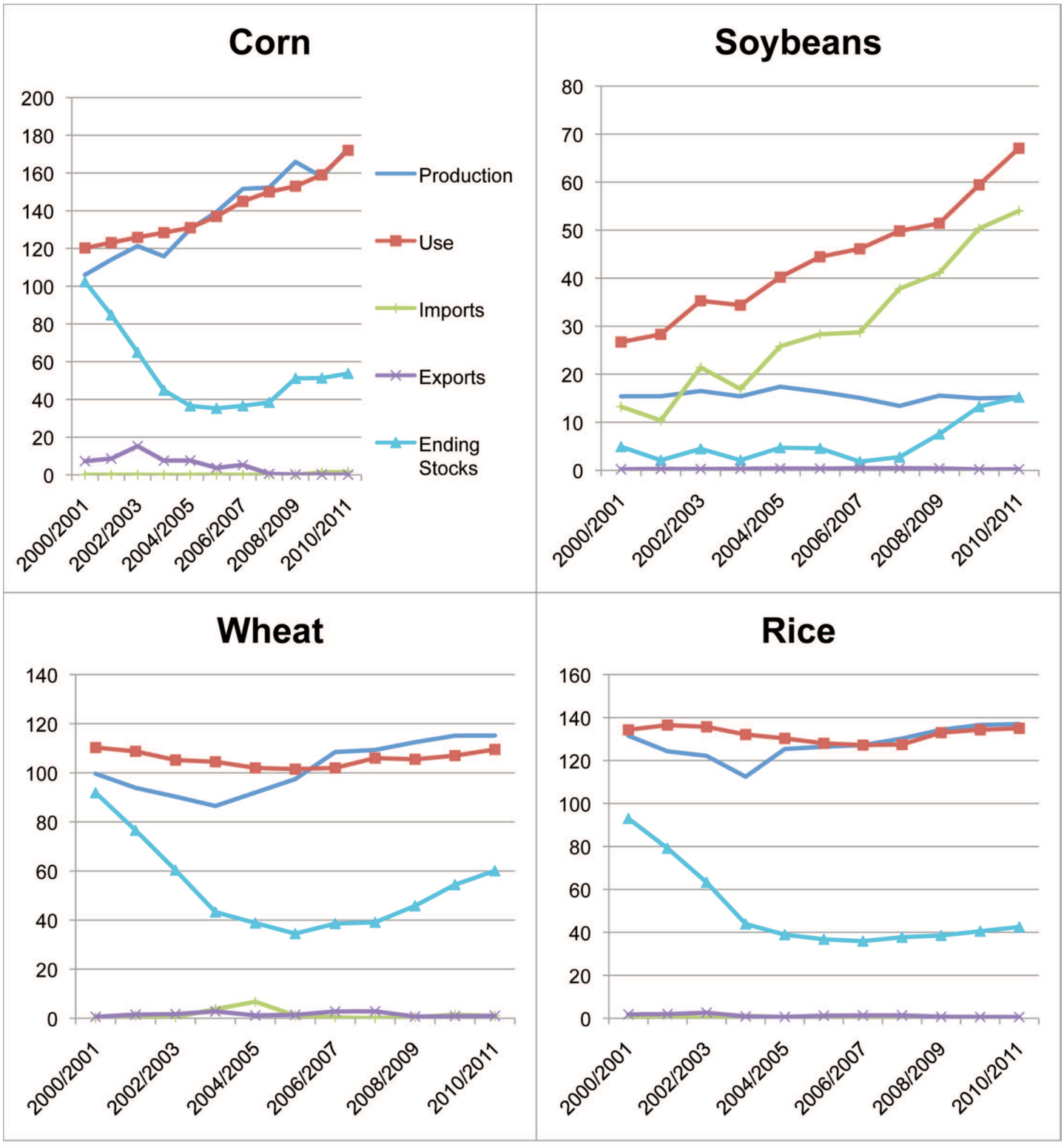
China figures prominently in supply and use explanations of world trade, with specific attention now to be focused on Chinese stockholding. Based on averages for the last three crop years, China accounts for 19% of world grain production and 32% of ending stocks, but only 1.6% of imports and 0.6% of exports. In the case of soybeans, however, China now accounts for only 6% of production, 57% of world imports and 23% of world ending stocks.

Many researchers misunderstood the importance of Chinese trade and stocks policies—and of grain self-sufficiency. This, in turn, leads to misunderstanding of the world supply and use situation relative to the agricultural price increases in 2007-08. One theme was that world stocks had been declining since 2000, leading to tightness in grain markets, and significantly contributing to high prices in 2008. Headey and Fan (2010) noted that when using stocks for the world less China, as shown in Table 3, low stocks explanations for those events are harder to defend. The draw-down in world stocks during the first half of the last decade was, to a larger extent, due to the Chinese reducing their enormous stockpile of grain, while at the end still holding for most grains more than 30% of annual use.

If Chinese grain markets were disconnected from world markets, neither importing nor exporting significant quantities of grain, variations in stocks levels would be disconnected from world markets. In fact, yearly variations in Chinese grain ending stocks, responding to domestic circumstances, were an order of magnitude larger than variations in trade levels. In examining the 2007-08 U.S. stocks-to-use ratios or world stocks less Chinese stocks, the importance of low stocks appears to be evident only in the wheat market. Today, regardless of measures used, stocks-to-use ratios are more directly related to prices.

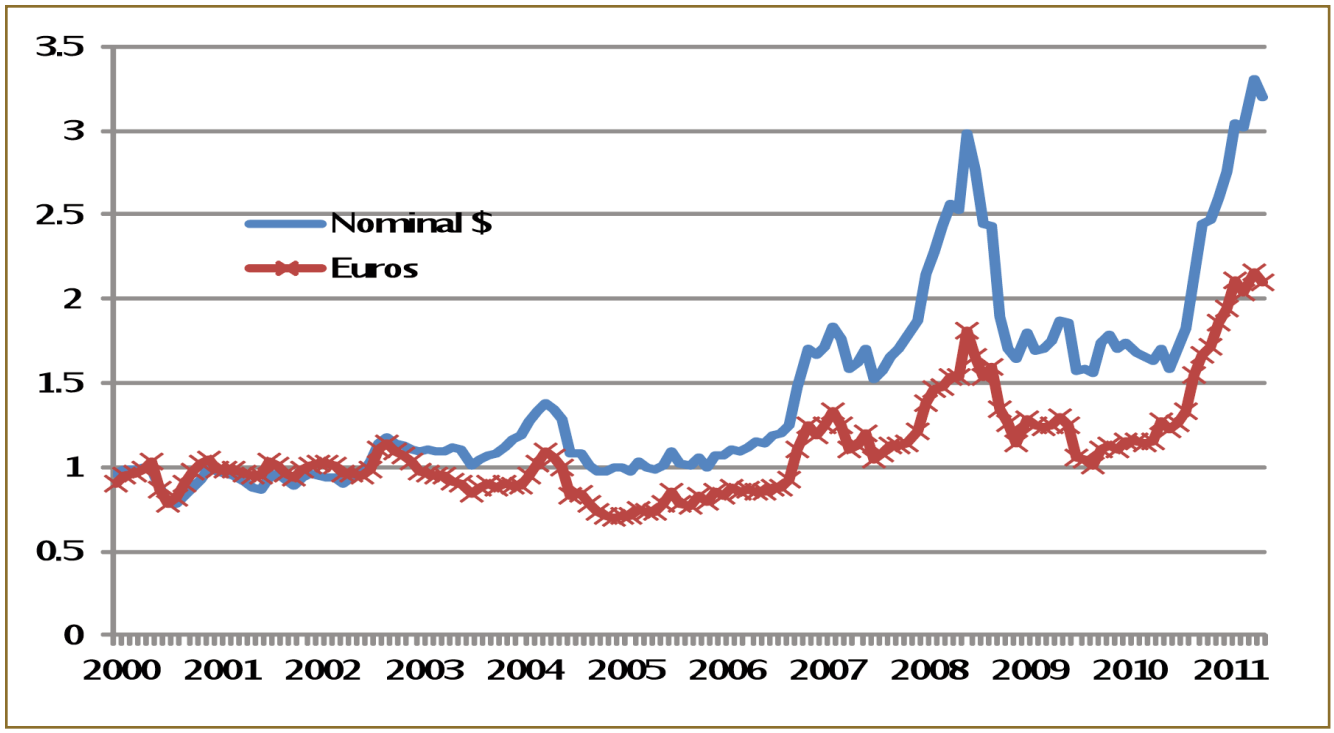
A key factor behind Chinese behavior, and one that varies across commodities, is the nature of Chinese trade policy and how that affects its role in particular markets. In the case of grains, China is among the most isolated and self-sufficient countries. Net trade is less than 1% of production and use, and domestic prices bear little relationship to world prices. In the case of soybeans, China abandoned self-

Figure 12: Chinese Supply-Utilization Balances for Grains and Soybeans



Source: FAS (2011) UDSA PS&D online dataset

Figure 13: Corn Price in $ and Euros



Note: Monthly corn prices in $ and € are expressed as an index equal to 1 on average in 2002
Source: IMF, 2011

sufficiency in the mid-1990s, relying on trade to supply 82% of the requirements of its domestic market. China's supply-utilization balances for wheat, rice, corn and soybeans from 2000 to 2011, shown in Figure 12, demonstrate these outcomes.

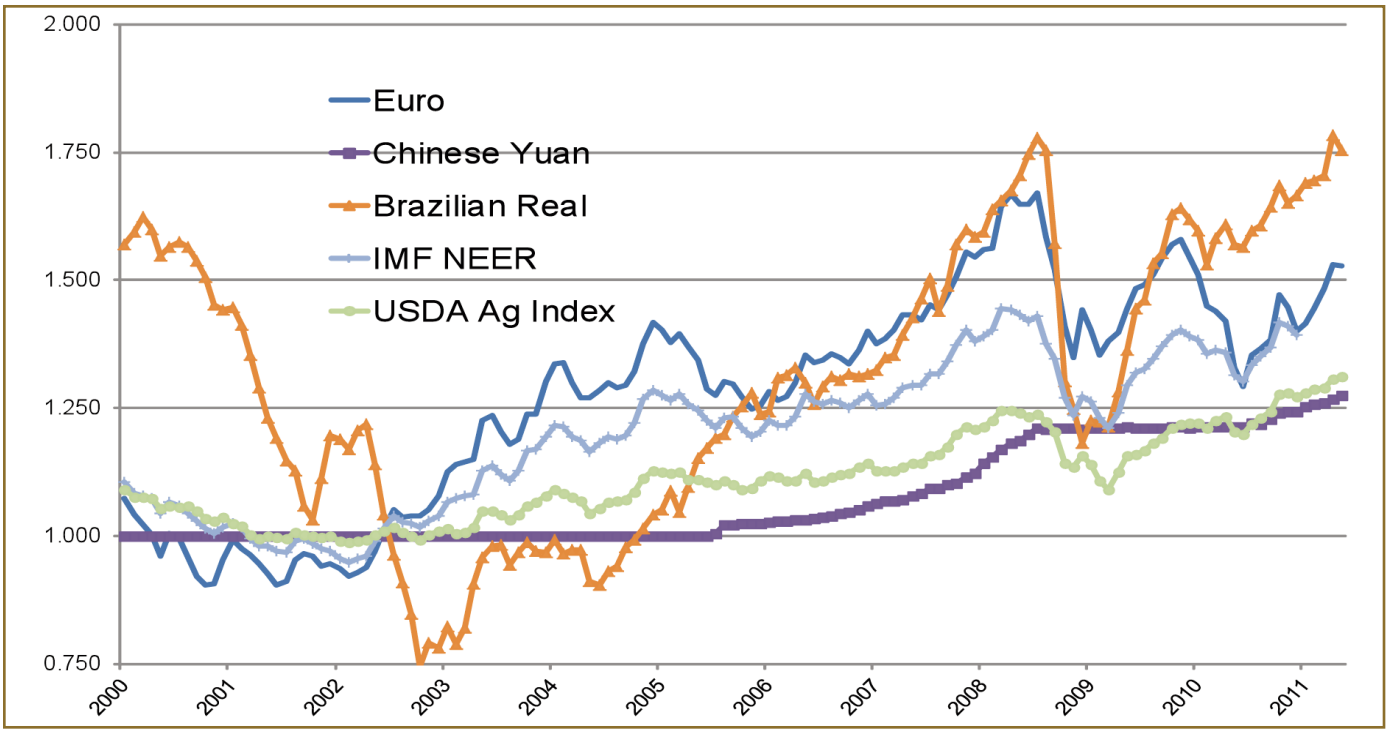
Figure 12 shows the extent of self-sufficiency in grains maintained by China from 2000. Production and use are about equal, while exports and imports are barely visible at the bottom of the graphs. Use exceeded production as China drew down very large stocks until about 2006. China increased large stocks positions again after the 2006-08 crisis. With soybeans, production is flat but use has been increasing the entire decade, and stocks began to increase after 2008. More than 40% of the increase in Chinese soybean imports since 2008 is due to stocks increases. While grains stocks also increased, that has occurred out of domestic production rather than from imports.

Grain and oilseed prices may be part of a general commodity boom that is surely being driven, at least in part, by rapid economic growth in developing economies. But the role of Chinese and Indian economic growth for food grains is often exaggerated. Both Abbott, Hurt and Tyner (2008) and Headey and Fan (2010) argue that trade policies leading to self-sufficiency means the importance of these effects on Chinese and Indian domestic markets has had limited spillover onto international markets. Figure 12 shows the extreme degree of self-sufficiency and the lack of connection between Chinese domestic grain markets and trade levels. Moreover, those trade levels are small relative to most world grain markets. Similar graphs were shown by Abbott, Hurt and Tyner (2008) for India. This self-sufficiency policy led to domestic grain prices disconnected from world prices (Timmer, 2008; Abbott, 2011). Domestic price data show soybean prices more closely following world prices.

The important exception to this is Chinese soybean trade, where a completely different trade policy regime is in place. Over the last few years, China's food grain trade policy has become even more inward looking, while soybean and crude oil regimes have become increasingly open. As noted earlier, the recent soybean stock building by China has contributed importantly to its increasing soybean imports. While the imports reflect a relatively open market, the stocks increases show an active government that remains concerned with food supplies.

Some argue that feed demand—and so coarse grains trade—is becoming more open, since China has recently switched to a net corn importer. But corn imports only reached 1.3 million tons in 2009-10 and are projected to be only 1 million tons in 2010-11. This remains less than 1% of

Figure 14: Bilateral Exchange Rates, 2000 to 2011



Note: Monthly exchange rates are expressed as an index equal to 1 on average in 2002.
Source, IMF, 2011

Chinese corn production and 1.5% of world corn trade. Similarly, when drought threatened China's wheat harvest this year, some argued this would impact world prices. But China held large wheat stocks, and historically would have drawn from those stocks rather than import wheat. Not surprisingly then, world markets did not react strongly to that news.

Issue 5: Macroeconomics Still Matters

The exchange rate was ultimately identified by many analysts as a key factor explaining high commodity prices in 2008—even if some early work discounted effects on agricultural trade and prices (e.g. Collins, 2008). Some argued that the exchange rate may capture effects of broader macroeconomic forces, such as inflationary expectations, which could even help explain why speculation matters (Abbott, Hurt and Tyner, 2009). While the dramatic changes seen from 2002 to 2008 are not occurring today, the dollar remains weak and the macroeconomic environment continues to influence commodity prices.

Weak Dollar Exchange Rate

In 2002, a Euro cost US$0.90. When the dollar was weakest in mid-2008, a Euro cost nearly US$1.60. The dollar strengthened in late 2008 as recession spread worldwide and financial crisis set in. Once again the dollar served as a safe haven for international financial transactions. But at the dollar's strongest, a Euro cost US$1.19. The dollar has since weakened and at this writing has varied between US$1.40 and US$1.49. While the dollar remains quite weak relative to historical standards, it is not yet as weak as in mid-2008. Macroeconomic events, including debt concerns in Europe and monetary policy here and abroad, have influenced the value of the dollar and caused some significant swings since mid-2008.
A weak dollar means commodity prices seem less expensive for those countries whose currencies have appreciated relative to the dollar. Abbott, Tyner and Hurt (2008) presented the prices of crude oil and several agricultural commodities in dollars versus Euros to emphasize the importance of the weak dollar in explaining high international agricultural prices denominated in dollars in 2008. When the dollar strengthened in the second half of 2008, the gap between dollar and Euro-denominated prices narrowed. Figure 13 shows that as the dollar has weakened once again, the gaps for corn and other commodities have also widened, if not to the same extent it had reached when the dollar was at its weakest.

Figure 14 shows variations in important bilateral exchange rates, emphasizing the fact that specific changes relative to important traders matter to agricultural markets. That figure

shows the small changes in the Chinese Yuan, that some argue remains undervalued, contributing to a persistent U.S. trade deficit. Revaluing the Yuan would make imports into China cheaper, including soybeans. Figure 14 also shows the more extreme variations in the Brazilian Real, the currency of an important competitor in key commodity markets, especially soybeans. While the overall pattern and timing relative to the Euro show up in other currencies, magnitudes differ. A noteworthy characteristic of this data is that USDA's agricultural trade-weighted exchange rate index does not show the variability or changes seen in bilateral rates or other indices. That index may be heavily weighted by China and by importers, who peg their currency to the dollar, and does not include competing exporters. This may have led some to discount the importance of the exchange rate as a factor behind agricultural price changes in 2007-08. The same concerns are not evident in the IMF's nominal exchange rate index for the United States, which follows the path of the Euro.

Bilateral exchange rate adjustments have altered the competitive position of the U.S. relative to Brazil in the Chinese soybean market. With the Yuan pegged to the dollar, U.S. soybeans remain cheap in China, while appreciating currencies in Brazil would drive down domestic currency soybean prices there. The Argentine currency has not appreciated relative to the dollar, but Argentina has imposed export taxes on soybeans. Nevertheless, soybean production and exports have increased from both these Latin American sources.

If the United States were a small country in international agricultural markets, the law of one price linking exchange rates to dollar-denominated commodity prices would yield a proportional relationship. Since the United States is a large trader influencing world price in most commodity markets, the law of one-price relationship would suggest a less than proportional response to exchange rate changes. Historical correlations of commodity prices with exchange rate changes suggest a more than proportional relationship, however. This means more than just transmission of prices across borders is captured in the commodity price-exchange rate relationship. This may be caused by some fixed price-flexible price overshooting adjustment mechanism, or may simply be a correlation among macroeconomic variables that influence the exchange rate. Inflationary expectations are one possible factor related to both exchange rates and commodity prices. The nominal exchange rate may reflect either some investors with high inflationary expectations or loose monetary policy in the United States. Economic growth, and expectations of growth, may also influence both exchange rates and commodity prices. Thus, the weak dollar may be a cause of high agricultural prices, but may also be a symptom of broader worldwide macroeconomic forces influencing those prices.

Macroeconomic Performance and Commodity Booms

Macroeconomic variables determine the background environment in which supply-utilization events play out. Exchange rates, business cycles (economic growth), interest rates and inflationary expectations are among the more important macroeconomic factors influencing international commodity pricing. Three issues related to the macro economy bear further investigation:

- the role of recession and financial crisis in ending the earlier commodity boom,
- the role of and explanation behind agricultural prices "overshooting" exchange rate changes, and
- the role of speculation as a factor behind past and current commodity price increases.

Understanding each issue requires a better understanding of relationships between inflationary expectations, exchange rates and commodity prices.

Agricultural markets were a latecomer to the commodity boom that started about 2003 and ended in mid-2008 at the same time that agricultural prices peaked. Some have argued that a new commodity boom began in mid-2009 as the great recession ended and economic growth increased worldwide, especially in developing economies that are demanding more energy, metals and agricultural commodities (IMF, 2009). Both rapid economic growth and inflationary expectations worldwide are believed to contribute to rising commodity prices. Economic growth leads to greater demand pressure, which would be lower for commodities where income elasticities of demand, as for food, are low. If the effects observed are entirely due to demand pressure, what is being observed now is real relative price shifts, not inflation. If, as some believe, future inflation is likely, commodity prices can also represent the leading-edge of higher inflation to come in the future. In its initial stages, demand pressure due to economic growth and inflation shows up more in those prices that are flexible, and less so in prices that are sticky. Hence, commodity prices increase before manufacturing prices, services prices or wages, and likely more so in the short run than the long run.

Nominal exchange rates also reflect inflationary expectations. One explanation for the weak dollar both in the first half of 2008 and now must be looser monetary policy in the United States than abroad. The United States began cutting interest rates to fight inflation in August 2007, while the European central bank did not do so until

July 2008, when the dollar reversed direction. These were key moments in the 2007-08 commodity price run-up. It is believed that the United States is now holding to low interest rates, and implementing quantitative easing to a degree that is more likely to be inflationary than are the monetary policies of most other developed country central banks. As of April 2011, the European central bank began to increase interest rates, while the U.S. Federal Reserve maintained quantitative easing through June 2011. In some developing countries inflation is now more prominent, and policies are shifting in some places to fight potential future inflation.

On the other hand, it must be recognized that measures of current inflation in the United States remain low, and excess capacity and unemployment remain important problems. Commodity prices, including agricultural prices, may be increasing in dollar terms both because of economic growth that is stronger now in developing countries, and because of the potential for future increases in inflation. Exchange rates are both a symptom and a transmission mechanism for these effects.

Recession and Financial Crisis

The 2003-08 commodity boom began with recovery from the 2001 recession. The recession that spread worldwide in mid-2008 and became severe due to the financial crisis in September 2008, is one important factor explaining the fall in agricultural commodity prices. Until those macroeconomic events played out, expectations in mid-2008 were that some prices could trend even higher. Moreover, the combination of recession and financial crisis led to an unprecedented collapse of world trade in late 2008 and early 2009. Worldwide, short-term trade levels fell 60% according to IMF (2010) data. WTO annual data for 2009 show a 23% fall in world trade in 2009, the first such significant fall in years. While higher prices had not earlier curtailed agricultural imports, recession and financial crisis did. Several factors may explain the collapse in trade. While incomes fell worldwide, commodities exhibiting low-income elasticities of demand saw smaller trade effects. Trade requires both foreign exchange and finance, however, so financial crisis and depreciating exchange rates in importing countries would both limit imports.

Recovery since mid-2009, which is now stronger in developing countries, apparently restarted a commodity boom and is contributing to rising commodity prices. Once again, agricultural prices have lagged energy and metals, but the pressures that led to commodity prices rising surely have spilled over to agricultural goods. Thus, business cycles and economic growth, as well as inflationary impacts, have likely contributed to price increases with recovery and price decreases during recession. Moreover, the changes in expected inflation and in the value of the dollar have likely led to a shift in mean agricultural prices to a higher level now than was realized in 2000-2005. A new recession could once again lower agricultural prices.

Speculation

Inflationary expectations, a weak dollar and economic recovery are factors that have led to "financialization" of commodity markets, and the emergence of "speculators" using investment instruments based on commodity prices. The commodity booms have spawned commodity index funds and exchange-traded funds, allowing investors to potentially profit from rising commodity prices. There were substantial increases in demand for agricultural commodity futures contracts, evidenced by huge increases in the number of contracts issued and open interest in those markets. That interest has been attributed to these new investment vehicles and to expectations by some investor's that commodity prices would continue to rise.

This demand for futures contracts to back commodity-based investment vehicles has led some to argue that the substantial amount of money going into these investments fueled higher grain prices. Others argued that the price expectations on which these investments were based were unrealistic in light of market fundamentals. According to that argument, increasing demand from uninformed speculators for financial instruments backed by commodity futures contracts created a bubble in agricultural markets and disconnect prices from supply-use balances. Controversy persists on the importance of speculation and the financialization of commodity markets as factors behind increasing commodity prices. While the sheer amount of money invested in commodities convinced many that speculation must matter, most experts in commodity markets insist that unless these vehicles in some way alter supply-use balance, spot market prices should be unaffected. It is also argued that there is no evidence that such mechanisms can be found (Irwin and Sanders, 2010; Wright, 2011). Gilbert (2010), however, believes common macroeconomic factors, possibly including speculation, may have played a significant role in 2008.

Regardless of how one stands in that debate, one factor that matters is future expectations on agricultural prices. Futures markets have historically represented the best assessment of where the market is on that. Futures prices in 2007-08 behaved differently than prior spikes in agricultural commodity prices. In the past, when there were short-term shortages and spot prices as well as nearby futures prices

increased, distant futures prices did not increase nearly as much, reflecting expectations that prices would return to lower historical means. In 2007-08, distant futures prices were at or above spot prices, reflecting market expectations that prices would continue to rise. In the current price run-up, distant futures prices for corn have remained below nearby and spot prices, reflecting expectations that prices would again return to lower levels. But those longer-term expectations are substantially above the mean nominal prices realized from 2000 to 2006. Distant futures prices for soybeans and wheat exhibit the pattern of 2008, and are higher than recent historical means.

Expectations on distant futures prices depend on two broad factors: long-run supply-use balance and long-run expectations on the macroeconomic environment. Expectations in mid-2008 may have been based on simply misinformed speculation, on expectations concerning production and demand that ultimately were incorrect but nevertheless were valid fundamentals-based expectations, or on assumptions concerning an inflationary macroeconomic scenario that proved incorrect as the great recession unfolded.

Implications for the Future

Will Demand Surges Persist?

Increasing use of corn for biofuels in the United States and increasing Chinese demand for U.S. soybean imports are key drivers of the 2011 commodity price increases. What are the likely near-term future directions for these drivers?

The United States produced 13 billion gallons of ethanol in 2010 and has production capacity today exceeding 14 billion gallons. The portion of the RFS which can be met by corn starch is 15 billion gallons by 2015. In other words, the mandated level has essentially been reached, and growth will be quite slow moving forward. In fact, from this point forward, normal trend yield increases will be able to satisfy the future increases in corn-based ethanol demand. The level and percentage of corn use for ethanol will remain high, but growth will be low.

The outlook is similar for Chinese soybean imports. Table 2 shows that Chinese soybean stocks have now reached 23% of use, the highest level of the past decade. China will not continue to build stocks much beyond this level. China will, however, continue to import large amounts of soybeans to fill the domestic gap between consumption and production—not to further accumulate stocks.

Both of the key demand drivers responsible for today's price situation are expected to have less growth in the future, but today's large demand levels will not go away. With the reduced growth rates, it will be much easier for global production to catch up with demand—a scenario that is expected to take at least two years. Prices are not anticipated to remain at the recent record levels beyond that two-year period unless there are serious weather and yield problems.

Short Term: Normal or Sub-Trend Yields?

Normal Yields Not Likely to Restore World Supply in 2011-12

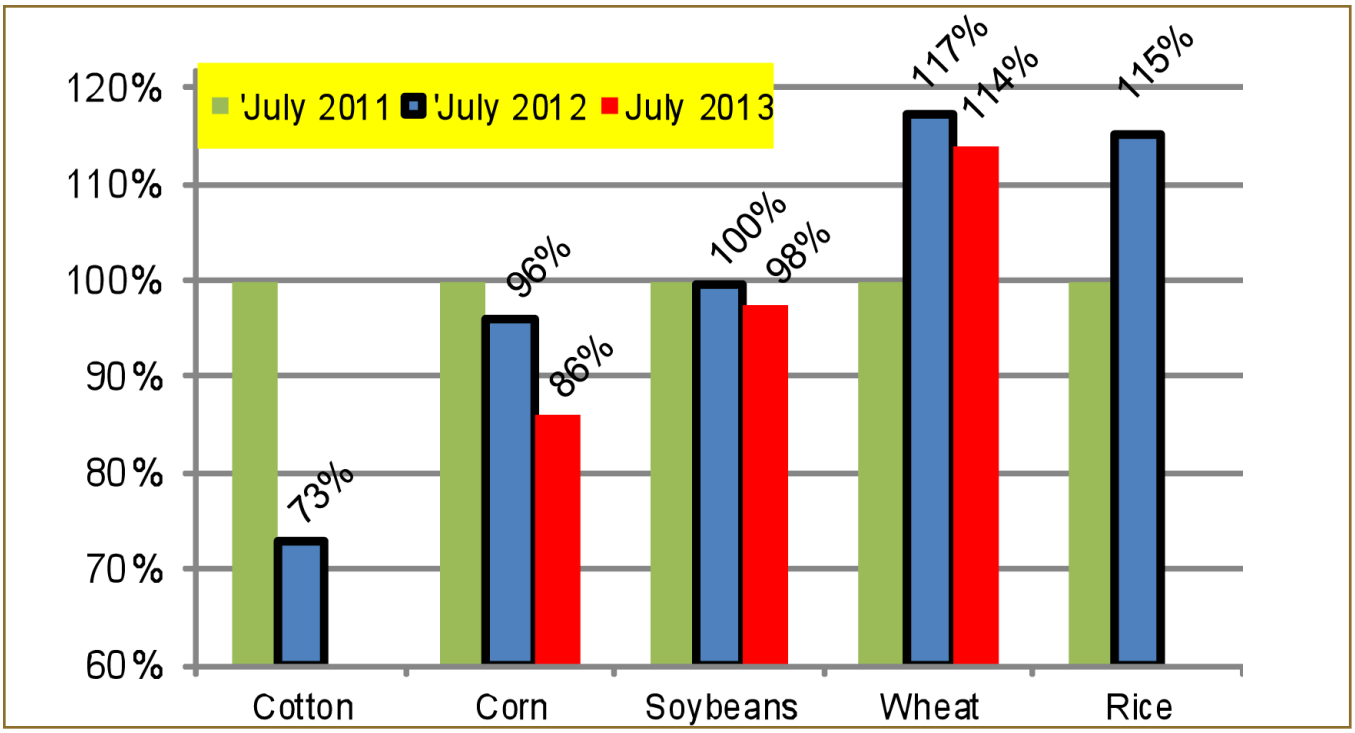
Will normal yields in 2011-12 restore more favorable world inventories? The best answer appears to be that normal yields will just allow the world to keep up with the strong demand. Stocks will not be substantially improved, and overall high prices by historical standards will tend to persist for at least one more year.

This conclusion is based on the May 2011 World Agricultural Supply and Demand Estimates (WASDE) update from USDA (WAOB, 2011), which tends to use trend yields. In the WASDE analysis, stocks-to-use ratios for total world grains would actually tighten somewhat. Stocks-to-use would improve a bit for corn, soybeans and cotton, but would erode modestly for wheat and rice. Since both wheat and rice currently have reasonable stocks levels, this implies a shift away from higher-stocks crops to lower-stocks crops. However, the important point is that normal yields in 2011-12 only modestly improve stock levels of the current high-price crops of corn, soybeans and cotton.

Cotton and corn had record high prices in the spring of 2011. Those extreme price levels reflect very tight stocks and very strong returns for producers. Thus land area is expected to shift toward those crops, moderating prices somewhat. However, prices for 2011 and 2012 would remain high by historic measures. Stocks positions for soybeans, wheat and rice are more adequate, in that order. Even with futures prices suggesting persistence of current prices for soybeans and appreciating prices in 2012 and 2013 for wheat and rice, the premium to returns to land in corn mean acreage for that crop will expand and will likely fall for wheat, rice and soybeans.

As expected, the persistence of high prices varies by commodity. Figure 15 illustrates the persistence of selected grain and oilseed futures market prices in early May 2011. The bars represent the futures prices for the July futures contracts for 2011, 2012 and 2013 expressed as a percentage of the current July 2011 price. Cotton and rice futures were not yet trading July 2013 contracts. In general, futures markets also reflect high price persistence.

Figure 15: Futures Price Persistence July 2011, 2012 and 2013 (May 5, 2011)



Source: Chicago Mercantile Exchange quotes

Much is riding on 2011-12 production. A return to normal yields barely allows the world to continue to meet trend consumption. Yield uncertainty means there may be wide swings in prices. Yields below trend imply a need to ration short supplies, with prices even higher than those of the first-half of 2011. Yields above trend could mean some moderation in prices, but not nearly as large as was experienced in late 2008 and 2009 with worldwide recession.

In the absence of yields well above trend, it appears the tight world stocks situation cannot be overcome in one crop year, and high prices will persist for two crop years or longer. In essence, high prices, at least by historical standards, appear to be the new norm. Meanwhile, the world is walking close to the edge of food insecurity with the potential for extraordinarily high prices in any year of major production setbacks.

Sub-Trend Yields in 2011-12

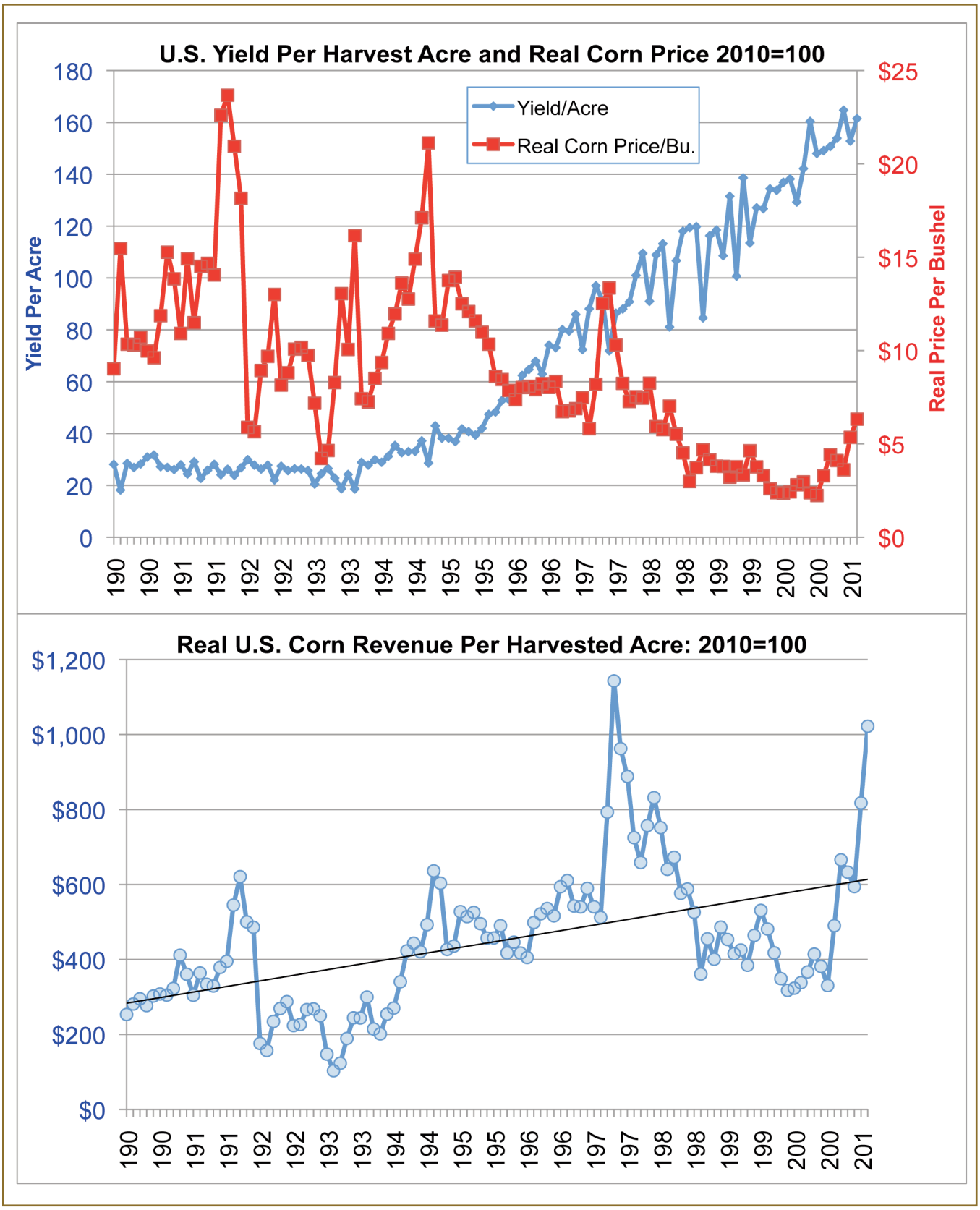
Sub-trend yields are, of course, a possibility in 2011-12 and imply rationing of supplies that will be too short to meet trend consumption. Total grain yields one standard deviation below trend would represent a drop in production of about 50 mmt. The reduction of 50 mmt from trend would be similar to the shortfall of production that occurred in 2010-11. Back-to-back shortfalls of that size would imply the necessity of end users cutting back about 1% on total usage from 2010-2011 levels. While this seems like a small amount, it is large in a world of growing demand. For historical perspective, since 1960-61 there have only been four years when total consumption declined, and three of those years were less than 1%.

Production shortfalls in corn, soybeans or cotton would require more severe end-user cutbacks, since there are almost no stocks on which to draw. The most serious cutbacks in usage would be in corn, where a one standard deviation yield reduction from trend would reduce world production about 28 mmt. Similar levels of production shortfalls in wheat and rice would not require as severe of cutbacks in use, because there are more adequate stocks from which to draw. In an open market, the mechanism for usage reduction is higher prices. Prices must rise to discourage a sufficient number of end users to reduce purchases. The particular commodities that experience supply shortfalls would also be important to price levels. Supply shortfalls in corn, soybeans or cotton, where shortages are already dire, would likely generate new all-time record prices. On the other hand, if the production set-backs were in wheat or rice, new price highs might not be established.

Longer-Term: Can Supply Catch Up?

Barring any major weather problems, the current tight stocks period and relative high prices are expected to continue

Figure 16: Real Corn Prices (2010=100), U.S. Corn Yields and Real Revenue per Acre



Source: USDA (NASS and ERS)

for the next one to two years. Ultimately, the question is whether world supplies can not only catch up with recent demand increases but keep pace with demand growth over time. An added question is what the impacts would be on prices, food and fuel availability, and food security.

History suggests that periods of unusually high prices do not continue and, in fact, have been followed by long periods of low prices. Figure 16 illustrates these price cycles. When spanning such a long time period, two problems arise: inflation had large impacts on prices, and yields changed sharply over this period. For this reason annual nominal corn prices received by U.S. farmers are adjusted by the CPI (2010=100) to form a real price. These real prices are shown in the upper portion of the figure and are scaled on the right hand side. The impact of steady yield increases after 1940 also had a powerful influence on real prices. These yield increases are the primary reason for sharp declines in real prices, especially after 1950. Corn yield per acre is also shown in the top of the figure and is scaled on the left side.

The lower portion of the figure shows real revenue per acre, a combination of the real price times the yield per acre. As such, it shows the combined impacts of the two big changes over this long period. The cycle becomes evident with four periods of revenue surges: during World War I and World War II, the 1970s and very early 1980s, and the current period of 2007 to 2011, a cycle which is now playing out. In all four, a demand surge caused prices to initially move higher. In each of the first three periods, there was a large price collapse after the demand surge, with subsequent long periods of low prices and low revenues.

The robustness of each boom/bust cycle depends on the magnitude of the demand shocks, short-crop production years during the demand shocks, the responsiveness of supply to higher prices, and macroeconomic events. As an example, the World War II surge was not as large due to the use of wage and price controls, and the downside in the 1950s was not as severe due to strong macroeconomic growth in the United States.

Similar to the first three periods, the 2007-2011 boom is in place due to demand surges—for biofuels and soybean exports to China. One of the most important potential differences is that the factors which caused the previous three demand surges did not persist. In the World Wars, European production was reduced due to hostilities and the United States, Canada and Australia became the major food suppliers to Europe. When hostilities ended, European farmers returned to production and U.S. food exports fell. In the 1970s, corn exports, as an example, increased by a factor of nearly five times from 1970 to the peak in 1979. But, by 1985, exports had declined by one-half.

Today, biofuels demand is expected to persist up to the 15-billion-gallon ethanol mandate under the RFS, and Chinese soybean demand is expected to persist and may even grow, but at a slower rate. The surging nature of those demands over the past five years was one of the critical factors in the price peaks. These demands will now grow much more slowly as the United States approaches the RFS mandate and as China has built soybean stocks back to acceptable levels. This means the world supply will have a better chance to catch up in coming years and return stocks back to more adequate levels. This may not result in a bust, but rather a moderation of the extreme prices and high revenues experienced in the 2007 to 2011 period. Of course, other factors—such as biofuels policies around the world, supply responses and macroeconomic events—will all influence how this cycle finally plays out.

Demand Challenges and Opportunities

The United Nations estimates world population will reach 9.1 billion people by 2050, with nearly all that growth coming in developing countries. People will be living in primarily urban areas—wholly dependent on someone else for food production. FAO contends overall food production must increase by 70% by 2050—and that does not include growth in other uses such as biofuels. Furthermore, 80% of the production expansion must come from higher productivity, with only 20% from more production area. This expansion must be done in a world of dwindling natural resources in a period of potential global warming, which may slow productivity growth rates. This is a troubling vision of the future challenges (FAO, 2009).

While there are many challenges, there are opportunities, as well. To the extent prices are higher in the longer run, farmers will be induced globally to increase acreage and production. In other words, there would be a global response to the higher prices resulting in more crop production and ultimately a moderating of high prices. At present there are many regions of the world with grain yields less than half those in the United States, but with adequate soils and available rainfall. One study of yield gaps for major crops (Licker, et al. 2010) estimates that 50% more maize, 40% more rice, 20% more soybeans, and 60% more wheat could be produced globally if the top 95% of croplands produced at their current climatic potential. Clearly, in practice all this potential could not be realized. It does, however, illustrate the broad scope for yield increases globally if economic incentives are strong.

Table 4: Test Plot and Country Average Maize Yields: Selected Countries 2008 to 2010

Country	Test mean yield (bu/ac)	Test mean yield stdev (bu/ac)	Tests (n)	Country yield average (bu/ac)	Yield gap (bu/ac)	% of test mean	Testing mechanization level
United States	199	36	723	156.9	41.9	79%	High
Vietnam	103	23	86	69.2	34.0	67%	Low
France	221	31	133	143.9	77.6	65%	High
Italy	231	29	76	146.5	84.9	63%	High
Argentina	188	52	88	114.1	73.6	61%	High
China	153	30	140	84.6	68.1	55%	Intermediate
Thailand	121	22	184	65.7	55.5	54%	Low
Philippines	105	29	277	40.8	64.7	39%	Low
Indonesia	107	32	51	38.2	69.1	36%	Low
Pakistan	148	21	50	45.5	102.7	31%	Intermediate
Mexico	181	54	113	52.4	128.2	29%	High
India	142	35	114	36.2	105.8	25%	Intermediate

Source: Mike Edgerton, Monsanto Corp.

Table 4 provides data on test plot corn yields compared with farmer yields in different world regions to indicate the size of yield gaps. The test plots are composed entirely of hybrid varieties and generally do not include genetically-engineered traits for herbicide or insect resistance. This creates some differences between the test plots and local production practices. Many countries, such as Mexico and India, still plant significant amounts of open pollinated varieties (OPV), which generally have lower yields than hybrid varieties. In other countries, such as the United States, Argentina and South Africa, a large percentage of the production fields will include genetically-engineered traits for herbicide and/or insect resistance. The insect resistance traits provide superior protection from insect damage than do chemical insecticides, which can lead to higher average yields. The last column indicates the level of agronomic technology that was used in the test plots. For example, low technology could involve hand planting, weeding, harvest and nutrient application. The United States yield gap evidenced in Table 4 is around 20%, but other countries have gaps as high as 75%, indicating a tremendous potential for achieving higher productivity using existing agricultural technologies in these areas.

Higher corn prices could induce farmers in these areas to make technical changes, such as improved seed varieties or higher fertilizer use, which would help close the yield gap somewhat. In fact, this outcome could be quite positive as much of this area is in developing countries with poor farmers. Higher revenue from sales of grains at higher market prices could help alleviate poverty in these areas. The potential poverty reductions would not apply to all rural residents, but mainly to land-owning farmers.

A precondition for achieving this supply response, production increase and possible poverty reduction is that developing country governments permit higher world prices to be transmitted to their farmers. In the 2008 price run-up, many developing country governments attempted to prevent the higher world prices from spilling over into their markets. Governments adopt such policies in an attempt to protect the politically powerful urban consumers but to the detriment of their rural populations.

The magnitude of supply response over time also would depend on the difficulty of removing very important constraints in credit markets, rural infrastructure, marketing

infrastructure, crop insurance and institutions. The difficulty of making these changes will vary region-to-region, but higher price will be an inducement to move in the direction of higher productivity. The World Bank (2008) estimates that 70% of the world's poor live in rural areas in developing countries and derive their primary livelihood from agriculture. While it is not entirely clear how the different segments of the rural economy would fare from higher prices, and it would vary from one region to another, it is likely that to the extent that governments permit higher world prices to be transmitted to rural areas, farmers would respond with higher production, resulting in higher rural incomes.

The bottom line is that the short-run and long-run impacts of higher commodity prices could be very different. Short-run volatility from supply or demand shocks is inevitable. In the longer-run, however, there is potential gain in poor, rural areas through higher incomes from the induced supply response.

Another factor that works in the opposite direction is climate change. Most studies predict greater variability in rainfall and warmer weather due to climate change. In most world regions, these climate changes induce yield reductions. A recent study (Lobell, et al., 2011) estimated that climate change that occurred between 1980 and 2008 has led to major crop prices already being somewhat higher than they would have been without the climate change. Predictions for the future are for much larger yield changes, which would lead to larger price increases. This is a concern with high uncertainty, but likely to be a factor of increasing importance in the future.

Consequences Here and Abroad

Attention is already being given to food inflation—a significant potential consequence that may develop if food processors, distributors and restaurants pass along higher commodity prices. USDA (ERS, 2011) now predicts U.S. food inflation could reach as high as 4% in 2011. As of May 2011, food inflation year-over-year was 3.4%, while core inflation (CPI less food and energy) was 1.5%, resulting in an increasing relative cost for food. Energy inflation is more problematic now at 21.5%. This inflationary experience is not yet as severe as in 2008, however. In July 2008, year-over-year food inflation equaled 6.0%, energy inflation was even higher at 29.3%, while core inflation was only 2.5% (BLS, 2011). It is important to recognize that these statistics mean food and energy costs were rising relative to both costs of other goods and wages at these times. In 2009, recession meant deflation was evident for these two volatile categories, while core inflation fell but did not become negative. Food inflation in 2008 was stronger in many developing countries than in major exporting countries, even when world prices were not fully transmitted to domestic prices. According to the Organization for Economic Cooperation and Development (OECD), by February 2008 food inflation had already exceeded 20% in Kenya, China and Sri Lanka, and was at more than 10% in another eight developing countries (OECD-FAO, 2008). Only three developing countries were reported to have experienced food inflation less that 10%; all were higher than U.S. food inflation at 5.1% at that same time. In poor countries, the share of expenditure on food is much larger, food expenditures include more staples, and food prices include smaller food processing and distribution costs. Higher food prices were politically sensitive and even led to food riots in many countries at price increases much smaller than the increases in world prices.

In developed countries, the shrinking margins of livestock producers, food processors and distributors cushioned the effects on consumers in 2007-08. More of the grain and feed cost increases may be showing up as food inflation in developed countries now, as livestock prices are higher and processors and retailers are less willing to reduce margins. Food inflation in many developing countries in 2008 exceeded U.S. food inflation in both 2008 and today.

Poverty and hunger became worse where domestic food prices rose. The World Bank (2009) estimated that high food prices in 2008 put an additional 105 million people in extreme poverty. USDA (Rosen and Shapouri, 2008) and FAO (2008) estimated that between 75 million and 133 million additional people suffered from malnutrition. The World Bank (2011) now estimates that the current price run-up has put an additional 44 million people in extreme poverty. Where policy measures were pursued to mitigate effects of high world prices, effects on poverty and hunger were reduced, however (Headey, 2011).

Policy Issues

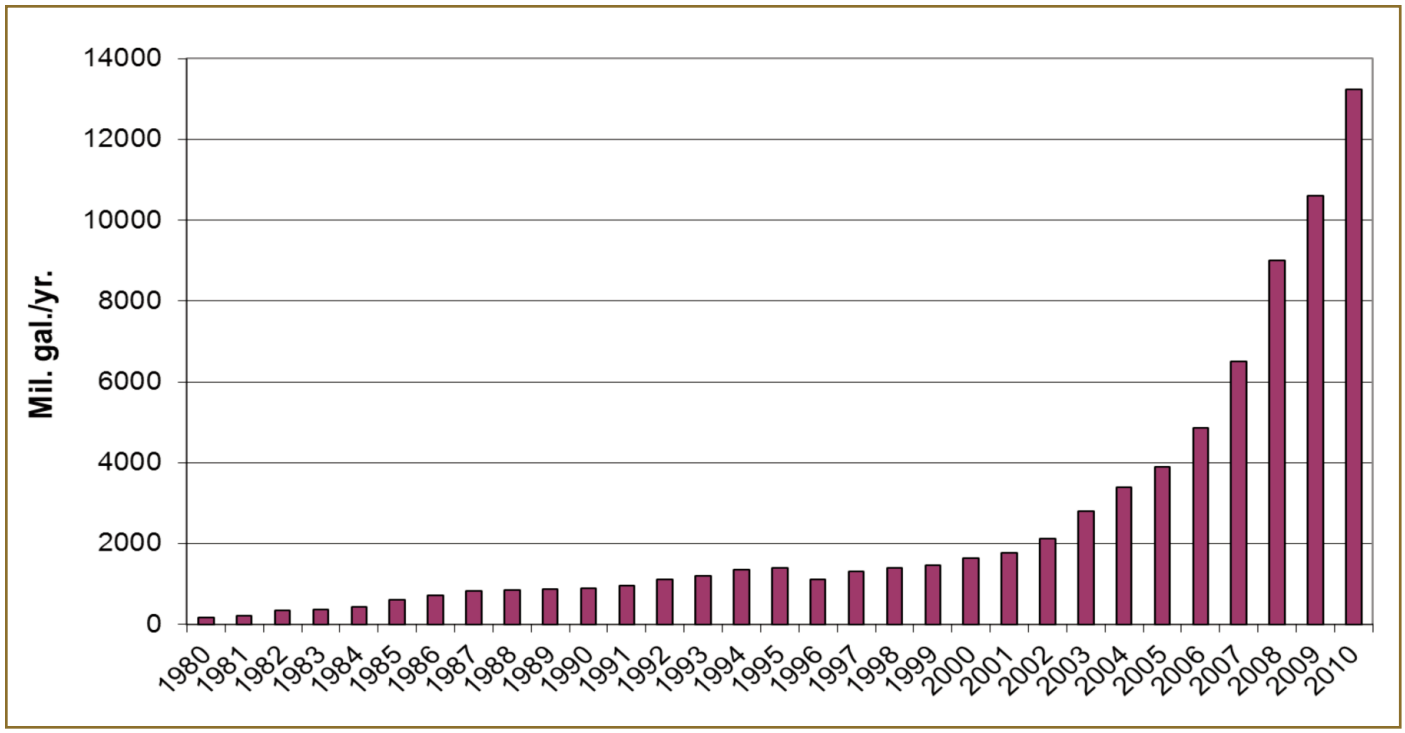
Three distinct sets of policy issues are relevant to the above discussion: biofuels policy, U.S. agricultural policy and trade policy.

Biofuels Policy

Mandates and Subsidies

The United States began subsidizing biofuels in 1978 with the passage of the National Energy Policy Conservation Act of 1978 (Tyner, 2008; U.S. Congress, 1978). Biofuels policy objectives have evolved over time but have included increasing farm income, improving environmental quality, and increasing

Figure 17: Ethanol Production



Source: Renewable Fuels Association (www.ethanolrfa.org).

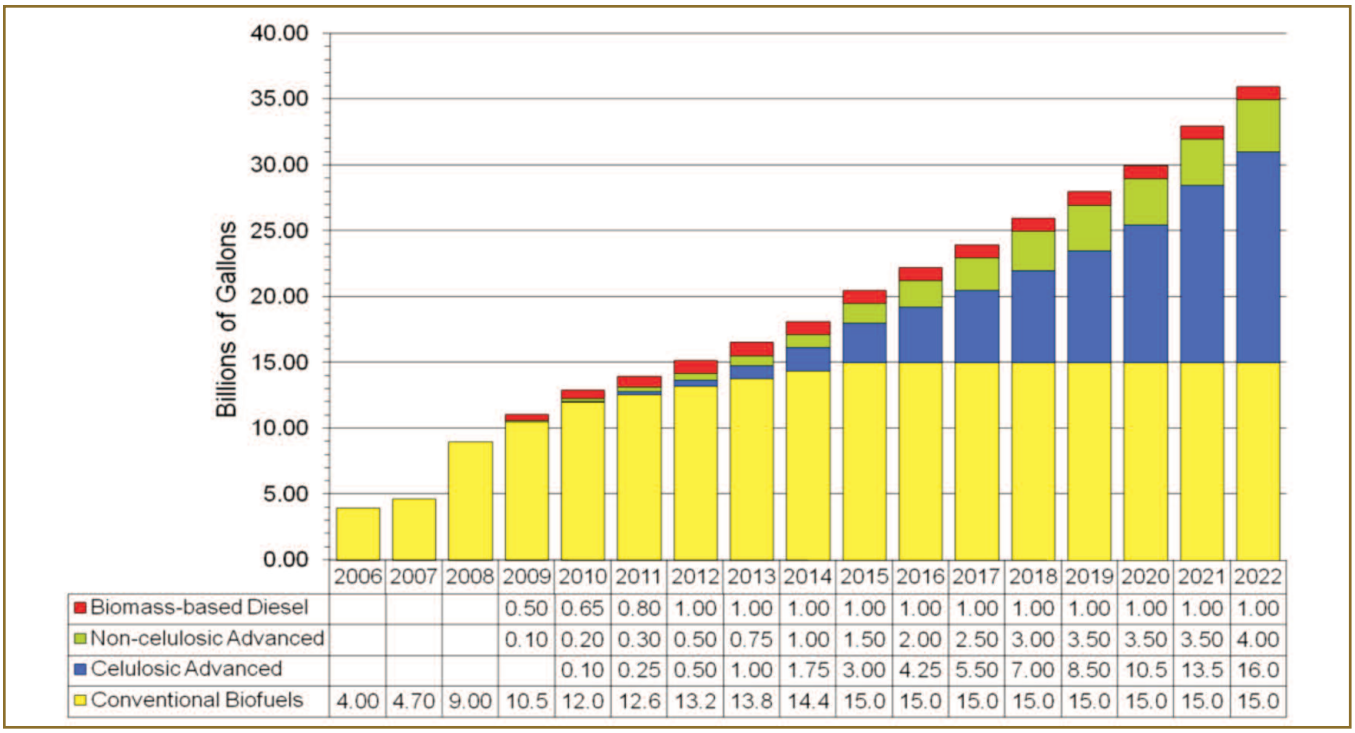
national energy security. Since 1978, the subsidy has ranged between 40¢ per gallon and 60¢ per gallon of ethanol, and is currently 45¢ per gallon. From 1984 to 2003, the price of crude oil averaged about $20/bbl., and the subsidy was sufficient to promote a slow but steady growth in the ethanol industry as illustrated in Figure 17.

In 1983 ethanol production was 375 million gallons, growing to 2.8 billion gallons by 2003. By 2010—in just seven years—it jumped to 13.0 billion gallons. By 2005 crude oil was more than $40/bbl., on its way to a monthly average peak around $130 in July 2008. In addition, in 2005 energy legislation (U.S. Congress, 2005) effectively promoted greater use of ethanol as an additive because oil companies did not receive immunity from prosecution for using MTBE, a known toxic chemical that was found leaking into ground water supplies in several states. The same legislation also created the first Renewable Fuel Standard (RFS). However, the combination of higher oil prices and a subsidy calibrated to render ethanol profitable at $20 oil had already ramped production beyond the minimum levels of the first RFS. Until 2008, the key policy instrument for biofuels was the subsidy, which at the time was 51¢ per gallon of ethanol.

The subsidy and increasing crude oil prices established a strong link between crude oil and corn prices, with a correlation of 0.80 between 2006 and 2008 (Tyner, 2010). Prior to 2006, the correlation between both crude oil and corn and ethanol and corn had been very low—sometimes even negative. Between 2006 and 2008, the correlation between crude oil and corn was strong, in part because ethanol was needed to supply the oxygenate market. In 2008, the ethanol market changed. The oxygenate market was becoming saturated and corn prices rose significantly, rendering ethanol production unprofitable in many cases. The largest firm in the industry went bankrupt, and nationally, more than 2 billion gallons of capacity shut down because of poor profitability.

In 2008-09 and afterward, a close relationship was established for the first time between ethanol and corn prices, with a correlation of 0.84. In 2008 and part of 2009, it was due to poor profitability. Ethanol could only be produced profitably if corn price permitted, so the two prices moved in lock-step. Subsequently, the blend wall became binding, keeping a strong price link between ethanol and corn. The important point here is that there have been two "regime" changes: first in 2006 when the price link between crude oil and corn became strong, and second in 2008 when the price link between corn and ethanol became strong for entirely different reasons. In December 2007, the U.S. Congress passed major new energy legislation mandating widespread improvements in

Figure 18: Biofuels Renewable Fuel Standard



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Biomass-based Diesel				0.50	0.65	0.80	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Non-celulosic Advanced				0.10	0.20	0.30	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	3.50	3.50	4.00
Celulosic Advanced					0.10	0.25	0.50	1.00	1.75	3.00	4.25	5.50	7.00	8.50	10.5	13.5	16.0
Conventional Biofuels	4.00	4.70	9.00	10.5	12.0	12.6	13.2	13.8	14.4	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0

Source: Energy Independence and Security Act of 2007, U.S. Congress.

energy efficiency and a new, much larger RFS, now known as RFS2 (U.S. Congress, 2007). The RFS, depicted in Figure 18, includes four categories of biofuels totaling 36 billion gallons of ethanol equivalent biofuel by 2022. Of that, up to 15 billion gallons can be starch-based (mainly corn) ethanol called conventional biofuels. The 15-billion-gallon level in RFS2 is reached in 2015, and the industry capacity is already about 14.5 billion gallons. The remainder is non-corn based biofuels.

The impact of any biofuels policy changes will be determined, in part, by what happens to crude oil and gasoline prices. Figure 19 contains the U.S. Department of Energy (DOE) 2011 forecast of crude oil prices out to 2035. DOE has three forecast cases: low, reference and high. For 2035, the low, reference and high price forecasts (in 2009 dollars) are $50, $125 and $200, respectively. For 2015, these forecasts are $55, $95 and $146. Essentially, the impact of policy changes hinges on the relationships among the prices of crude oil and gasoline (which are highly correlated), ethanol, and corn.

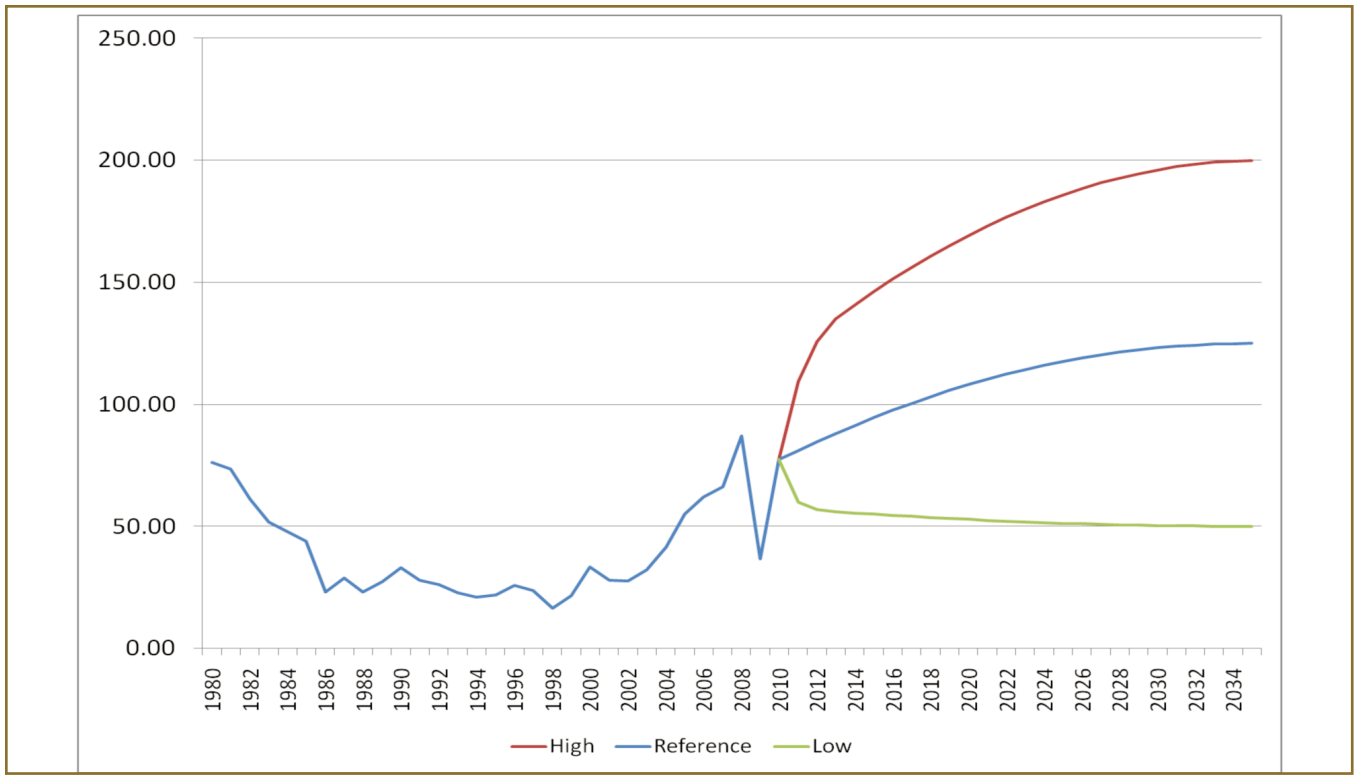
Consideration needs to be given to the potential impacts of policy changes that could be considered in the near term. The main categories of policy changes are:

- a change in the biofuels subsidy,
- a change in the biofuels mandates, such as a temporary partial waiver,
- an increase in the blending limit for standard gasoline type fuel and the associated blend wall, or
- a change in the mandate rules that would permit corn ethanol to be used in the advanced biofuels category.

Under certain conditions, the administrator of the U.S. Environmental Protection Agency (EPA) can waive or reduce the mandate if significant economic damage is deemed to be caused by the mandate. In 2008, Texas Gov. Rick Perry requested EPA reduce or waive the mandate because of the damage being done to the livestock industry by high corn prices. EPA declined to issue a waiver. For the mandate to be credible, EPA would need strong justification for waiving or reducing the mandate. Even if the mandate were waived, with more than 14 billion gallons of capacity already in place, it is not clear that production would fall much as long as firms could cover variable costs of production. That could be the case as long as oil prices remain high. If the mandate were waived and oil prices fell significantly, there could be a drop in corn ethanol production. The more likely scenario, however, is continued high oil prices, so even waiving the mandate would not likely have much short-run impact.

EPA has approved increasing the standard blend level to 15% for autos built since 2001, but not for older vehicles, motorcycles and small engines. Since the 2001 and newer

Figure 19: 2011 DOE Crude Oil Price Forecast (2009 $/bbl)



Source: U.S. Department of Energy

vehicles constitute about 62% of the vehicle fleet, it is not certain that station owners would make the switch to E15 even if final approvals are granted. For now, the E10 limit remains in force. Given the much higher level of the mandate, the RFS2 has become a much more important policy instrument than the subsidy. With the blend wall, it is likely that only a small portion of the subsidy gets passed on to ethanol producers, so the remaining major current driver of biofuels policy is the RFS2. This is significantly different from the situation in 2008 and earlier.

Multiple changes in biofuels subsidies are now being considered. But as long as the blend wall remains binding, what happens to subsidy policy does not matter much for the ethanol market, since most of the subsidy under a binding blend wall goes to consumers and blenders. If the effective blend limit is increased, the subsidy policy and subsidy mechanisms become more important. If the blend limit is increased, the RFS2 for corn ethanol becomes an important factor. Here are four expected impacts of some possible combinations of policies and prices:

- With the blending limit relaxed and the subsidy continued:
  - o Under high oil prices, the subsidy could pull ethanol production beyond the RFS2 level, depending on relative corn and gasoline prices.
  - o Under low oil prices and high corn prices, the subsidy would increase the amount of ethanol that could be produced and thus continue pressure on corn prices.
- With the blend wall in effect:
  - o The subsidy has little impact unless the point is reached where plants start to shut down because of an inability to cover variable cost. If that occurs and production falls below the blend wall, the subsidy comes back into play.
  - o The only way the RFS could be met under the blend wall is if E85 consumption is significantly expanded. That would require large infrastructure investments and probably cross-subsidization to make the E85 more price-competitive for consumers.
- With a waiver of the RFS2 quantity:
  - o If oil prices remain high such that the existing capacity continues to cover variable cost, plants would continue to produce, so the waiver would have little impact.
  - o If oil prices were low such that plants could not cover variable cost, the waiver would result in plants shutting down, at least temporarily. The waiver would mean the RFS market guarantee was temporarily removed.
- Change in RFS2 to permit corn ethanol to count as an advanced biofuel: This is not possible under current

legislation. If the legislation were changed, effectively increasing the corn ethanol RFS, the demand for corn and its price would increase accordingly. This option has been suggested by some in the ethanol industry.

Clearly, there is a high degree of uncertainty in terms of market conditions and government policy. The impacts of any policy changes would be conditioned by the prevailing market conditions.

To what extent have the government policy objectives described at the beginning of this section been achieved? Clearly, income for crop farmers has increased. However, livestock farmers have been adversely affected. The environmental benefits from corn ethanol are likely positive, but not as large as originally hoped (EPA, 2010). Energy security is somewhat enhanced with ethanol, amounting to about a half million barrels per day of gasoline-equivalent fuel. Total U.S. oil consumption is about 19 million barrels per day, and globally, 89 million. To put the ethanol number in perspective, the Libya conflict has pulled a bit more than one million barrels per day off the market. In addition, there have been perhaps unintended consequences of significantly higher corn prices due, in part, to biofuels. Given that higher farm income was one of the original objectives, certainly higher corn prices were part of that objective. But one cannot argue that $7/bushel corn was envisioned when the move down the biofuels pathway began. The total impacts of the inelasticity of corn demand introduced by the fixed mandate were not adequately anticipated either in terms of price level or price variability.

Cellulosic Biofuels

As is clear from Figure 18, the biofuels mandates in the RFS2 encompass cellulosic biofuels, other advanced biofuels and biodiesel. The cellulosic biofuels component alone is 16 billion gallons of ethanol equivalent by 2022. With no commercial cellulosic biofuels plants in the United States today, EPA has been forced to waive most of the cellulosic biofuels mandates for 2010 and 2011, and will need to do the same for 2012. There are no commercial plants today because none of the cellulosic conversion processes are economically competitive with gasoline and diesel. The only guarantee of a market for the product is the RFS2, and investors are reluctant to commit the hundreds of millions of dollars that would be needed under that condition.

What would be the impact on food prices if a successful cellulosic biofuels industry were developed? The argument has been that cellulosic biofuels do not compete with food/feed, but that is not completely true. The limiting factor is land. Cellulosic biofuels can come from crop and forest residues or from dedicated energy crops. Land use would not be significantly impacted by use of residues. Residues might be available to fulfill half of the RFS2 mandate, but dedicated energy crops would be needed for the rest. Dedicated energy crops would require land that today is largely cropland pasture, pasture or used to cultivate hay. In other words, there would be some competition via the livestock sector. We have already seen higher prices for pasture land and forage crops. At this point, good estimates are not available on the extent to which this competition might lead to higher livestock prices.

World Biofuels Policies

The United States is not the only country that has established policies to promote biofuels. The European Union (EU) has a goal of 10% renewable automotive fuels by 2020. The U.S. volumetric mandate is roughly 14% by 2022. Hertel et al. (2010) evaluated the impacts of U.S. and EU biofuels policies separately and in combination, concluding that the impacts of both areas implementing policies are greater than the sum of each acting alone. This conclusion makes sense, in that larger biofuels demands push on a limited land supply. As more and more land is needed, the productivity of land to be converted to biofuels crops is lower, and consequently, more land is needed. In other words, the global land supply system is non-linear with high quality land being taken first, and lower quality land being used as demand increases. Other countries have advanced biofuels policies, as well, notably Brazil with its large ethanol program. Clearly, the impacts of all the global biofuels programs taken together could be quite significant.

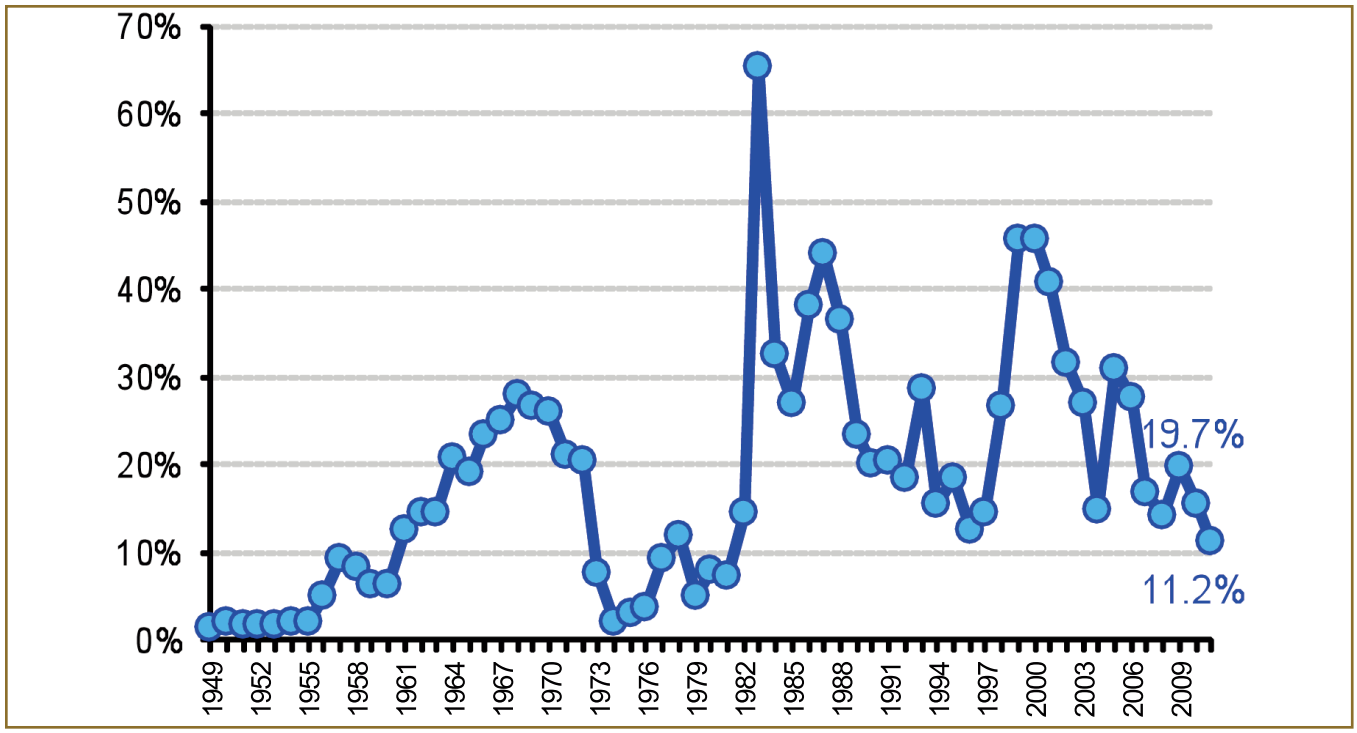
U.S. Agricultural Policy

Is this a new era that has changed the environment for establishing U.S. food and agricultural policy from one of relative abundance to one of shortages? How might policy differ in a period of shortage?

Policy of Abundance

U.S. agricultural policy has primarily been a policy of abundance. The United States has generally been blessed with the ability to produce more than could be consumed at profitable prices for producers. There have been a few periods in the past 100 years when the growth of demand outpaced production and short periods of shortage ensued. Those include World War I, when European food production was limited; again in World War II; the 1970s, when Soviet Union demand surged and U.S. monetary policy sharply devalued the dollar; and the current period when biofuels, population, world income and monetary policy are once again driving demand.

Figure 20: Direct U.S. Government Payments as % of Net Farm Income



Source: ERS, USDA, Farm Income Data Files

However, periods of abundance have dominated, providing abundant food at low prices but with generally low farm incomes and considerable instability in prices and farm incomes. Policies of abundance were designed to reduce supply, increase demand and thereby increase and stabilize farm incomes. Supply reduction was the objective of land set-aside programs, and partially of programs such as the Soil Bank, and the current Conservation Reserve Program (CRP). Supply reduction motives have always been mixed with conservation objectives to gain political support. Clearly these programs did/do have multiple objectives. Demand stimulation programs have been numerous: Food for Peace; school lunch programs; food stamps (SNAP); export subsidies; export promotion; and biofuels mandates and subsidies.

Periods of abundance have been characterized by low agricultural prices and low farm incomes. Since the 1950s, the federal government has used agricultural policy to increasingly provided income support during periods of abundance. Figure 20 shows the general uptrend in government payments as a percent of U.S. farm income. During periods of surplus production, the government's role has often reached 20% to 45% of sector income. These periods include most of the 1960s and early 1970s, and 1983-2006. The exceptions are periods of shortage in 1973-1981, the mid-1990s when Asian demand was growing prior to the Asian financial crisis in 1997, and the current time period. U.S. policy today was primarily developed during a period of abundance and therefore may be misaligned in the current period of shortage.

Policy of Shortages

Policies of shortage would emphasize programs that stimulate supply and do not subsidize demand with taxpayer funds or political mandates. U.S. experiences with policies of shortage are limited, and the current high degree of inelasticity complicates the issue even more. Wage and price controls were used in World War II and U.S. farmers were given military deferral because of the strategic need to keep food production at high levels. In 1973 to 1975, the land accumulated in the Soil Bank was released and returned to crop production. In 1973, U.S. soybean exports were embargoed for a short period due to insufficient stocks. A grain export embargo was used again in 1980 as a political tool to punish the Soviet Union for intrusion into Afghanistan.

Today, a shift to policies of shortage would focus on supply and demand components, as well. The role of the 31.2 million acres of land in the CRP could be a central focus on the subject of available land area. The size of that reserve would be a critical focus. A more flexible policy toward haying and grazing of the land that stays in the reserve would be helpful. Clearly, yield technology has and will

continue to be the primary way to enhance supply over time. Research and education are the primary vectors to promote improved yields, and that requires increased investments in agricultural research.

An examination of demand stimulation programs would be important in a policy of shortage. Biofuels mandates and subsidies, export subsidies and food consumption subsidies all would be considered.

Setting Priorities

Policymakers could define guidelines as to which end users had priorities when agricultural products were in short supply. In essence current biofuels mandates give priority to the use of grains and oilseeds for fuel over other uses. Highly volatile prices are then the allocating mechanism for short supplies among non-fuel users in a very inelastic world. One clear goal of policy could be to seek ways to increase adjustment flexibility during supply shocks.

There are always multiple objectives in policy. In surplus production periods, it is politically valuable to strive for any objective that has positive benefits to someone. In periods of shortage, there should be processes for deciding which of the multiple objectives have priorities, or leave those decisions to the marketplace. Agricultural and food policy has had many objectives, and policy of shortages could encourage policymakers to prioritize those objectives.

The history lessons of the last 100 years suggest that periods of shortage are short-lived, and have subsequently been followed by long periods of surplus. No one can answer whether the current period is truly a new era, but clearly some aspects of the current shortages are driven by public policies of countries worldwide.

Trade Policy

Trade policy is both a means by which countries cope with high and volatile international commodity prices and a reason why those world prices are so volatile. The more countries have isolated themselves from world markets to stabilize their own domestic markets, the more unstable the world market (Bale and Lutz, 1979; Tyers and Anderson, 1992). Trade policy responses to stabilize domestic markets help to explain some of the more difficult issues, and possibly incorrect explanations of the 2007-08 world price increases.

While new trade policy changes, such as renewed export restrictions, may not be contributing significantly to the current increases in world prices, concern with price volatility and debate on stabilization strategies is prominent in international policy debate, and is part of France's current G20 initiatives. A consortium of international organizations, including UN agencies and the OECD, are now proposing reopening the WTO agenda to include disciplines on agricultural export restrictions and measures to enhance world food security. Proposals to stabilize global markets are emanating from the International Food Policy Research Institute (IFPRI), G20 discussions, and France. Many authors and institutions (International Policy Council, IFPRI, World Bank, OECD, FAO) also recommend more open and transparent trade regimes as a response to recent food crises. But many countries seem to be ignoring that advice.

Domestic Stabilization

One strong rationale behind stockholding and self-sufficient trade policy regimes is the desire for stable domestic markets. Countries like China, India and other Asian countries pursue this goal diligently in food markets, while relaxing it to an extent in feed or other markets. Many countries have exhibited a preference for stable food markets. Recent trade policy debates have addressed this tradeoff, considering both domestic stabilization strategies of individual countries and strategies to stabilize global markets (see Abbott, 2010 for a review). Concerns with the domestic stabilization approach arise because of the spillovers to international trade, and because policies are likely to be very costly, especially if they involve substantial stockholding.

Prior to the 2007-08 world food crisis it was believed that instability in many countries was, to a greater extent, the consequence of domestic events, like production shortfalls, than variation in border prices (World Bank, 2005). A liberal trade regime and an open border would therefore result in a more stable domestic market. But countries that had opened borders prior to 2007 and relied on trade for food supplies faced high domestic prices and high import bills.

From a short-run perspective, the events of 2007-08 look like a dramatic change in the distribution of world prices, and price variability relative to domestic production. Many have asserted that grain markets are now more volatile. A longer-term view is that world agricultural prices have exhibited short spikes after long periods of relatively low and stable prices. The current period differs somewhat in that events are related to and may be a continuation of the demand shifts that precipitated the 2007-08 crisis. Intelligent decisions on how to use trade policy, if a national government desires some degree of domestic price stability, require a better understanding of what the world price distribution will look like in the future. In the absence of that understanding, it is not surprising that some countries, seeking a strong degree of stability, wish to pursue simple

isolating strategies, and may emphasize self-sufficiency to a greater extent in the future. But if the large food producing countries continue to do so, the international market will remain very unstable.

WTO Commitments

One hope for ongoing (and past) WTO negotiations, and the inclusion of agriculture since the Uruguay round of negotiations began in 1986, was that trade liberalization would lead to more stable international agricultural markets. But the events of 2007-08 suggest that WTO disciples had accomplished little to help bring that outcome. Neither the export restrictions nor the tariff cuts that countries used to isolate domestic markets then were in violation of WTO commitments. The WTO has focused on market access in a world of surplus production—not on trade policy changes when worldwide shortages may be evident. Limiting exports taxes was discussed as the agenda for the Doha round of negotiations began, since the EU had imposed export taxes in the mid-1990s when world prices increased. But that topic fell off the agenda.

WTO tariff bindings are maximums, so countries are free to reduce tariffs below their commitments, as many countries have recently done. There are calls now for more free and open trade, as well as for further tariff cuts by importers (eg. IFPRI, IPC). That is driven by the fear that tariffs will be restored to high levels, should low world prices and surpluses re-emerge, and the hope that freer trade would lead to more stable world markets. However, current disciplines allow countries to vary tariffs in a way that mimics a variable levy and stabilizes import access.

Export Restrictions

Disciplines on export restrictions are among the most prominent policy proposals to cope with international price volatility. Export quotas that permit something like normal exports, but isolate domestic prices from world prices, have been proposed as a better alternative than the simpler bans on exports that were commonplace in 2008. Getting export policy back on the WTO Doha round agenda may be timely, but complicates negotiations that are not now promising. There needs to be fairness in the limitations imposed on the use of trade policies to stabilize—proposals that limit only some countries' stabilization tools while leaving unaffected policies of others are unlikely to be accepted in international agreements.

International Stabilization

For world markets to become more stable, and for trade liberalization to contribute to that stability, large traders and large, self-sufficient producing countries all need to follow more liberal, open trade regimes. Importers, as well as exporters, need to participate in the liberalization.

It remains an open question whether a liberalized world market in food grains would bring about a sufficient degree of stability to satisfy a country such as China, which now permits little variation in its domestic rice and wheat prices.

As an alternative to each country pursuing its own beggar-thy-neighbor stabilization strategy, strategies to stabilize international markets have been proposed. In a recent policy brief, IFPRI calls for an international grain reserve scheme (Fan, Torero and Headey, 2011). Some have argued that the instability in world markets represents a bubble disconnected from fundamentals. They propose "virtual reserve schemes" where financial, not physical interventions, are used to stabilize markets (von Braun and Torero, 2009). In the early 1990s, the work on grain stockpiling began to consider financial alternatives because the expected distribution of world prices could mean stocks would be held for a long time at high cost. That issue persists, with greater uncertainty now as to the future distribution of world prices. Better understanding of the causes of price increases in 2007-08 and now will lead to better assessments of the strategies that might stabilize international or domestic markets. But if surpluses re-emerge, stockpiling for an international reserve could be a very expensive option. Experts in futures markets and stockpiling (Irwin and Sanders, 2011; Wright, 2011) question the bubble hypothesis and doubt that a financial intervention that does not influence the quantity of grain available in world markets could stabilize world prices. Work in the early 1990s on international market stabilization concluded that such efforts were likely to be costly, and would follow the fate of failed international commodity agreements that had been unable to effectively stabilize markets before that time. Those failures were attributed to both costly stocks accumulation and the political difficulty of coming to a political consensus among countries with divergent interests (Gilbert, 1996).

Current trade policy regimes have and continue to contribute to world price volatility. The extremes resulting from export restrictions are not evident now, but inelastic world markets persist because of the desire for stable domestic markets in many countries. While international cooperation may promise more stable world markets and less world price volatility, widespread cooperation is needed for that to be achieved.

Development Assistance and Self-Sufficiency

As a strategy complementary to stabilization, many countries are now seeking a greater degree of self-sufficiency, and are less willing to rely on trade for their food supplies.

Accomplishing that will require more rapid agricultural development. Foreign assistance to agriculture has been in decline since the early 1990s, however, and public investments in agricultural research have also diminished. Moreover, the policy responses of many countries that isolated their domestic markets from world price increases also prevented incentives to expand production from reaching farmers.

The UN High Level Task Force on the Global Food Security Crisis (UNHLTF, 2008) proposed a two-pronged approach to address food security issues in developing countries, issues exacerbated by the 2006-08 food crisis. One prong was to establish or shore up safety nets for the poor. This was met, in part, by providing additional funding to the World Food Program, and insuring that food aid increased at this time of greater need but higher costs. But development practitioners preferred conditional cash transfers that were ramped up in a few cases (Wodon and Zaman, 2009). The second prong was assistance to agricultural development. At the 2008 G20 meeting in Italy, an additional $20 billion was promised. While significant new initiatives have been launched, including the USAID Feed the Future program, new funding to agricultural development has been well below the $20 billion goal.

One reason why foreign assistance to agriculture had fallen was that many earlier agricultural development projects had not succeeded, and donors have been skeptical of the effectiveness of available options. The World Bank (2007), through its World Development Report published in 2007, had launched an effort to increase attention to agricultural development before the food crisis was apparent. That report explains why agricultural development matters, and what lessons may be learned from past experience. Other initiatives focusing on African agriculture have also begun as ways to foster both economic growth and poverty reduction on that continent.

Science exists or can be mobilized to foster more rapid agricultural development, and while economic issues must be faced, that has happened in some places. Foreign assistance, or at least increased financing, is required to realize this objective. As noted above, policy goals of developing-country national governments did not always align with donors and international institutions—priority has not been given to agriculture and rural poverty. Political obstacles must be overcome, and commitments of national governments are required, for greater food security in a world of higher agricultural prices to be achieved.

Based on policy responses to the food crisis, goals of developing country governments and international donor initiatives appear to be at odds (Abbott, 2009). International donors would focus new programs squarely on poverty reduction. In their trade policy responses, and in their requests to donors, national governments addressed concerns of urban consumers as much as the poor, and asked for budget support to relieve the financial costs of actions taken. Where governments were able to use tariff cuts to hold back food price increases, tariff revenue was diminished. One of the biggest demands on the World Bank's response to the 2006-08 food crisis, the Global Food Crisis Response Program, were requests by governments to restore "fiscal space" via budget support. Another downside to preventing high domestic prices is that incentives for a supply response by farmers are diminished. Imperfect integration and policy responses meant most of the strong agricultural supply response that followed the 2006-08 crisis occurred in the large, more developed exporting countries.

Summary

Agricultural prices and other commodity prices have increased again in 2011. Is this a rerun of the 2008 price spikes, or are the underlying drivers and mechanisms different this time around? Basically, it is both—some of the drivers are similar to 2008, but others are quite different. Five key issues are important elements of the agricultural commodity price story: 1) two big, persistent demand shocks 2) greater market inelasticity 3) weather and stocks; 4) Chinese policy; and 5) macroeconomic factors. Key lessons behind current commodity market events cut across these issues.

Issue 1: Persistent Demand Shocks: Biofuels and Chinese Soybeans

For 2011, the two big, persistent demand shocks driving agricultural commodity markets are biofuels policies and demand, and Chinese soybean imports. In the United States, the simplest way to express these drivers is to measure the change in acreage required to satisfy biofuels production and U.S. exports of soybeans to China. In 2005, 16.1 million acres were required to satisfy these two demands in the United States. In 2010, it took 46.5 million acres to satisfy these two demands, an increase of 189% in five years. While weather events, such as drought in Russia, are more significant now than in 2008, accumulated stocks have buffered the effects on world prices. The demand shocks on corn and soybean markets, which have persisted since the 2006-08 crisis and have not yet been met by sufficient production and stocks increases, leave those markets vulnerable to smaller supply shocks. Satisfying these two persistent demands has had repercussions throughout the agricultural supply and demand systems.

Issue 2: Market Inelasticity

One of the key mechanisms behind what is happening in agricultural commodity markets today is a reduction in elasticity, or price responsiveness, of demand and supply. The main sources of this inelasticity are:

- Tightness of land supply and more limited reallocation possibilities,
- Biofuels policy constraints,
- Higher livestock prices contributing to persistent feed demands,
- Depleted stocks and futures price incentives to store, and
- Trade policies that isolate national markets

These factors together today result in markets with much less capability to adjust demand or supply to higher prices than in normal times. All five of these drivers result in agricultural commodity markets that are much more inelastic than normal. The consequences of the combination of all of these mechanisms taken together are greater than the simple impact of each in isolation. This increased inelasticity explains much of the current higher price levels and short-term volatility of prices, both upward and potentially downward.

Land Supply More Inelastic: Land has become an increasingly limited resource in 2011 compared to 2008. The world has responded to new demands by bringing more land into production, and by shifting area from lower-demand growth crops to higher-demand growth crops. Greater demand for land has also brought increases in land prices and rents. The seven major crops that had increases in worldwide area in the past five years totaled 38 million hectares, with corn, soybeans and rapeseed accounting for more than 30 million hectares. Of that acreage, 27 million new hectares came into production and 11 million hectares shifted out of lower-demand crops. Thus, for the world, the flexibility to expand area for high-demand crops was composed of about 70% new area, with 30% by displacing alternative crops. The total land base five years ago was about 870 million hectares, so this change represents a 3% area increase in five years, faster than the increase in area in the previous decade. For the world, new acres were a more important source of area expansion. In the United States, land area was fairly stable, thus it was primarily shifting of crops from lower demand to higher demand uses. It is important to note that the three largest area increases for corn, soybeans, and rapeseed are tightly linked to the two big drivers—biofuels and Chinese soybean imports.

Biofuels Policy and Demand: Biofuels policy today is driven largely by the RFS2, which is essentially a fixed mandate for ethanol production that grows to 15 billion gallons of corn ethanol in 2015. With the amount of mandated ethanol today taking up around 27% of the corn crop (net of the by-product credit), there is little doubt that biofuels play a role in the corn price level and variability, and this has spilled over into other commodity markets. The RFS2 has been important in establishing ethanol production capacity and the minimum biofuels demand for corn realized today.

The other big driver in the U.S. biofuels arena is the blend wall, which derives from the fact that under restrictions set by the EPA, U.S. ethanol is currently blended at either E10 or E85, with the vast majority being E10. This limits the maximum amount of ethanol that can substitute for gasoline. In the corn ethanol industry, the blend wall and the RFS2 constrain ethanol production at about the same level—12.6 billion gallons. Actual production in 2010 was 13 billion gallons, but 350 million gallons were exported. The exports were made possible by the high world sugar price, which led Brazil to produce more sugar and less ethanol.

The ethanol demand for corn is essentially fixed by these two policy-determined constraints, which requires all the other demands and supplies for corn to do the adjusting.

Persistent Feed Demands for Livestock: When there is a surge in animal feed prices, as experienced in 2008 and again in 2011, it takes time for the livestock sectors to adjust. That adjustment period varies by livestock type, with poultry typically being first and beef last. The adjustments occur through reduction in herd size, which reduces output which, in turn, increases product prices. For example retail pork prices have increased 14% since 2008 and beef prices 11%. Now that the livestock product prices have made the adjustment to higher commodity prices, producers can better weather the current commodity price increases. That means less livestock production capacity adjustment would be expected now, and therefore, more inelastic demand for animal feed components, such as corn and soybeans. Prices for forage crops also have increased, which has implications for second generation biofuels.

Grain Stocks and Futures Prices: When stocks are abundant, much of the adjustment to supply or demand shocks is through changes in expected carry-out stocks. Once stocks are expected to be depleted, they can no longer adjust, and carry-out stocks demand becomes very inelastic. The difference between nearby and distant futures prices creates incentives to increase or deplete stocks depending on the sign. When distant futures prices are above nearby prices, as is the case for wheat, rice and soybeans now, there are disincentives to drawing stocks down further. Tight stocks make for less elastic markets, helping to explain spikes in prices.

Table 5: U.S., World and "World less China" Stocks-to-Use Ratios (%)

Commodity	U.S.	World	World less China	Interpretation
Corn	5.4	12.5	8.3	Low
Wheat	32.7	23.8	18.8	Normal
Rice	23.3	20.2	15.8	Normal +
Soybeans	5.4	18.4	17.4	Normal – (U.S.)
Cotton	12.0	28.6	30.2	Low

Source: Table 3 with authors' interpretation

Trade Policies that Isolate National Markets: As world prices increased in 2007 and 2008, countries altered trade policies to isolate their domestic markets from effects of those high prices, and so partially stabilize their domestic markets. The most egregious measures, and most significant as a factor behind world price spikes, were export restrictions, especially for rice. Importers cut tariffs and taxes, drew from stocks, and even subsidized imports and consumption to isolate domestic markets from world prices. The collective action of many importers to stabilize, and not to bear some of the adjustment burden required in world markets, surely contributed to the inelasticity of those markets and so to the very high prices realized.

Trade policy responses are believed to be less important in the current period of rising international agricultural commodity prices than was the case in 2007-08. While some of the extreme trade policy measures have not yet been repeated in the current agricultural price run-up, these motivations behind trade policy mean international agricultural markets remain thin and volatile.

Issue 3: Weather and Stocks

A key factor often influencing price surges is low stocks-to-use ratios. Falling stocks-to-use ratios reflect consumption gains relative to production and/or added stock holding. As indicated in Table 5, 2011 is no exception. China and world less China matter because China often is a very large stock holder, and changes in Chinese stock holding and trade policy can have a significant impact on world markets. Table 5 shows United States, world, and world less China 2010-11 stock levels in percent of use and provides a qualitative assessment of what this means for world and U.S. markets.

Clearly, the stocks-to-use ratios vary significantly among the commodities. Corn has the tightest stocks, followed by cotton and soybeans, particularly in the United States. Wheat and rice have normal to somewhat above normal stocks-to-use ratios. For that reason, wheat and rice prices have not reached the 2008 peaks despite production problems for wheat. Since 2008, there was enough wheat stock building to buffer the 2010 production shortfalls.

Issue 4: Chinese Policy

As indicated above, China has been a major stockholder of agricultural commodities, but the stocks-to-use ratio has varied considerably over the past decade for each commodity. Changes in stocks have had a major impact on world markets in cases where trade policy was relatively open (soybeans and corn in the early 2000s), but not where self-sufficiency has been extreme (wheat, rice and possibly corn now). Here are some of these changes by commodity:

- Corn: In 2000-01, China had a stocks-to-use ratio of 80%, but followed a destocking policy through 2006-07, leaving it with a stocks-to-use ratio of 24% in that year. Especially since 2008, China has accumulated stocks to reach 31%, at a time when U.S. and world stocks are very low.
- Wheat: China followed a similar pattern in wheat, beginning with a stocks-to-use ratio of 83%, dropping to 33% in 2006-07, and increasing back to 54% in 2010-11, in spite of world production shortfalls.
- Rice: Stocks-to-use ratios equaled 68% in 2000, but fell through 2004. There has not been as much change in rice since, with stocks-to-use ratios around 30% for the past seven years.
- Soybeans: For the 2000-01 to 2005-06 period, stocks-to-use varied from 6% to 18%, with no particular trend. However, from 2006-07 to 2010-11, the stocks-to-use ratio went from 4% to 23%. This radical shift in stocks accounts for much of the U.S. soybean area being needed to satisfy Chinese imports.
- Cotton: There is no particular pattern for cotton except that for 2010-11, stocks are considerably lower now, as they are for most regions.

The major impacts of these stocks changes are three-fold: 1) In the five years of 2001-2005, China was destocking corn, rice and wheat. This destocking policy led to Chinese exports for corn, which offset production-consumption

imbalances elsewhere, but not for wheat or rice. 2) The substantial Chinese soybean stocks accumulation in the past four years had a very large impact on world markets, as the stock accumulation was accomplished mainly through imports. 3) Recent Chinese stocks accumulation in wheat and corn has been a product of domestic production exceeding consumption and has had little impact on world markets.

Issue 5: Macroeconomics

The dollar exchange rate weakened dramatically from 2002 to 2008, contributing to a commodity boom that was also influenced by worldwide monetary policy and inflationary expectations. While changes are not so dramatic in 2011, the dollar exchange rate remains quite weak and volatile. Another commodity boom appears to have begun in June 2009, with agricultural prices once again lagging. The exchange rate is also correlated with other macroeconomic factors, including worldwide economic growth, that influence the expected high level of agricultural commodity prices.

Implications for the Future

Biofuels and Chinese Soybean Import Demand Revisited

For biofuels, the United States produced 13 billion gallons of ethanol in 2010 and has capacity today exceeding 14 billion gallons. The portion of the RFS2 which can be met by corn starch is 15 billion gallons by 2015. In other words, the mandated level has essentially been reached, and the growth rate will be quite slow moving forward. From this point forward, normal trend yield increases will satisfy the future increases in corn-based-ethanol demand. However, the demand levels will remain high.

For Chinese soybean imports, the story is similar. Table 2 shows that Chinese soybean stocks have now reached 23% of use, the highest level of the past decade. China will not continue to build stocks much beyond this level. China will continue to import large amounts of soybeans, but it will be to fill the domestic gap between consumption and production, not to further accumulate stocks.

Both of the key drivers responsible for creating today's situation will be less important in the future. The level and percentage of corn use for ethanol will remain high, but growth will be quite low. With the reduced growth rate in these demands, it will be easier for global production to catch up with demand. It is expected it will take two years to increase stocks to more adequate levels, but it is not anticipated that prices will remain at recent levels unless there are serious weather and yield problems.

Not Likely to Restore World Supply in 2011-12

Much is riding on 2011-12 corn and soybean production. A return to normal yields barely allows the world to continue to meet trend consumption. Yield uncertainty means there may be wide swings in prices. Yields below trend imply a need to ration short supplies, with prices potentially even higher than those of the first-half of 2011. Yields above trend could mean some moderation in prices, but not nearly as large as was experienced in late 2008 and 2009 with worldwide recession.

In the absence of yields well above trend, it appears the tight world stocks situation for corn and soybeans cannot be overcome in one crop year and that high prices will exist for two crop years or longer. In essence, high prices, at least by historical standards, appear to be the new norm. Meanwhile, the world is walking close to the edge of food insecurity, with the potential for extraordinarily high prices in any year of major production setbacks.

If 2011 yields are below trend yields, the impact would vary by crop. If there were sub-trend corn yields, for example, much higher prices would be expected and there would be a need to ration the already tight supply. The same essentially would be true for cotton. For the other crops, the impacts might be smaller, but still could be significant.

Longer-Term: Can Supply Catch Up

Historically, short periods of demand surge, or of production shortfalls when stocks were low, have sharply increased prices, leading to a supply response that brings more land into cultivation. If demand did not persist, this supply response has typically led to longer periods of lower prices and a boom/bust cycle. This time the two demand surges are likely to persist, but their rate of growth is likely to slow. This slowing of demand growth will give world supply growth an opportunity to catch up in coming years. Prices would then moderate from current high levels and a bust phase might be avoided. That of course will depend on other factors as well such as new demand growth, the extent of supply response, and world macroeconomic events.

While there are many challenges, there are opportunities as well. To the extent prices are higher in the long-run, farmers globally will have reason to increase acreage and production, ultimately moderating high prices. At present there are many regions of the world with cereal yields less than half those in the United States but with adequate soils and available rainfall. Higher corn prices could encourage farmers in these areas to make technical changes—improved seed varieties, more fertilizer, that would help close the yield gap to some extent. In fact, this outcome could be quite

positive as much of this area is in developing countries with poor farmers. However, many technical, economic and political barriers would have to be overcome to achieve this success.

Policy Issues

Biofuels

The United States uses both subsidies and mandates at present to encourage biofuels production, but the RFS2 mandate is currently more important than the subsidy. If subsidies are reduced or eliminated, or the mandate is changed, changing policies would have little near-term impact under most circumstances. Most of the subsidy does not now reach the ethanol producer, so reducing it has little impact on corn demand under most circumstances. Reducing the RFS2 would not have much impact as long as oil prices remain high because the production capacity already exists. The blend wall now constrains the impact of high oil prices on corn. Relaxing blending restrictions could lead to further increases in biofuels demand for corn. Under a lower oil price regime, the impacts of subsidy and RFS changes would be significant.

U.S. Agricultural Policy

U.S. agricultural policy has primarily been a policy of abundance, because the United States has generally been blessed with the ability to produce more than could be consumed at profitable prices for producers. Policies of abundance were designed to reduce supply, restrict land use, increase demand and thereby increase and stabilize farm incomes.

A shift to a policy of shortage would do the opposite, with an emphasis on programs that stimulate supply and do not subsidize demand with taxpayer funds or political mandates. Experiences with policies of shortage are more limited, and certainly the greater inelasticity limits degrees of freedom in that policy domain. Today, a shift to policy of shortage would focus on supply and demand management policies. The 31.2 million acres of land in the CRP could be a central focus on the subject of land area available for expansion. Clearly, yield technology has and will continue to be the primary way to enhance supply over time. Research and education are the primary vectors to promote improved yields. A re-examination of demand stimulation programs would be important in a policy of shortage. Biofuels mandates and subsidies, export subsidies, and food consumption subsidies all would be considered.

Trade Policy

For world markets to become more stable, and for trade liberalization to contribute to that stability, the large traders and the large, self-sufficient producing countries all need to follow more liberal, open-trade regimes. Importers as well as exporters need to participate in that liberalization. It remains an open question whether a liberalized world market in food grains would bring about a sufficient degree of stability to satisfy a country such as China, which now permits little variation in its domestic rice and wheat prices.

Trade policy regimes have in the past and continue today to contribute to world price volatility. The extremes resulting from export restrictions in 2007-08 are not evident now, but inelastic world markets persist because of the desire for stable domestic markets in many countries. While international cooperation may promise more stable world markets and less world price volatility, widespread cooperation is needed for that to be achieved.

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Mission Statement

Farm Foundation, NFP serves as a catalyst for sound public policy by providing objective information to foster a deeper understanding of issues shaping the future for agriculture, food systems and rural regions.

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Farm Foundation, NFP
1301 West 22nd Street, Suite 615
Oak Brook, IL 60523
Tel (630) 571-9393
Fax (630) 571-9580
www.farmfoundation.org