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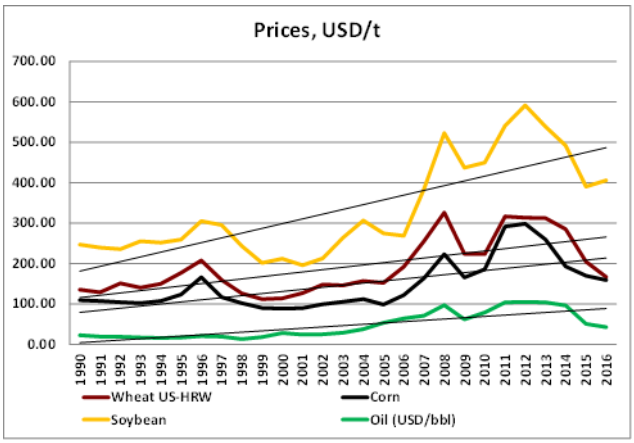
International Grain Price Prospects and Food Security



Until recently, since 2011 international grain prices declined steadily, but bottomed out around September 2016. Since then, international grain prices have experienced a recovery, though at a slow pace. In particular, based on monthly data, wheat prices increased from USD 122/ton in September 2016 to USD 150/ton in February 2017. Similarly, corn prices increased from USD 148/ton September 2016 to USD 163/ton in February 2017. Soybean prices increased from USD 355/ton in September 2016 to USD 385/ton in February 2017. The average growth in these five months was about 14%. On a yearly basis, the average growth rate was about 35%.

Nevertheless, the evolution of grain prices in the last five years has created uncertainties about the prospects for future grain prices over the medium term (five to ten years). In particular, are prices likely to remain depressed during this period? Would flat or declining prices lead to food supply shortages, endangering food security? This note addresses these questions.

First, we should notice that the decline in food prices in the last five years was the result of a significant overshooting in prices that took place in 2008 and 2011-12 and the subsequent downward market "correction" that took place thereafter, as shown in the side chart. The 2008 price hike was due to a generalized commodity boom that started in 2005 and insufficient grain availability in 2008 due to bad weather. The subsequent price collapse was due to the sub-prime financial crisis in the US and EU that shrank international trade financing and led to a collapse in worldwide trade (Ukraine experienced a decline of 48% in its exports in 2009.) For instance, wheat prices increased from USD 150/ton in 2005 to USD 320/ton in 2008, only to drop to USD 220/ton in 2009. In 2011-12, prices again increased substantially with wheat prices going to USD310/ton; but this time it was due principally to supply constraints caused by bad weather in mayor producing countries, with Russia even imposing a ban on grain exports. There is also some evidence that there was a high degree of market manipulation, as many grain traders "anticipated" the Russian ban and played heavily with financial derivatives, securing record profits during these crises years. From 2012 to 2016, prices declined as a "correction" of the previous overshooting and also due to a deceleration of economic growth, as discussed below. Nevertheless, as shown in the side chart, over the long-term, the trend in grain prices has been slightly upwards, except for the 2008-2012 volatility, with grain prices increasing at a rate of about 2.1% per year.

Second, we should notice that the historical closeness of data on grain production and consumption is an unreliable indicator of whether or not there were imbalances between demand and supply in the past. This is because the observed data represents the ***ex-post*** market equilibrium between demand and supply and does not represents the levels of "intended" demand and "intended" supply, which are the main determinants of prices (this is the so-called "identification" problem in econometrics). The fact is that, "ex-post", production and consumption are close by definition. Agencies such as FAO or the USDA can get information on what companies have produced and sold during any period of time and the level of inventories at the end of the period. Consumption is "calculated" as a residual, as the difference between production and changes in inventory. Since inventories are inelastic as there are limits to the level of stocks that can be held (they cannot be negative, the upper limit is available storage capacity, and there are location rigidities), the level of actual production and "calculated" consumption will be very close. Many agencies use the term "apparent utilization", instead of just consumption to make clear the distinction. Therefore, it is not surprising that, ex-post, the time series of production and consumption published by international agencies evolved in a close pattern. Production will always look as catching up with consumption and vice-versa. But this is not an indication of equilibrium in the markets.

In order to assess the likely evolution of grain prices, we need to calculate the likely evolution of intended consumption and desired production as separate variables. This will tell us if there are 'ex-ante" disequilibria between demand and supply in the markets that could push prices up or down. What will determine prices are the gaps between "intended" consumption and production.

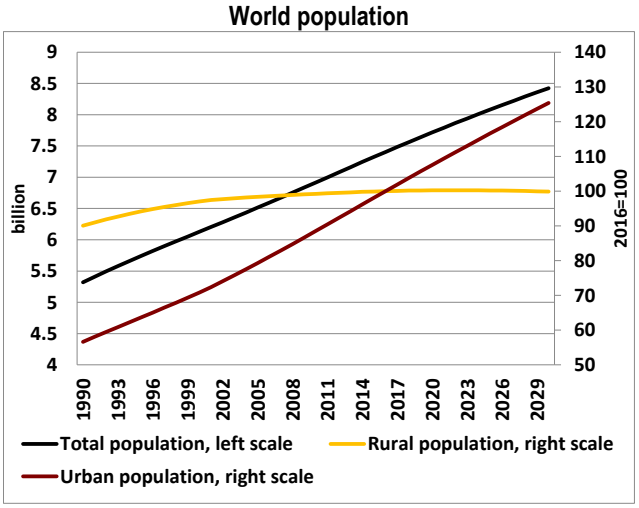
Prospect for Future Grain Prices

Agricultural commodity prices, as prices of any commodity, are determined by global macroeconomic conditions, commodity fundamentals of supply and demand, and so-called technical "noises". Since technical "noises" (quality of stocks, logistics, exchange rates, and governmental decisions) influence prices mainly in the short-term, they are not a subject of interest of this paper.

Global Macroeconomic Conditions and Food Consumption

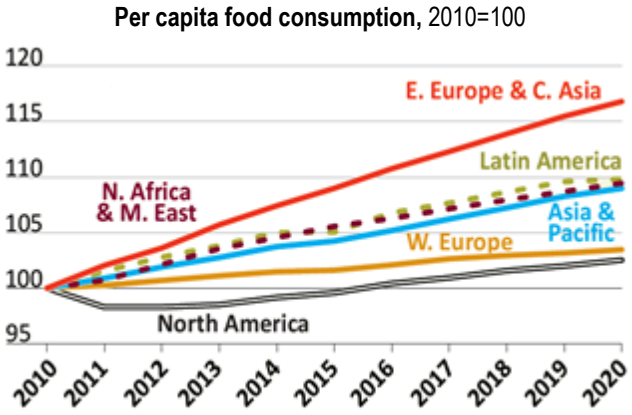
A major factor driving the evolution of commodity prices is economic growth. Lower than expected and continuously decelerating world real economic growth was one of the reasons of the decline in food prices over the last few years. According to the IMF data, world economic growth decelerated gradually from 5.5% yoy in 2010 to 3.1% yoy in 2016. But this is already changing. In fact, in its latest World Economic Outlook, the Fund forecasts acceleration of growth from 3.1% in 2016 to 3.4% yoy in 2017, and 3.6% yoy in 2018. Furthermore, these forecast growth rates were revised upwards compared to the previous IMF forecast reflecting more optimistic perceptions of the Fund concerning global economic development. The economic outlook has improved in advanced economies mainly on the back of a cyclical recovery in global manufacturing. The US economy, in turn, is expected to continue recovering, supported by changes in macroeconomic and taxation policy, more expansionary fiscal policy, and further normalization of monetary policy in line with economic development. At the same time, IMF forecast for emerging and developing economies continues to be favorable, with rates of growth improving from 4.1% in 2016 to 4.5% in 2017 and to 4.8% in 2018, making them the main drivers for the strengthening of the global economy.

Our "intended" grain consumption forecasts are based on forecasts for GDP in various regions and calculations of the income elasticity of demand for grains (i.e., percentage change in grain consumption per 1% change in GDP income. Consistent with IMF data, we expect the following annual rates of growth in GDP for the next ten years: US and Canada, 2.3% pa; Europe, 1.5% pa; Latin America, 3.0% pa; Africa, 5.0% pa, and Asia, 6/0% pa. Based on country specific calculations made by the US Department of Agriculture, the following are our calculations for income elasticity of demand for grains (both for human consumption and for animal feed): US/Canada, 0.20 (0.2% increase in human and animal feed grain consumption per 1.0% increase in GDP); Europe, 0.35; Latin America, 0.50; Asia, 0.50, and Africa, 0.70. Based on these numbers, world grain consumption fostered by higher GDP income is expected to increase by 2.2% per year.

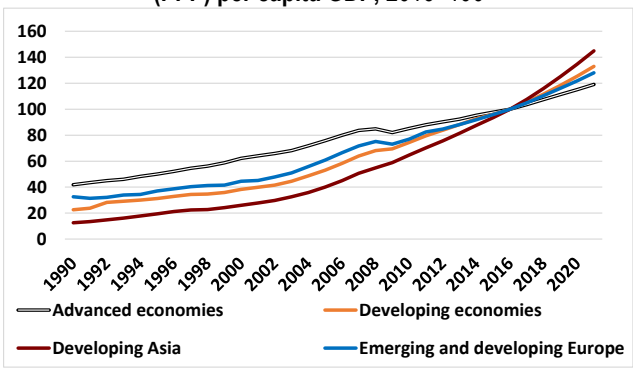


Source: FAO

In addition to income growth, population growth is another major factor driving consumption of agricultural commodities. Growth of the world population is expected to slightly slow down to an average rate of about 1.6% per year during 2016 to 2025. Most of the population expansion is expected to occur in developing countries, particularly Africa. The population of Asia and Pacific is also expected to expand faster than the average in the world and is going to reach almost a half of world population by 2025. Overall, the world's population is projected to grow from 7.4 billion in 2016 to almost 8.5 billion in 2025 with 95% of the increase taking place in developing countries, which should also increase their current low levels of food consumption per capita as their income grows. The population growth of 1.6% per annum should induce an additional growth of world grain consumption of about 1.0% per year. This lower rate is due to a less than 1.0 population elasticity of grain demand.



Source: FAO



Source: IMF

Furthermore, population growth is accompanied by the rapid pace of urbanization in the world. The world's urban population is expected to increase by 20% over the next decade, mostly due to growing cities in the developing part of the world. Due to changes in lifestyle of the urban population, per capita consumption of food will increase, putting additional pressures on food supply. Urbanization also has implications for agricultural production, which we will discuss later. Furthermore, urbanization and increased per capita income are changing consumer diets towards increased consumption of calories in general and calories from animal proteins in particular. Thus, with growing incomes, people substitute grains with animal proteins, fruits, and vegetables. This will actually further increase demand for grains as more animal proteins in human consumption means growing more livestock. But more livestock means more food for it which is actually more grains. These additional factors will add an additional 0.5% pa in world grain consumption.

Considering the grain consumption effects of GDP growth (2.2% pa), population growth (1.0% pa), and other factors (0.5% pa), world grain consumption is expected to grow on average at about 3.7% pa during the next ten years. For individual crops, we anticipate the following growth rate in grain consumption in the next ten years: wheat, 2.5% pa; and corn, 4.3% pa. We also anticipate that world soybean consumption will increase by about 4.5% pa.

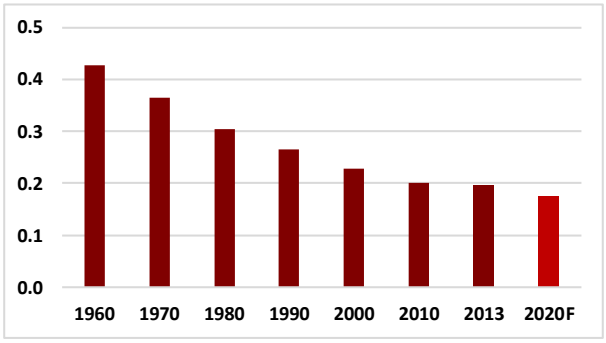
Food Production

In order to maintain food prices stable, agricultural production needs to catch up with growing demand for food as noted above. However, agricultural production faces several constraints limiting growth.

First of all, population growth and increasing urbanization are already diminishing the amount of land suitable for agriculture. According to FAO estimates, the global availability of per-capita arable land declined from about 0.4 hectares in 1960 to about 0.2 hectares in 2013 (the latest available data from FAO) and is expected to further decline by 2020. These land limitations mean that future agricultural supply may have to come mainly from productivity increases.

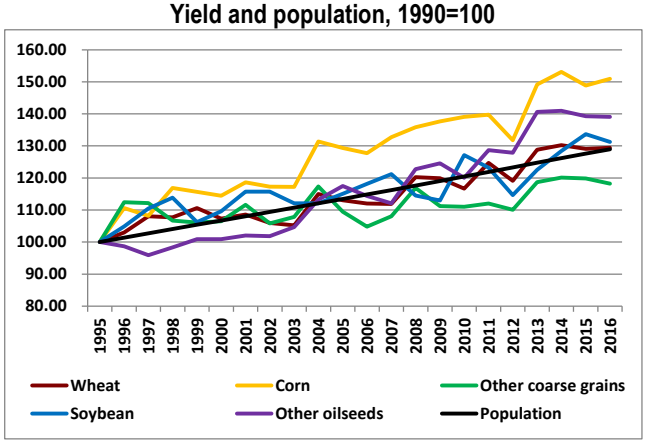
Second, the growth rate of agricultural productivity is already slowing down. As FAO data shows, global yield growth for wheat slowed from almost 3% per annum in 1962-1989 to 1.3% pa in 1990-2011. Other popular crops also experienced declines in global yield growth during these periods. As shown in the side chart,

Per capita arable land, Ha per person



Source: FAO

Yield and population, 1990=100



Source: FAO

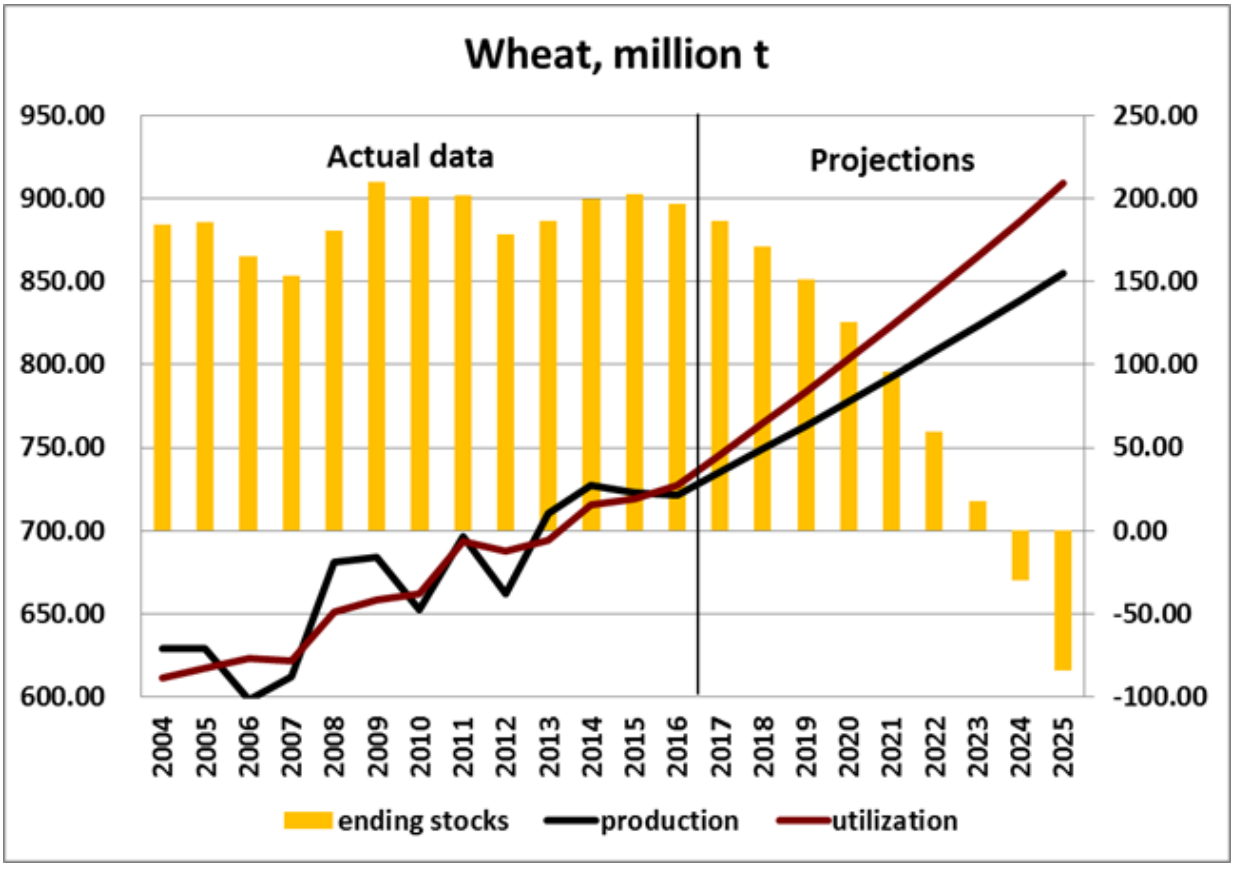
only corn yield growth continuously exceeded growth of population since 1990. Yield growth rates of other grains were close to that of population, while yield growth of other coarse grains even decelerated below growth of population since the beginning of 2000s.

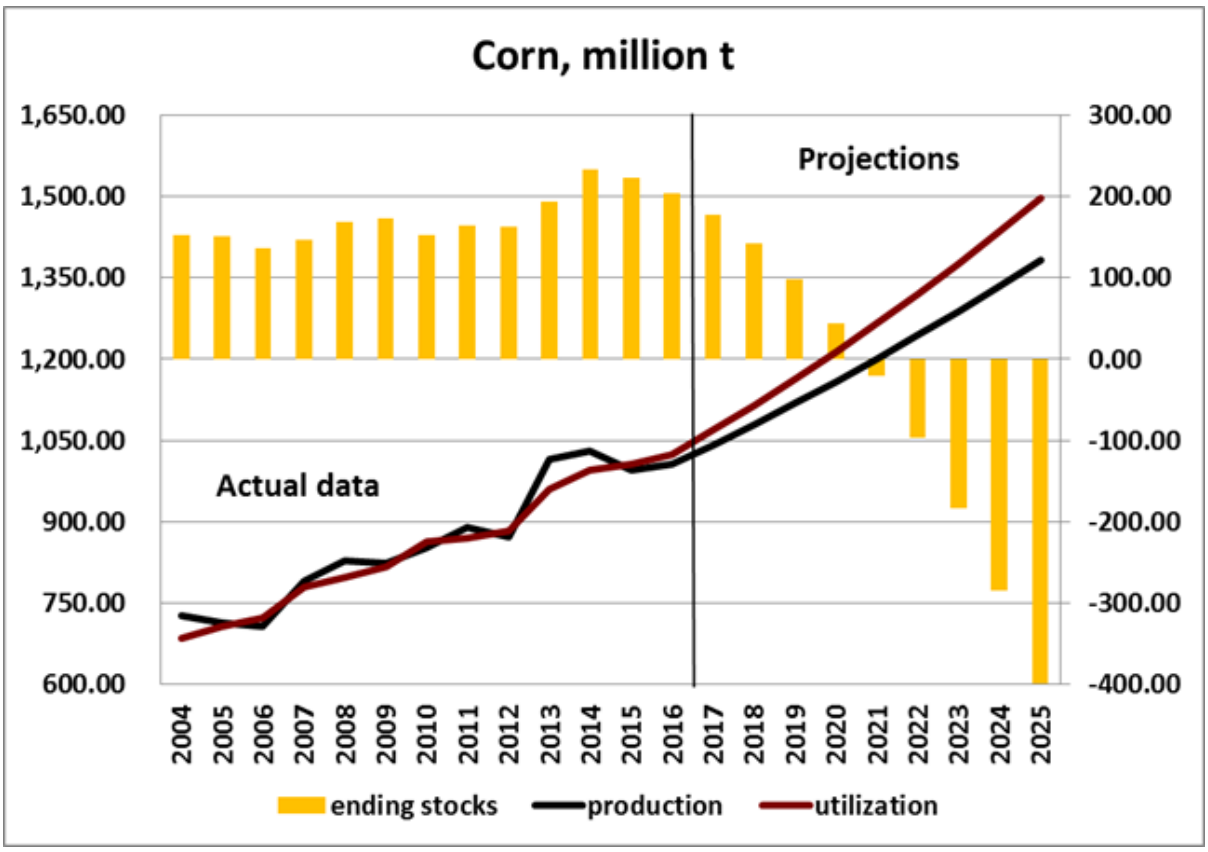
Third, pollution and soil erosion are already limiting the upside potential for further yield gains in agriculture. They make crops more susceptible to pest damage, while deforestation and extensive use of pesticides are stressing fragile ecosystems.

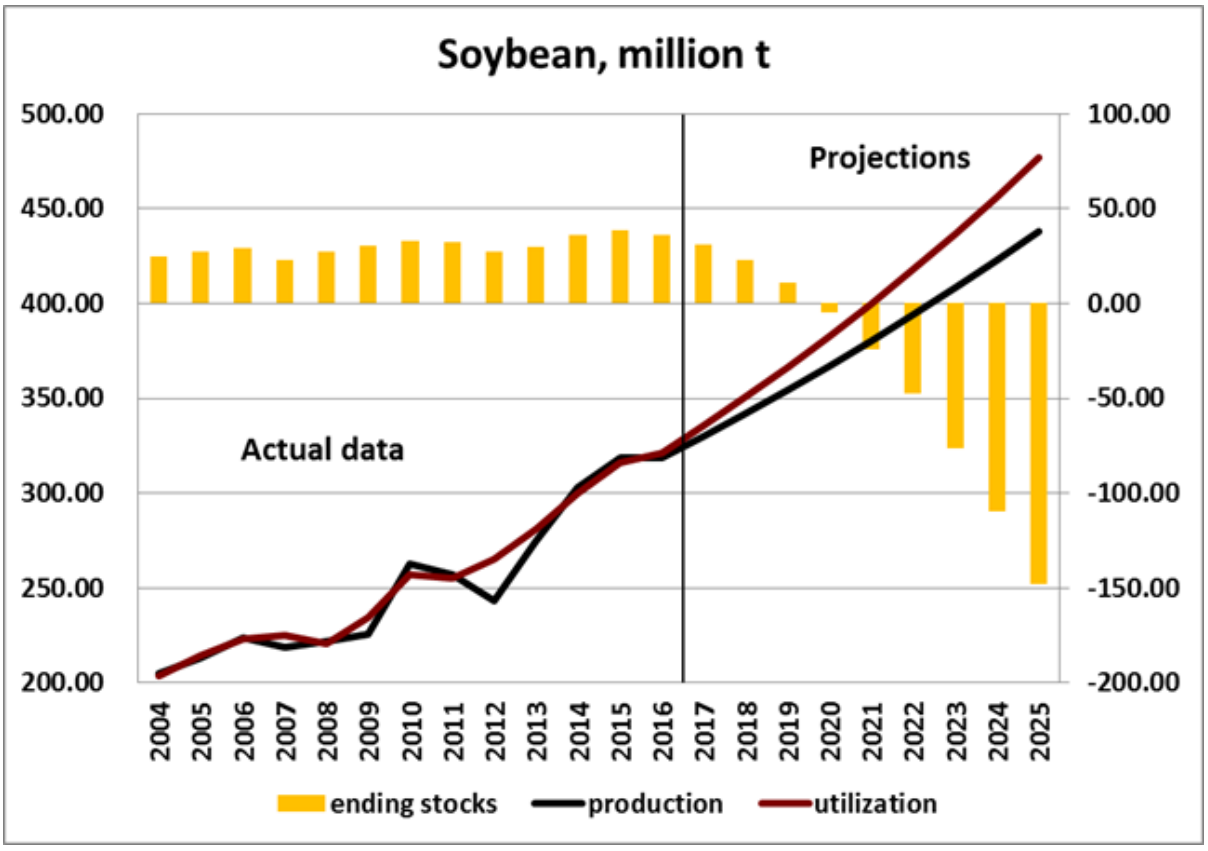
All these factors suggest that growth of food production is likely to continue at historical rates, while growth of consumption is likely to accelerate as noted earlier. Based on past data, we expect that food production would increase at the following rates during the next ten years: 1.9% pa for wheat; 3.6% pa for corn; and 3.6% pa for soybeans.

Therefore, there will be a gap between intended or target food consumption and potential food production. This gap will amount to about 0.6% pa for wheat; 0.7% pa for corn; and 0.9% pa for soybeans. These gaps will be covered initially by the current high level of inventories, but as stocks become depleted, agricultural commodity prices would increase, though at a slow pace. These calculations are consistent with the latest OECD-FAO forecasts, as these institutions expect consumption of different grains to increase at an annual rate 1% to 3% faster than production by 2025.

Based on our calculations, below are charts for separate food categories on production, utilization and gaps:

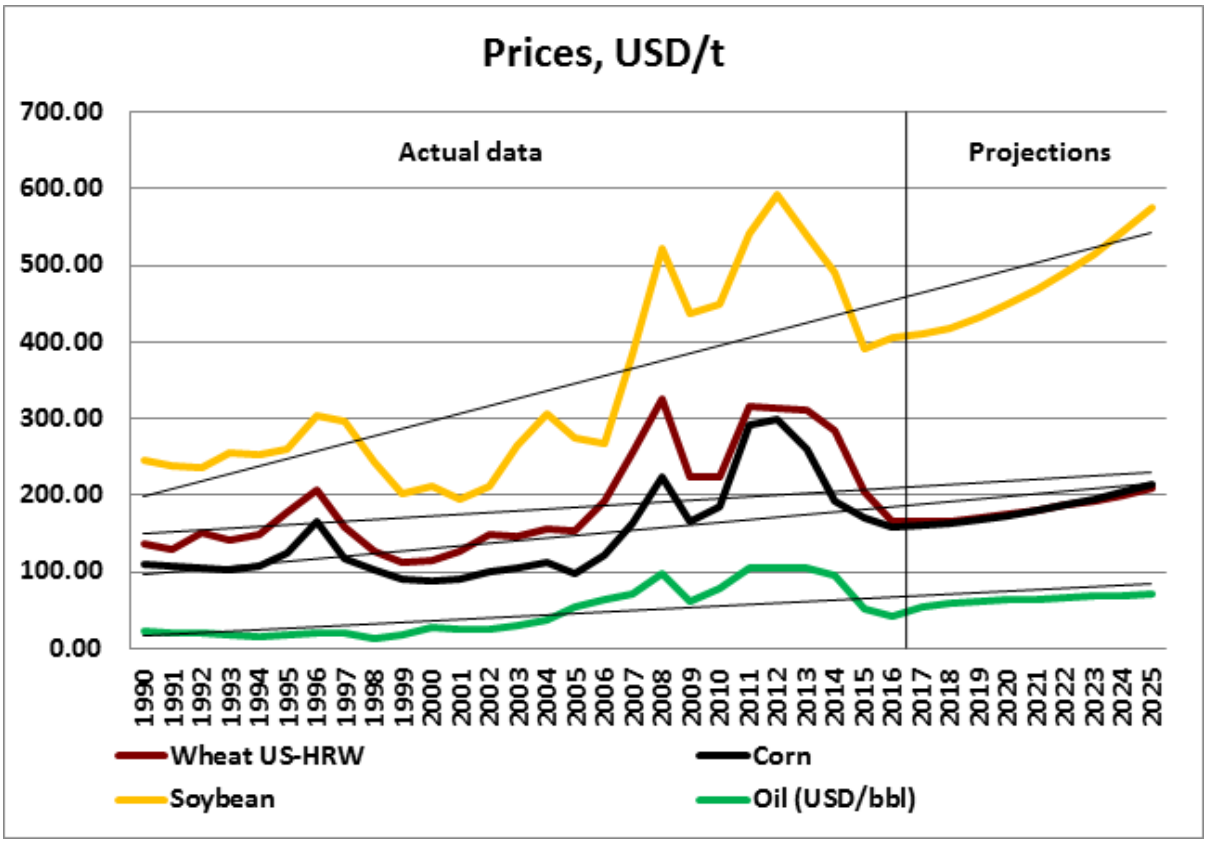



Corn, million t
1,650.00
1,500.00
1,350.00
1,200.00
1,050.00
900.00
750.00
600.00
300.00
200.00
100.00
0.00
-100.00
-200.00
-300.00
-400.00
Projections
Actual data
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
ending stocks
production
utilization


Soybean, million t
500.00
450.00
400.00
350.00
300.00
250.00
200.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
Projections
Actual data
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
ending stocks
production
utilization

Forecasts of Food Prices

Although food prices bottomed out in September 2016 and have been increasing since then, the current high level of inventories will suppress food prices during 2017 and part of 2018. However, after 2018, food prices are expected to grow. We forecast that the price of wheat will start to increase in 2019 by 2.5% pa, accelerating to a growth rate of 4.0% pa by 2025, due to the increasing gap between intended consumption and production. These price increases are needed to ensure that, ex-post, sufficient supply would be available to meet intended consumption. Similarly, the price of corn would start growing by 3.0% pa in 2019, accelerating to 5.1% by 2025. The price of soybeans would increase by 3.5% pa in 2019, accelerating to 5.9% pa by 2025. The chart below shows the historical and likely evolution of food prices. Furthermore, as it can be seen from the linear trend lines, grain prices historically grew faster than crude oil prices.



Potential Role of Ukraine

As indicated in our report on "Unleashing Ukraine's Agricultural Potential", Ukraine is in a privileged position to fill any future gap between intended consumption and available production. Ukraine agricultural land is one of the world's richest and is located not too far away from ports. Other potential supplying countries, such as Russia, Kazakhstan and Brazil, have their main agricultural land far away from ports and are already facing major transportation and logistical difficulties. Furthermore, in Ukraine, the cost of production per ton of grain is the lowest among major producers. With additional investments of about USD 5 billion per year in the agricultural sector, Ukraine should be able to increase its grain production from the current level of about 60 million tons per year, to about 100 million tons by 2015.