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Working Party on Agricultural Policies and Markets

OECD-FAO AGRICULTURAL OUTLOOK, 2014-2023:
PART I

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This is the final version of Part I of the *OECD-FAO Agricultural Outlook 2014-2023*, the annual report prepared in close collaboration with the Food and Agriculture Organization (FAO) of the United Nations.

It is circulated on OLIS as part of the following set of documents forming the 2014 report:

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Executive summary

The international prices of major crops have dropped significantly from their historical highs, largely in response to bumper crops in 2013/14. In contrast, meat and dairy product prices are at historically high levels, primarily because their supply fell short of expectations in 2013. World ethanol and biodiesel prices continued their declines from the historical peak levels they had reached in 2011 in a context of ample supply for both.

Demand for agricultural products is expected to remain firm although expanding at slower rates compared with the past decade. Cereals are still at the core of human diets, but growing incomes, urbanisation and changes in eating habits contribute to the transition of diets that are higher in protein, fats and sugar.

In the next decade, livestock and biofuel production are projected to grow at higher rates than crop production. This changing structure of global agricultural production prompts a relative shift toward coarse grains and oilseeds to meet demands for food, feed and biofuel, away from staple food crops like wheat and rice. The bulk of the additional production will originate in regions where determining factors, such as land and water availability, and policy regulations, are the least constraining.

Crop prices are expected to drop for one or two more years, before stabilising at levels that remain above the pre-2008 period, but significantly below recent peaks. Meat, dairy and fish prices are expected to rise. In real terms, however, prices for both crops and animal products are projected to decline over the medium term. The expected stock-to-use ratios for cereals improve significantly, which should ease concerns about their price volatility.

World fishery production will be driven primarily by gains in aquaculture in developing countries. Sustained high costs in a context of firm demand will keep fish prices well above their historical averages, holding back consumption growth in the coming decade.

Production growth will come mainly from developing countries in Asia and Latin America. Trade continues to grow, although at a slower pace compared with the previous decade. The Americas will strengthen their position as the dominant export region, both in value and volume terms, while Africa and Asia will increase their net imports to meet their growing demand.

Recent policy reforms in agriculture and fisheries markets have enabled demand and supply fundamentals to become more responsive to market signals; however, both remain influenced by policies such as producer support, public stockholding and biofuel mandates. Further policy changes are underway. The United States’ Agricultural Act of 2014 and the 2013 reform of the Common Agricultural Policy in the European Union have been agreed upon during the last year; however, their provisions are not considered in the current projections because implementation details have not been completed/specified.

Global commodity highlights to 2023

- **Cereals:** World prices of major grains will ease early in the outlook period, boosting world trade. Stocks are projected to rise with rice inventories in Asia reaching record high levels.

- **Oilseeds:** The global share of cropland planted to oilseeds continues to increase albeit at a slower rate as sustained demand for vegetable oils pushes prices up.
• **Sugar**: After weakening in late 2013, international sugar prices will recover, driven by strong global demand. Exports from Brazil, the world dominant sugar exporter, will be influenced by the ethanol market.

• **Meat**: Firm import demand from Asia, as well as herd rebuilding in North America support stronger meat prices, with beef prices rising to record levels. Poultry overtakes pork to become the most consumed meat product over the outlook period.

• **Dairy**: Prices fall slightly from their current high levels due to sustained productivity gains in the major producing countries and resumed growth in China. India overtakes the European Union to become the largest milk producer in the world, building considerable skimmed milk powder exports over the projection period.

• **Fisheries**: The growth of aquaculture production will be concentrated in Asia. It remains one of the fastest-growing food sectors and surpasses capture fisheries for human consumption in 2014.

• **Biofuels**: The consumption and production levels of biofuels are expected to increase by more than 50%, led by sugar-based ethanol and biodiesel. The ethanol price increases in line with crude oil price, while the biodiesel price follows more closely the path of the vegetable oil price.

• **Cotton**: The expected release of accumulated global stocks will boost consumption on the back of lower prices, before prices recover by 2023

**Focus on India**

This edition of the *Outlook* focuses on India, the world’s second most populous country with the largest number of farmers and also the largest number of food-insecure people. The *Outlook* portrays a relatively optimistic scenario for India, which is projected to sustain production and consumption growth of food, led in particular by higher value added sectors.

The new National Food Security Act is the largest right to food programme of its kind ever attempted, allocating rations of subsidised cereals (about 90% below retail price) to more than 800 million people. Its implementation will be a major challenge.

Subsidies to encourage greater use of fertilisers, pesticides, seeds, water, electricity, and credit, as well as market support prices, have contributed to strong annual agricultural output growth in the last decade. These programmes continue to promote production growth enabling Indian agriculture to expand per capita supplies considerably, although rising resource pressures reduce absolute growth rates over the next decade.

While remaining largely vegetarian, Indian diets will diversify. Cereal consumption is expected to grow, but greater consumption of milk and dairy products, pulses, fruits and vegetables will contribute to improved intake of food nutrients. Fish will also provide an important and growing source of protein, while meat consumption will grow strongly, though still ranking among the lowest in the world.

Key uncertainties lie in India’s macro performance, the sustainability of yield growth and the viability of government programmes.
Note on macroeconomic assumptions

The macroeconomic situation underlying this Outlook assumes an average GDP growth of 2.2% per year for OECD countries. Economic prospects for many emerging economies are robust but revised downward slightly compared to the last decade. Most African economies exhibit strong growth. A stronger US dollar will affect the competitiveness of numerous countries. The crude oil price is assumed to reach USD 147 per barrel by 2023.
Chapter 1.

Overview

Introduction

The Agricultural Outlook is a collaborative effort of the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization (FAO) of the United Nations. It combines the commodity, policy and country expertise of both organisations with inputs from collaborating member countries and international organisations to provide an annual assessment of medium term projections of national, regional and global agricultural commodity markets. The projections cover production, consumption, stocks, trade and prices for 25 products for the period 2014 to 2023. These projections constitute a plausible scenario of how global agriculture would develop under a certain set of assumptions about its main drivers, productivity, macroeconomic and population trends as well as agricultural and trade policy settings of countries around the world. Given the uncertainties which surround agricultural markets, the final section of the Overview discusses important assumptions affecting the future evolution of agricultural markets and the sensitivity of the baseline projections to selected conditioning factors.

This year’s edition contains a chapter on India, the world’s second most populous country, which is fed by the largest farming community in the world. India’s agricultural sector has witnessed a considerable transformation in recent years, with significant gains in productivity and total production volume. With its predominantly vegetarian diet, large arable land base and slowly urbanising society, India presents unique opportunities and challenges. Most of the country’s agricultural policies in the next decade will be focusing on food security and how to invigorate agriculture to promote growth and employment in populous rural communities.

The setting: Turbulent agricultural markets at the start of the outlook period

Global production of most agricultural commodities increased in 2013, after having been affected by adverse weather conditions in the previous year. Production increases were particularly pronounced for cereals, especially for wheat and maize which rose sharply to record levels due to good growing conditions in the main producing countries. Driven by soybeans, global oilseed production is setting a new record in 2013/14. Together with further expansion in Indonesian palm oil production, this resulted in surplus production of both vegetable meal and oil in the current season. The increased production levels allowed countries to rebuild stocks and increase trading activities. Global sugar markets also experienced a significant surplus in 2013. During the course of the 2013/14 marketing season, international prices of most crops remained under downward pressure, largely in response to positive supply situations.

While grains and oilseeds markets were characterised by significant production increases, meat production increased marginally in 2013. The profitability of meat production has been highly uncertain in recent years as the occurrence of animal diseases and higher feed costs worked their way through the meat complex, driving prices higher and slowing consumption growth.

Higher feed cost, in combination with a significant production shortfall in China, drove the firm rebound in milk and dairy prices in 2013, following a sharp decline in 2012. During the first half of 2013, the United States, European Union, New Zealand and Australia – all major players in global dairy markets – produced less milk than in 2012, further contributing to the price recovery.
Fish from aquaculture production has been growing rapidly, reaching more than 40% of total production in 2013. This expansion has been the main factor allowing markets to meet the increasing demand for fish and fish products. Despite these gains, prices for fish and fishery products have been volatile as they are influenced by inelastic supply due to catch quotas for captured fish and volatile conditions in the aquaculture sector stemming from disease outbreaks and fluctuation in feed costs.

Cotton prices reached a peak in 2010, but have been on a declining trend ever since, while the stock-to-use ratio has increased rapidly, reaching about 85% in 2013. These record stock levels were mainly driven by China, where the authorities have been purchasing large quantities of cotton for the official reserve since 2010.

In 2013, world ethanol and biodiesel prices continued their declines from the historical high levels of 2011 in a context of ample supply for both ethanol and biodiesel. The 2013 market environment for biofuels was strongly influenced by policies: blending requirements were increased in Brazil (ethanol), and in Argentina and Indonesia (biodiesel); the European Union put in place anti-dumping duties against Argentinean, US and Indonesian shipments of biodiesel; and there were proposals towards lower biofuel targets for 2020 in the European Renewable Energy Directive (RED) as well as towards lower mandates in the United States.

In addition to the above-cited market factors specific to each commodity, a number of other developments need to be considered for the projections. Among the major influences are the economic slowdown in many emerging markets, in particular China and India; high oil and energy prices; slower population growth rates; moderate inflation rates; and an appreciation of the US dollar compared to the currencies of Brazil, India and South Africa by more than 40% for the period 2014-23. Box 1.1 discusses the main assumptions underlying the agricultural projections and Box 1.2 analyses recent food price movements.
Box 1.1. Macroeconomic and policy assumptions

The main assumptions underlying the baseline projection

The Outlook is presented as a baseline scenario that is considered plausible given a range of conditioning assumptions. These assumptions portray a specific macroeconomic and demographic environment which shapes the evolution of demand and supply for agricultural and fish products. These general factors are described below. The statistical tables, at the end of the publication, provide more detailed data for these assumptions.

The global recovery is likely to remain modest and uneven

Growth since the 2008 global crisis has been uneven and hesitant, and continues to show divergence both between and within advanced and emerging economies. The global recovery remains modest, despite some moderate acceleration in the short term, and there are large downside risks. The growth slowdown in the emerging market economies leads to large negative spillover effects on the world economy as a whole via trade effects. Moreover, with the BRICS now accounting for about 28% of world GDP (at PPP rates), a slowdown in growth has larger effects on the global economy and OECD countries than in the past. In OECD countries, direct trade relations with non-OECD countries have grown substantially in importance over the past two decades.

Moreover, any slowdown in emerging economies is also likely to lower commodity prices, with adverse effects on the terms of trade of commodity exporters. Financial conditions have tightened significantly in some emerging economies, and financial linkages with OECD countries could increase the impact of a decelerating growth in the emerging economies. Similarly, as the links in the banking sectors of several developed and emerging economies have grown stronger since the financial crisis, tightening financial conditions in some emerging economies may also influence income growth of OECD countries.

In the Euro area, recovery is lagging and uneven. Unemployment remains very high, but inflationary pressures are subdued. Weakness in the banking system remains a major drag on growth in the Euro area. Still weak bank balance sheets, fragile public finances and the uncertain political situation in some vulnerable countries could unsettle financial markets.

The macroeconomic assumptions used in the Agricultural Outlook are based on the OECD Economic Outlook (November 2013) and the International Monetary Fund’s, World Economic Outlook (October 2013).

Growth in the OECD area was moderately better than expected in 2013 at 2.2%, and it is assumed to be stronger in 2014 at 2.6%. Growth prospects for OECD countries in the medium term are expected to be maintained at an average level of 2.2% p.a. After a slight recession in 2013, EU-15 members as a group should show a positive growth of 1.3% in 2014, and for the remaining period, they are expected to recover gradually at an average growth rate of 1.75% p.a.

Among the OECD countries, Korea and Turkey are expected to exhibit the strongest growth during the next decade at 4.4% and 4.3% p.a., respectively. Australia and Mexico should continue to show a firm recovery at 3.5% p.a. The United States and Canada are expected to recover gradually; averaging 2.4 and 2.3% p.a., respectively, during the next ten years, and Japan should exhibit a slow growth of 1.1% p.a.

In the non-OECD area, medium term prospects for emerging economies have been revised slightly downward. China and India are expected to grow on average 7% and 6.4% p.a., respectively, over the next ten years. Although impressive compared to developed economies, these rates are below the growth rates experienced during the previous ten years. Two other major emerging economies, Brazil and South Africa, will maintain average annual growth rates of 3.7% and 3.4% p.a., respectively, during the next decade.

Among developing countries, those in the African region show strong growth during the next decade, partly because the expected recovery in the European Union leads to increasing exports from those countries. Asian countries also maintain high growth rates, but the slowdown in China and India will curb growth rates in the region. Income growth in Latin American economies is assumed to be weaker compared to other emerging economies, but the resilient US economy is a positive factor for the region.
Figure 1.1. Korea and Turkey expected to exhibit the strongest GDP growth in OECD

Average GDP growth rates 2004-13 and 2014-23

Source: OECD and FAO Secretariats.

Population growth to slow

World population growth is expected to slow to 1.0% p.a. in the next decade. This is the case for all regions, even for India, whose population will nevertheless increase by 141 million people. An additional 776 million people will be living on the planet in 2023, half of them in the Asia and Pacific region, although the growth rate in this region is below the growth rate experienced during the last decade.

Among OECD countries, Japan’s population is expected to decrease by nearly 3 million inhabitants during the next decade, and Europe should also expect a slightly negative growth of its population. The European Union however, continues to grow at a rate of 0.1% p.a. Australia, Turkey and Mexico have the highest projected population growth rates among the OECD countries.

The Russian Federation is another country where the population will be shrinking, with a drop of 4.5 million expected in the coming decade. World population growth is still driven by developing countries, and, among the
developing countries, those in Africa are expected to show the fastest population growth at 2.4% p.a., which is nevertheless lower than in the last decade.

**Inflation should remain moderate**

Inflation in OECD countries is measured by the Private Consumer Expenditure (PCE) deflator. It is expected to remain stable in most OECD countries and should increase only slightly at an average rate of 2.2% p.a. over the next ten years, close to the level of 2% in the last decade.

In the Euro area, where unemployment is still high, inflation remains low and deflation risk has risen. In Japan, where deflation is a concern, monetary policies should allow inflation to turn positive, with the inflation rate expected to reach 2.1% p.a. during the next decade.

Inflation pressures in developing countries (GDP deflator base) are expected to ease during the next decade. Capital inflows to emerging markets have been reduced, and countries which are exposed to inflation risk started to increase interest rates. Energy prices are estimated to increase, but their impact on inflation is expected to be limited.

**A stronger US Dollar in the outlook period**

The nominal exchange rate for the period 2014-23 is mostly driven by the inflation differentials vis-à-vis the United States (small change in real terms). The assumptions on exchange rates during the next decade are characterised by a stronger US dollar compared to other currencies in line with the recovery of the US economy. Nominal exchange rates adjust in line with inflation rates.

The projected depreciation of more than 40% of their currency for the period 2014-23 in some countries, like Brazil, India and South Africa, will stimulate export growth in these countries, although their competitive advantage may be muted if the currencies of their competitors also depreciate by similar magnitudes.

The exchange rates of developing countries are also expected to depreciate against the US dollar in most countries. However, currencies of some, especially resource rich, countries will appreciate relative to the US dollar.

**Energy prices**

The world oil price assumption used in the baseline until 2015 is from the short term update of the *OECD Economic Outlook* N°94 (November 2013), while oil prices during the projection period are from the *World Energy Outlook* (IEA, 2013).

In nominal terms, the price is expected to increase slowly over the outlook period from USD 109 per barrel in 2013 to USD 147 per barrel by 2023, an average annual growth rate of 2.8%.

**Policy considerations**

Policies play an important role in agricultural and fisheries markets, with policy reforms often contributing to change the structure of markets. Policy reforms such as decoupled payments and continued progress towards the elimination of direct price supports imply that policies will have a less direct effect on production decisions in many countries. However, import protection, domestic support and price intervention policies still loom large in many countries with the subsequent distorting effects on international markets and trade.

The projections for United States do not reflect the recently enacted Agricultural Act of 2014. Instead, the projections are based on the 2008 Farm Act which was assumed to be extended and remain in effect through the period.

This baseline does not take into account the proposal made by the US Environmental Protection Agency (EPA) to reduce the total, (i.e. the advanced and the cellulosic biofuel mandates) for 2014, as the final EPA decision is expected in June 2014 (or in the course of 2014).

The agreement on the reform of the common agricultural policy (CAP) towards 2020 provides EU Member States with implementation options which need to be decided by August 2014. Therefore, the baseline will reflect the CAP reform only in part: expiry of the milk quota as of 2015, expiry of the sugar quota system as of 2017, budget ceilings for decoupled single farm payment, coupled payments to stay at current level until August 2014 when each Member State
shall inform the Commission of their decision on the management and magnitude of coupled payments. The effects of “greening,” in particular the requirements on permanent grassland and ecological focus area, are also taken into account to the extent possible.

### Box 1.2. Food price inflation

**Consumer food price inflation is slowing across the world**

Global inflation of consumer food prices, as measured by year over year changes in the monthly global Consumer Price Index for Food (CPIF), is estimated at 6.4% in early 2014. During the commodity price crisis of 2008, CPIF inflation peaked at 16.5% then fell below 5% in the weakness of the Great Recession in 2009. It fluctuated between 5% and 11% from 2009 to 2013, following the volatility of commodity prices and general domestic inflationary pressures. The roller coaster path of primary agricultural commodity prices had a different impact on consumer prices around the world. Less developed countries faced the highest inflation rates (Figure 1.2). In Africa, for example, food price inflation peaked at 23% in 2008, and again at 14% in 2011, but it fell to 6% at the start of 2014. At the other extreme, food price inflation in the OECD area peaked at 7% in 2008, but has fallen to 2.1% at the beginning of 2014. At the start of the outlook period, food price inflation at the consumer level appears lower and more stable for all regions than it has been in the turbulent years following the price crisis.

**Figure 1.2. Consumer food price inflation lower in developed countries**

Average annual food price inflation rates in per cent, 2008-2014

Note: BRICS includes Brazil, the Russian Federation, India, China and South Africa.

Source: OECD and FAO Secretariats.

Regional data obscure the divergent experiences of individual countries. While those listed in Figure 1.3 follow the general global or regional trends, they exhibit variation that may also be the result of local factors such as exchange rate movements, higher domestic inflation or adverse weather events. For example, while food prices fell in the United States and Japan during the recession, India witnessed its highest inflation rate. Retail food price inflation in China has fallen from high to low levels in the past year. Food price inflation in Turkey has remained higher during the period relative to other OECD countries. Detailed information on a country basis is provided in Tables B.1 of the statistical annex.
Consumer prices for food follow primary agricultural commodity prices

In March 2014, the FAO’s Food Price Index (FPI) of internationally traded primary food commodities reached the value of 212, relative to its base value in 2002-04 of 100. This level is thus over 100% higher in nominal terms, and 50% in real terms, than its level a decade ago. Primary commodity prices transmit to retail level, and data show that consumer prices follow agricultural commodity prices. However, the degree of co-movement and the time-lag varies significantly across regions. Levels of price pass-through from international commodity markets to domestic retail markets depend on the degree of market integration, import dependency and the presence of short value-chains. Figure 1.4 illustrates some regional differences in transmission from the international benchmark price, as represented by FPI, to the domestic retail price indicator (CPIF). The transmission is stronger, for example in Eastern Africa than for the world as a whole, given the strong reliance on primary commodities in final consumption and on imports. The transmission from the FPI to the CPIF in the OECD area appears particularly weak, due largely to the length of value added chains in final consumption.

Real food consumer prices are rising

Real food consumer prices measure the extent to which food prices are rising relative to the prices in the basket of all consumer goods in the economy. Real food price inflation is still a feature in most countries, but it is

Source: OECD and FAO Secretariats.

Source: FAO, ILO, UNSD and national websites; calculations by FAO Statistics Division.
significantly higher and more volatile in developing countries than in OECD countries, as illustrated in Figure 1.5. One of the explanatory factors is a higher weight of food in the consumer basket of developing countries. Another factor is the higher integration in developed countries between food markets and other sectors of the economy, due to lengthier, more complex and diversified value-chains and market structures.

**Figure 1.5. Real consumer prices are rising**

Real food price inflation per cent change

Note: Real food price inflation is the ratio of Food CPIs to all items CPIs. BRICS refers to Brazil, the Russian Federation, India, China and South Africa.

Source: FAO, ILO, UNSD and national websites; calculations by FAO Statistics Division.

1 See glossary part for a description of methodology used in the construction of the indices.

2 Agricultural commodity prices refer to international benchmark prices for the main raw agricultural commodities such as wheat, maize, etc. The FAO Food Price Index measures the change in the value of the trade basket of several agricultural commodities, including sugar, dairy products and meat. Food consumer prices refer mainly to derived products bought in retail markets by consumers. Food Consumer Price Indices measure the change in the value of an average basket of food products purchased by households.

3 For more details on this topic, see for example: FAO Global and regional consumer food inflation monitoring, January 2014, FAO, Rome.

**Consumption: Global consumption continues to increase but at a slower rate**

Having demonstrated its resilience in the past, the demand for agricultural products is expected to remain firm through the outlook period, even if the rate of growth is slower compared to the past decade. Rapidly growing Asian economies are expected to account for the greatest share of additional consumption, while saturated levels of per capita food consumption and declining population growth rates result in much slower consumption growth from regions like North America and Europe. Substantial population growth in Africa will drive significant increases in total consumption, however per capita consumption growth in the region remains marginal.

In addition to increasing consumption levels, growing incomes and urbanisation also result in shifts in lifestyle habits and dietary structure, typically from a traditional cereal-based diet to a more protein-rich, diversified diet. Consumption trends also tend toward processed and prepared foods, widening the spread between farm gate and retail prices of food items. Expansion of the livestock sector alters the demand for crops, resulting in a declining share of pure food crops, in favour of crops like coarse grains and oilseeds.
which are also used to feed livestock. The emergence of biofuel and other industrial uses adds a further important dimension to demand, which will remain significant in the future.

Growing diversity in the use of agricultural products

Cereals are still at the core of human nutrition, but their role has been shifting and will continue to do so in the coming decade. On a global scale, food remains the most important use of cereals: more than 1.2 billion tonnes (Bt) of food demand is projected for 2023, which is 150 million tonnes (Mt) more than in 2011-13 (Figure 1.6). Feed demand is the fastest growing sector, in line with shifting diet preferences. Almost 160 Mt additional feed will be needed by the end of the decade. After the rapid expansion in the previous decade, ethanol use currently accounts for 12% of global coarse grains consumption. However, a significant slow-down in the expansion of maize-based ethanol is expected as the blend wall in the United States is approached in the coming years.

Based on strong feed demand, coarse grain demand will grow by 20%. Wheat demand, mostly a food commodity, is projected to increase by 12% through the next decade, while rice consumption will grow marginally faster, increasing by 15% through the same period. Consumption of rice in Africa is expected to increase substantially, increasing its importance relative to other more traditional staple food crops, like roots and tubers. Supported by a strong demand for vegetable oils and protein meals, oilseeds consumption will increase by 26% through the ten-year period, more than any other commodity.

Growing incomes, urbanisation and a certain globalisation of eating habits all contribute to more food being consumed ready-made, increasing the consumption of vegetable oils and sugar. Both are important components in human diets and especially in many developing economies constitute a crucial source of energy. The annual per capita food consumption of vegetable oils in developing economies is expected to grow by 1.3% p.a. over the next decade, reaching a level of just over 20 kg per capita by 2023, compared to a level of 25 kg per capita in developed economies. Per capita consumption of vegetable oil in least developed economies is expected to reach only about 13 kg by 2023. Projections indicate that sugar consumption will grow on average by 2% p.a., with developing countries displaying the fastest growth. Sugar consumption is projected to show little or no growth in many developed countries due to saturated consumption levels in these markets. The increasing demand for biofuel will impact on the sugar, coarse grains and vegetable oil markets by providing a demand dimension that links food to energy markets and their political environment. Increased consumer spending power will elevate the demand for cotton products. India, the world’s largest cotton producer, will be the leading beneficiary of additional cotton intake through the next decade. However, China is expected to retain the biggest share of global cotton use in 2023.
Figure 1.6. Growing diversity of crop use
Cereal consumption in developed and developing countries

Source: OECD and FAO Secretariats.

Food and fuel use of agricultural commodities continues to be regulated in many countries

The policy environment will continue to shape the consumption of agricultural commodities, both as food and biofuel. For example, the Indian National Food Security Act, adopted by the Indian Parliament in 2013, is expected to subsidise the consumption of rice and wheat for about two-thirds of the Indian population, resulting in higher levels of rice, wheat and coarse grain consumption in India over the outlook period.

The consumption level of bioethanol for fuel and biodiesel continues to depend mostly on the targets or mandates set by governments in both developed and developing economies. Those targets have been introduced over the past years to achieve higher levels of energy security, lower levels of carbon dioxide emissions, and generate income opportunities. Most of these policies establish blending targets of renewable fuels in total transport fuels and changes in these target levels will impact the use of biofuels in the next decade.

Population growth and changing dietary preferences drive firm demand for meat and dairy products

The demand for meat and dairy products will increase substantially through the next decade, as higher income levels and increasing urbanisation in developing regions allow consumers to raise the level of protein intake in their diets relative to starches. Global meat consumption is projected to increase by 1.6% p.a. through the next decade, resulting in more than 58 Mt of additional meat consumed by 2023 (Figure 1.7). Consistent with the trend through the past decade, developing countries will consume more than 80% of the additional meat, in part due to substantially higher population and income growth relative to developed countries, but also due to the fact that per capita meat consumption in developed regions is already high. In Canada for example, per capita meat consumption will stagnate through the next decade.

The choice between different meat products consumed is driven mostly by the relative prices of meat products, traditional tastes and preferences, as well as consumer sentiments related to health, the environment and convenience. Growth in global meat consumption will be led by poultry, which remains
the cheapest and most accessible source of meat for lower income consumers, while its low share of saturated fats results in it being viewed as the healthiest meat choice. In addition, poultry faces few cultural barriers related to its consumption, resulting in robust consumption growth across geographical areas. This combination of factors results in poultry accounting for half of the additional meat consumed by 2023.

The second most popular meat is pork which is projected to account for nearly 30% of the additional meat consumed in the next decade. This increase is driven by Asia and the Pacific, notably Chinese consumers who will capture half of the global increase. Beef amounts to 15% of the additional meat consumed and sheep meat to the remaining 6%. Growth in demand for sheep meat is concentrated in Asia and the Pacific and the Middle East, while that for beef is concentrated in Latin America and the Caribbean.

Per capita fish consumption will also be rising on all continents except Africa where it will decline slightly. Average annual growth rates in fish consumption are expected to slow down in the second half of the outlook period, when fish prices will increase more than meat prices, and, as a consequence, consumers will substitute some fish dishes by meat dishes.

![Figure 1.7. Most of the growth in meat and fish consumption will occur in developing countries](image)

Livestock consumption in developed and developing countries

Source: OECD and FAO Secretariats.

The demand for dairy products will continue to expand at a rapid rate through the next decade. Fresh dairy products constitute the bulk of consumption in developing regions, where India is expected to increase its consumption to 170 kg per capita by 2023. Nevertheless, total consumption of dairy products in milk equivalent will remain considerably higher in developed than in developing countries. This difference stems from the per capita consumption of cheese which is more than tenfold higher in developed countries compared to developing ones. Per capita consumption of dairy products in developing countries is projected to increase by 1.9% p.a. for cheese and butter and at 1.2% p.a. for milk powder.

Production: The developing world remains the epicentre of most agricultural production growth

Rising income levels and a growing global population that is increasingly urbanising, especially in populous developing countries together with increasing non-food use of agricultural products, will require a substantial expansion of production through the coming decade. While cereals remain a key dietary component, particularly in least developed countries, rising protein consumption in other developing
regions will require an increased production of livestock and dairy products, which also implies greater demand for feed grains and oilseeds.

The rate of production growth is constrained by different factors, including increasing costs of production, limited expansion of agricultural land, environmental concerns and changes in the policy environment. These factors are particularly relevant in most developed countries and some highly populated developing countries, limiting expansion in these countries while presenting opportunities to regions that are less affected by these limiting factors. As in the past decade, projected production growth through the outlook period will be led by Latin America, Sub-Saharan Africa, Eastern Europe and parts of Asia, with production growth in Western Europe increasing only marginally. Developing regions will account for more than 75% of additional agricultural output over the next decade.

Global cereal production is expected to increase by almost 370 Mt through the next decade, reflecting a growth of 15% by 2023, relative to the base period (Figure 1.8). Developing regions will account for 60% of additional production by 2023. Coarse grains remain the greatest driver of increased cereal production in terms of volume, while the rate of production growth for oilseeds, at 26% through the ten-year period, will exceed that of all other crops. Developed countries will account for almost 50% of the additional global coarse grain production, while developing countries will supply approximately 65% of additional oilseed production. The expansion of coarse grain and oilseed production will be driven by high demand for biofuels and other industrial uses in developed countries, as well as greater feed demand, particularly from developing regions.

In contrast to crops produced for multiple purposes, the expansion rates of cereals, produced mainly for food consumption, will be moderate through the outlook period. Wheat production will increase by around 12%, while rice production is projected to increase by 14% through the ten-year period, well below their growth rates through the past decade. While developed regions are expected to account for almost 50% of additional wheat produced globally by 2023, developing countries will produce more than 95% of the additional rice output, with China accounting for the greatest share of global production to meet the ambitious self-sufficiency targets set up by the Chinese government.

**Figure 1.8. Production of crops rising**

*Additional crop production: volume and per cent 2023 relative to 2011-13*

Source: OECD and FAO Secretariats.
Sugar production is projected to increase by 20% through the coming decade, concentrated mainly in developing countries. Brazil remains the world’s largest sugar producer and it is expected that its sugarcane producers will keep taking advantage of the fact that they can supply for two competing markets: sugar and ethanol. This will allow for a continued expansion of sugar production in Brazil through the next decade.

Biofuel production will expand substantially, with both ethanol and biodiesel production increasing by more than 50% through the next decade. This represents a significant slowdown relative to the past decade, when production more than doubled through the ten year period from 2004 to 2013. It is anticipated that cellulosic biofuels will only contribute marginally to these figures and that traditional feedstock (i.e. sugar molasses, maize and vegetable oils) will remain the main feedstock for biofuel production in the next decade.

**Poultry continues to dominate the livestock sector**

Global meat production will increase by more than 58 Mt through the outlook period, concentrated in developing regions, which will account for 78% of the additional meat production, mainly from countries that produce surplus feed grains (Figure 1.9). Poultry continues to dominate the meat sector, as reflected in production growth of 27% by 2023 relative to the base period. This represents almost half of additional meat produced globally by 2023. A high feed conversion ratio, short production cycle and simple production process has made poultry the low cost alternative which consumers in developing countries demand first as their income level rises. Currently, pork accounts for the greatest share in world total meat production, however, a comparatively slower growth rate through the next decade will result in it being surpassed by poultry by 2020. Pork production is projected to increase by 17 Mt, by 2023, 15% higher compared to the base period. China continues to dominate the market and is expected to produce almost half of the additional pork.

The production of pork and poultry relies on the intensive use of feed grains. This increases the extent to which the supply response is conditioned by feed prices that remain relatively high through the outlook period compared to historic norms. The result is declining production growth rates through the projection period compared to the last decade. In contrast, beef production, which exhibits greater flexibility in terms of feeding regimes, is expected to grow faster in the coming decade compared to the last. Nevertheless, projected production growth through the outlook period is only 13%, as reduced herd numbers, environmental constraints and a longer production cycle limit the initial supply response to improved profitability. Brazil will account for the greatest share of additional beef produced through the next decade. Sheep meat production is also projected to grow faster in the coming decade than the last, driven by firm prices due to strong import demand from Asia and the European Union. An increase of 28% through the outlook period amounts to 3.8 Mt. Australia and New Zealand are expected to supply the bulk of this additional output. However, firm dairy prices, which imply greater competition for pasture from the dairy sector, result in much slower production growth in New Zealand compared to Australia.
Figure 1.9. Higher livestock production

Additional livestock production: volume and per cent 2023 relative to 2011-13

Source: OECD and FAO Secretariats.

India is expected to become the largest milk producer in the world through the next decade, thereby overtaking the European Union’s leading position in the dairy sector. China’s milk production prospects have been lowered in this Outlook, due to low production levels in 2012 and 2013, but it is expected that its dairy industry will return to a stronger growth path. Most of the production increases in cheese and skimmed milk powder (SMP) will occur in developed countries, while butter and whole milk powder (WMP) production will grow the strongest in developing countries.

Fish production is expected to expand by 17% over the next decade. This growth will be the result of increased aquaculture production, which is anticipated to surpass captured fish for human consumption in 2014. In 2023, 62% of the world aquaculture production will take place in China.

Yield increases will drive production growth of most crops

The main challenges that contribute to declining production growth rates through the outlook period are the rising costs of production, including higher prices of energy inputs, feed and labour. Further resource constraints, like land degradation, water scarcity and increasing environmental pressures, present additional limitations, particularly in regions where land availability for agricultural expansion is severely constrained. Continued investment in research and development, and extension services, remains critical to achieve much needed productivity gains, especially in developing countries. Box 1.3 lists different policy actions that can enhance agricultural productivity in China. The recent expansion of shale gas production in the United States could potentially reduce fertiliser prices in the United States, but this input price reduction is not expected to transfer to other countries (Box 1.4).

Box 1.3. Enhancing agricultural productivity and food security in China

Better access to and availability of food along with higher incomes in China have lifted 114 million people out of undernourishment (from 272 million in 1990-92 to 158 million in 2011-13, accounting for two-thirds of the worldwide drop). The incidence of undernourishment almost halved in China, falling to 11.4% of the population (FAOSTAT, 2014). Indeed, the past two decades have witnessed a more than five-fold increase in urban real per capita incomes and a more than three-fold increase for rural households. During the same period food availability per person doubled and protein supply per person was up by more than one-third. Currently, undernourishment in China is concentrated...
among the poorest in rural areas, often amongst members of small-scale farm households.

Improving agricultural productivity, while conserving natural resources, is an essential requirement to increase China’s food supplies on a sustainable basis. Currently, China’s agriculture is still dominated by small-scale farming that is intensive in terms of input use—fertilisers and pesticides—leading to high land productivity but at the cost of environmental degradation. With continued large-scale rural-urban migration, the number of farmers is falling, boosting the low level of labour productivity and raising incomes, but remaining farmers are ageing with negative implications for future productivity. Consolidation of smaller farms and greater mechanisation will be needed to ensure increases in production from a falling and ageing labour force. Overall, the old model of intensification with ever increasing inputs is no longer sustainable and China’s food system will need to “produce more from less” and to benefit from stronger integration with international markets. A number of policy actions can support transformation, including:

- **Completing the conversion of input subsidies into direct payments and, ultimately, into strategic public investments**: gradually replace input subsidies by direct payments paid at a flat rate per unit of land, with no requirement to purchase a given input or to produce a specific commodity.

- **Improving agricultural productivity via enhanced innovation**: further strengthen research and development, intellectual property rights, technology adoption and transfer, education, and farm training and advisory services; consider new seeds and applying better fertilisers.

- **Enhancing efficient water use**: adjust water pricing to cover water provision costs and to stimulate a move away from water-intensive crops.

- **Let the market mechanism play a more decisive role in the allocation of resources**: balance between market mechanism and government intervention; innovate markets regulation and strengthen credit availability and risk management.

- **Diversifying sources of food through stronger integration of domestic and international agro-food markets**: safeguard national grain security, ensuring 100% self-sufficiency in rice and wheat; promote the opening-up of agricultural markets and make timely and appropriate use of global resources and channels of international agricultural products market.

- **Enhancing the development of the land market**: improve the land rights of farmers, allowing them to buy, sell, lease and inherit land rights so improving prospects for larger farms and mechanisation; base the compensation paid when agricultural land is converted to other uses on market prices; allow farmers to sell land zoned as residential directly to developers.


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**Box 1.4. Feedstock issues and developments in the nitrogen fertiliser sector**

Natural gas currently accounts for two-thirds of global ammonia capacity, (ammonia being one of key components of nitrogen fertiliser). Other feedstocks include coal, naphtha and petroleum fuel. Over the next decade, virtually all new ammonia projects will be based on natural gas. Feedstock supply for the manufacture of fertilisers has become a decisive factor in the competitiveness of large producing and exporting countries, in terms of relative costs and security of supply. Between 2008 and 2013, natural gas prices have been rising in the main ammonia producing and consuming regions, with the exception of North America. According to industry sources, natural gas prices are projected to increase in the Russian Federation and China within the next five years, while remaining relatively stable in Western Europe. Moderate increases are expected in Western Asia and Northern Africa.

The rapid emergence of shale gas production in the United States has resulted in a significant increase in domestic gas supply and lower natural gas prices than five years ago. The United States accounts for 88% of global
unconventional gas' production (International Energy Agency, 2013). Shale gas accounted for 39% of the total US gas production in 2012, against 3% in 2002. Shale gas is expected to drive all incremental gas supply in the United States over the next decade. In 2035, shale gas production is projected to account for half US natural gas production (US Energy Information Administration, 2012). While many countries with potential shale gas resources wish to replicate the developments seen in the United States, no significant exploitation of shale gas is anticipated outside Northern America before the end of this decade.

Related to the development of shale gas, the most significant supply-related development in the global nitrogen fertiliser industry since 2011 has been the development of new ammonia capacity with ammonia capacity expanding in the United States for the first time since 1998.

Prospects of rising supplies of gas from unconventional sources and projections of moderate prices in the long term, have led several companies and organisations to announce plans for new greenfield capacity. Since June 2012, more than 25 projects have been announced in the United States (and some in Canada) for nitrogen-based capacity, including brownfield expansions, new stand-alone ammonia plants and fully integrated multi-production downstream complexes. These projects, if implemented, would add more than 10 Mt of new urea capacity in Northern America. Among the announced projects, only a few (between five to eight) are forecast to start operating before 2018, and already several (at least five) of these have been cancelled due to growing competition as well as regulatory and logistical issues. All new projects will have to comply with demanding regulatory processes and stringent environmental legislations.

![Figure 1.10. US ammonia capacity](image)

Note: e means estimate.
Source: IFA, 2014.

The expansion of shale gas in the United States will significantly shift the production and trade balance of the US fertiliser industry. The United States is currently the world’s fourth largest ammonia producing country (after China, India and the Russian Federation although its capacity has been dwindling since 1998, when it was close to 18 Mt. Due to competitive pressures, high feedstock cost and industry restructuring, US ammonia capacity fell by 40% between 1998 and 2012, to less than 11 Mt. Lower domestic production led to a rise in ammonia imports. At the beginning of 2000, the United States was the world’s largest importer of ammonia, accounting for nearly one-third of global ammonia trade (IFA).

With the new projects coming on stream, by 2017 US ammonia production is projected at around 16 Mt, 45% higher than 2012. Most new production plants are aiming to produce a wide range of downstream nitrogen products.

In the short term, access to ample supply of natural gas at competitive prices in the United States has improved the margins of nitrogen producers and allowed the US industry to improve its operational performance, increase production and operate at higher utilisation rates. In the near term, rising nitrogen capacity will mean that the United States will substitute some imports of ammonia and urea with domestic supplies. In very few cases, some projects may lead to the export of US nitrogen products, but overall the United States is not likely to become a large net exporter.
The term unconventional gas refers to methods used to extract methane gas from underground shale rock and coal beds.


The limited availability of additional arable land will impact the expansion and concentration of additional crop production. Additional arable land is more readily available in Eastern Europe, Latin America and the Caribbean and Sub-Saharan Africa, while the allocation of limited land amongst different crops in most other regions will be derived from market conditions and the relative profitability of suitable crops.

Production increases in wheat, coarse grains and rice will be mostly based on yield growth (Figure 1.11). Even though the area increases for coarse grains are relatively small, in 2023 this crop will account for the greatest share of total area harvested (34%), followed by wheat (23%) and oilseeds (17%). Production increases in oilseeds, sugarcane and cotton, on the other hand, are a combination of growth in yield and area expansion. This is not surprising as these commodities are mostly grown in regions where additional land suitable for agricultural production is still available: 63% of oilseeds are grown in the Americas, most of the world’s sugarcane is cultivated in Latin America and the Caribbean, while India is expected to become the world’s largest producer of cotton, surpassing China. West Africa will realise the fastest yield growth in cotton, while in China less area will be cultivated with cotton as a result of the uncertainties surrounding its cotton policies.

**Figure 1.11 Growth in arable crop area and yield**

Per cent change 2023, relative to 2011-13

![Chart showing growth in arable crop area and yield](chart)

Source: OECD and FAO Secretariats.

Milk production will be driven by yield growth in developed countries and by increased herd numbers in developing countries. Greater livestock numbers will also be required in order to meet the demand for additional meat through the outlook period, resulting in growing environmental concerns. Significant scope remains for improved productivity in both meat and dairy production, particularly in developing regions,
which will be key to the growth of a sustainable livestock sector. The cost of compliance to environmental regulations will also impact the regional concentration of livestock production.

**Growing influence of domestic policies on production decisions**

Policies continue to shape production decisions in many countries. Although producer support has fallen over time, in 2013, about one-sixth of farm gross receipts in OECD countries are due to public policies that support farmers. This is indicated by the percentage Producer Support Estimate (%PSE) which, on average for the OECD area, fluctuated between 18% and 19% over the 2011-13 period. In value terms, the PSE in 2013 totalled USD 258 billion. The composition of support is arguably even more important than the level. Some countries continue to rely mostly on output-based support, which is potentially the most production and trade distorting. The majority of this support is generated through border protection and domestic price regulation. Other countries reoriented their policies away from market price support. The shift away from market price support and the introduction of payments decoupled to different degrees from commodity output increase the flexibility of producers in their choices of product mixes. Boxes 1.5, 1.6, and 1.7 give an overview of recent policy developments in the European Union, the United States and Japan.

Agriculture policies in the key emerging economies monitored by OECD (Brazil, China, Indonesia, Kazakhstan, Russian Federation, South Africa and Ukraine) demonstrate trends that differ from those observed in the OECD area. Recently, agricultural support levels in most of the emerging economies have tended to rise, in particular in China and Indonesia. This reflects increasing availability of budgetary resources, policy priorities turning more towards agricultural and rural development, and recently, a strengthened emphasis on food security concerns which these countries tend to view mostly from the self-sufficiency angle.

Government policies also influence the biofuel industry, where they are still expected to drive future developments. They subsequently also shape production of the feedstock commodities. In the United States, government mandates have played a major role in the fast growth of maize based ethanol production, while the EU biodiesel policy has led to strong increases in the cultivation of rapeseed for vegetable oil production. Palm oil production in Indonesia and Malaysia is also expected to expand as a result of changing biofuel policies. Sugar production is promoted by government support schemes such as the US sugar programme and, through the increased interest in sugar-based ethanol, is also affected by biofuel policies. The future of biofuel production and the associated feedstock is hence greatly determined by how the main producers of biofuels will design their policies. The uncertainty that currently surrounds these policies, especially in the European Union and United States (see also biofuel chapter), implies that policy changes could completely change the production outlook for these commodities.

Government stockholding policies for various commodities in China, India, Thailand and Viet Nam have resulted in large inventories. The costs that these programmes may incur, especially if stocks have to be released at below acquisition prices, question their sustainability in the long run. Thailand’s rice pledging scheme, which was re-instated in 2011, has accumulated large inventories and the manner in which they will eventually be released has important implications for rice producers. In China, virtually the entire increase in cotton stocks has been driven by state authorities purchasing China’s official cotton reserves. Significant differences between world prices and domestic prices supported by policy resulted in substantial increases in imports, compounding the rising stock levels. Policy makers in China have indicated that the current level of cotton stocks is unsustainable and are reforming the policies that led to the increase. With such large stocks, any change in policy could have significant impacts on cotton prices, production and trade.
The new Common Agricultural Policy (CAP) began to enter into force on 1 January 2014. The year 2014 has to be considered as a transitory year with full implementation of the new system of direct payments as of 1 January 2015. While the existing structure of policy instruments was broadly maintained, the reformed CAP provides greater emphasis on environmental issues, and more flexibility in the reallocation of funds between the two pillars (Pillar I: direct payments and market measures; Pillar II: rural development programmes) as well as on the implementation of its instruments at Member State level.

The CAP has been allocated a total budget of EUR 408.3 billion for the period 2014-20, which represents 37.7% of all EU expenditure for the next multiannual financial framework. This constitutes a decrease in real terms in the total agricultural budget compared to the previous funding period.

The reformed CAP aims to maximise its effectiveness and efficiency in reaching its objectives, which includes a higher level of sustainability and an increase in competitiveness, through:

i) Requiring Member States to distribute 30% of first pillar direct payments subject to fulfilling certain practices beneficial for the environment and addressing climate change and to allocate at least 30% of each rural development programme (second pillar payments) to environment and climate related measures adapted to local needs.

ii) Limiting direct payments to beneficiaries who are actively engaged in agricultural activities, providing additional support for young farmers, and giving Member States the option to offer a special scheme for small farmers, a supplement for farmers in areas with natural constraints and to increase product specific support to potentially vulnerable sectors (the so-called coupled support).

iii) Direct payments among countries and among farmers will progressively be reallocated based on convergence of basic direct payment levels across and within Member States and on the degressivity of these payments; besides Member States may implement a voluntary redistributive payment to rebalance payments towards smaller farms and introduce a capping for the basic payments.

iv) Dismantling all existing restrictions on production volumes and modernising commodity aid schemes.

v) Offering more flexibility to implement exceptional measures and an improved risk management toolkit under the second pillar.

vi) Providing a reinforced framework for producer co-operation as tool for improving the functioning of the food chain.

vii) Establishing a common and coherent overall EU policy framework for all European Structural Investment funds, including rural development.

viii) Facilitating knowledge dissemination through the European Innovation Partnership and the Farm Advisory System.

As the agreement on the CAP reform provides Member States the possibility to decide their respective implementation options for Pillar I by August 2014, with full implementation of the reformed CAP from 1 January 2015, it is premature at this time to provide a full assessment of the impact of the reform.
Box 1.6. Japan’s agricultural policy reform post-2014

On 10 December 2013, Japan announced the Plan to Create Vitality for Agricultural, Forestry and Fishery Industries and Local Communities. The reform is the first major agricultural policy change since the introduction of income support payments in 2011. The Plan aims at doubling the incomes of agricultural industries and communities within a decade, doubling food exports up to JPY 1 trillion (USD 10.2 billion) by 2020, doubling the number of new entrants to agriculture (young farmers), concentrating 80% of farmland use to core (potentially viable) farmers and lowering the cost of rice production of core farmers by 40%. To achieve these goals, the Plan is based on four pillars: i) strengthening farms and production, ii) reforming agricultural subsidies with careful attention to the multifunctionality of agriculture, iii) establishing food value chains and iv) increasing demand for food and other agricultural products. This plan was developed against the backdrop of an increased need for supply-side structural reform in Japan. Over the past two decades, the agricultural sector experienced a decrease of nearly 30% of agricultural production (JPY 11.2 to 8.2 trillion), a drop in agricultural income of more than 40% (JPY 4.9 to 2.8 trillion), an increase in the average age of farmers by seven years (from 59 to 66 years) and a doubling of the size of abandoned farmland.

According to the Plan, the allocation of the rice production quota will be phased out by March 2019. The programme limits the supply of rice by allocating a production quota to rice farmers, and it keeps the price above the market equilibrium level. In spite of the production limits, the rice farming sector has experienced a price decrease of over 30% over the last two decades (1992-2011), driven by a decrease in consumption at an average rate of 80 000 tonnes annually. The government, agricultural organisations and farmers will work together in the next few years to create a situation where farmers plan rice production and shipment according to actual rice demand, without depending on the allocation of the rice production quota. In order to realise the situation, the government will provide more information on the forecast for supply and demand for rice and monthly data on selling and price situation by growing area to farmers. A number of changes have been planned for the payments for rice and upland crops. Starting in 2014, the direct payment for rice production, (under the income support payments), offered to rice farmers who met the quantitative target set by the government, will be reduced by half, from the current JPY 15 000 (USD 154) per 0.1 ha to JPY 7 500 (USD 77) per 0.1 ha. This payment will be abolished in 2018. The price-contingent payment for rice will be eliminated in 2014. This payment, for which all farms with sales records are eligible, triggers when the average producer price of current crop year falls below the average price of the preceding three crop years.

The direct payment under the income support payments for upland crops (wheat, barley, soybean, sugar beet, starch potato, buckwheat and rapeseed), for which all farms with sales records are eligible, will remain unchanged in 2014, but it will be made to core farmers regardless of their farm size from 2015 onwards. Also starting in 2015, the eligibility for the income-based payment (which is available to producers of rice, wheat, barley, soybean, sugar beet and starch potato) will be limited to core farmers, independent of their farm size. The income-based payment compensates 90% of the loss of income compared with the average income of the preceding three crop years (an average of three out of the previous five, leaving out the highest and lowest). If a farm is eligible for both the price contingent payment and the income-based payment, the income-based payment is made after subtracting the amount of the price contingent payment so as to avoid duplication of payment. A policy option to introduce income insurance will be considered in the medium-term. Incentives to diversify crops (e.g. rice for feed) will be reinforced by increasing the amount of payments as well as introducing a quantity based payment to support rice farmers who want to shift from rice production into other crops. In addition, a new multi-functional payment to local community activities to conserve and improve the quality of rural resources will be introduced in 2014 through reorganising the current financial support for infrastructure, such as irrigation and drainage facilities.

Discussions on related issues are also taking place in other fora. The Regulatory Reform Committee is responsible for the reform of the agricultural sector, including agricultural cooperatives and requirements for land ownership of private companies. The Council of Industrial Competitiveness deals with deliberating measures to increase added values of agricultural products and to double food exports. Based on these reforms, Japan will launch discussions to revise the Basic Plan on Food, Agriculture and Rural Areas in 2014. The Basic Plan is a national plan for implementing policies on food, agriculture and rural areas, which is revised every five years. The Basic Plan was previously revised in 2010. A key issue in the next revision will be to discuss whether the current food self-sufficiency target of 50% on a calorie supply basis and 70% on production value basis by 2020 is sufficient. This is in comparison to the former Basic Plan (revised in 2005), which targeted 45% on a calorie supply basis and 76% on a production value basis by 2015. The actual rates were reported at 39% and 68% in 2012 for calorie supply and production value, respectively.

Sources: Prime Minister of Japan and His Cabinet; Ministry of Agriculture, Forestry and Fisheries of Japan.
Box 1.7. New US farm legislation in 2014

A new farm law, the Agricultural Act of 2014, was signed on 7 February 2014, and will remain in force through 2018. The 2014 Farm Act makes major changes in commodity programmes, adds new crop insurance options, streamlines conservation programmes, modifies key provisions of the Supplemental Nutrition Assistance Program (SNAP, formerly known as food stamps), and expands programmes for specialty crops, organic farmers, bioenergy, rural development, and beginning farmers and ranchers. Total outlays for 2014-18 under the new Farm Act are projected to be USD 489 billion (nominal USD), of which 80% will be for programmes under the Nutrition title.

The 2014 Farm Act makes major changes in commodity programmes, ending more than 15 years of crop programmes that made payments to producers based solely on historical production, removing upland cotton from coverage under Title I programmes and introducing a new dairy margin insurance programme. The legislation also renews the Supplemental Disaster Assistance programmes for livestock and orchards and nursery stock. The Congressional Budget Office projects these changes in Title 1 will reduce outlays by USD 6 billion (nominal USD), or 25%, over the projected costs of continuing current commodity programmes.

The Direct Payments, Countercyclical Payments and Average Crop Revenue Election (ACRE) programmes are repealed, and replaced by the Price Loss Coverage (PLC) and Agriculture Risk Coverage (ARC) programmes. Producers of covered commodities (wheat, feed grains, rice, oilseeds, peanuts and pulses) may choose to participate in either, but not both programmes, for the life of the 2014 Farm Act. To receive payments under these programmes producers must comply with applicable conservation requirements, which also apply to producers participating in conservation and crop insurance programmes. The marketing assistance loan programme continues unchanged, except that the loan rate for upland cotton, unlike the fixed rates set for other commodities, will be based on a moving average within a fixed range, with a maximum rate no higher than the rate set under previous legislation. The sugar price support programme also continues unchanged.

The Dairy Product Price Support Program and the Dairy Export Incentive Program are repealed, and replaced by the Margin Protection Program (MPP) for dairy producers and the Dairy Product Donation Program (DPDP). MPP makes payments when the difference between milk prices and feed costs falls below a minimum level. Under the DPDP, the US Department of Agriculture will purchase dairy products for distribution to low-income Americans when milk margins fall below legislated triggers. The Milk Income Loss Contract (MILC) programme continues until MPP is operational, but is then repealed.

The Livestock Indemnity Program, Livestock Forage Disaster Program, Emergency Assistance for Livestock Honeybees, and Farm-Raised Fish Program and Tree Assistance Program are renewed with mandatory funding and made permanent and retroactive to cover losses in fiscal years 2012 and 2013, when many producers were impacted by severe weather.

The Stacked Income Protection Plan (STAX) provides premium subsidies to upland cotton producers to purchase revenue insurance policies in place of coverage for cotton under the new commodity programmes, seeking to address the WTO ruling that found US upland cotton subsidies distorted trade.

The Supplemental Coverage Option (SCO) offers producers additional area-based insurance coverage in combination with traditional crop insurance policies. Producers who elect to participate in the Agriculture Risk Coverage programme or the STAX programme are not eligible to purchase SCO coverage.

The 2014 Farm Act maintains strong overall funding for USDA conservation programmes and through consolidation reduces the number of programmes from 23 to 13. The Congressional Budget Office estimates that between 2014 and 2018, mandatory spending on USDA conservation programmes will decline by USD 200 million – less than 1% of the USD 28 billion (nominal USD) that would have been spent if the 2008 Farm Act had continued through 2018. All major conservation programmes, with the exception of Conservation Technical Assistance, have mandatory funding. Among the major changes:

1. The Conservation Reserve Program (CRP) acreage cap is reduced to 24 million acres by 2017. Current enrolment has fallen to 25.6 million acres. Up to 2 million acres of grassland can be enrolled. Funding for the Environmental Quality Incentives Program (EQIP) and the Conservation Stewardship Program (CSP) is increased;

2. The Wildlife Habitat Incentives Program is repealed, although 5% of EQIP funds will be set aside for habitat-related practices;

3. The new Agricultural Conservation Easement Program (ACEP) consolidates the Wetland Reserve Program, Grassland Reserve Program, and the Farmland Protection Program. Funding is just over half of what was provided for these three programmes in the 2008 Farm Act.

4. The Regional Conservation Partnership Program consolidates functions of existing regional programmes:
Agricultural Water Enhancement Program, Chesapeake Bay Watershed Program, Cooperative Conservation Partnership Initiative, and Great Lakes Basin Program.

The new Farm Act reauthorises the Market Access Program, Foreign Market Development Program and Technical Assistance for Specialty Crops Programs and maintains strong funding levels for these programmes. The new law reauthorises international food assistance programmes, including the McGovern-Dole Food for Education and Food for Progress programmes. It also authorises a new Local and Regional Purchase food aid programme. The Farm Act reduces the maximum repayment term under the export credit guarantee programme from three years to 24 months.

The new Farm Act reauthorises the Supplemental Nutrition Assistance Program (SNAP), the nation’s largest food and nutrition assistance programme, maintaining the programme’s basic eligibility guidelines while restricting access to an income deduction that boosted benefits for some households. It provides additional SNAP funding for enhanced employment and training activities, increased healthy food options, and expanded anti-fraud efforts.

Trade: The Americas dominate exports, while China drives import growth in Asia

In line with the reduced growth in production and consumption, trade will be growing at a slower pace when compared to the previous decade. Grains and meat trade, for example, are anticipated to grow by around 1.5% and 2.5% p.a. in volume-terms over the outlook period, which are only half the rates of the previous decade. Historic trade patterns are expected to continue; the leading export regions will maintain their positions and only a few newcomers are expected to enter the trade arena during the next decade.

The Americas will strengthen their position as the dominant export region, both in value and volume terms, as illustrated in Figure 1.12 and Table 1.1. Figure 1.12 shows the evolution of total net export values of all Outlook commodities from 2000 to 2023 in different regions, while Table 1.1 presents net exports by commodity from these regions in 2023. Net trade in value terms in Latin America and the Caribbean and in North America will grow more than 2% p.a. between 2011-13 and 2023 (Figure 1.12). This growth is mainly fuelled by increased exports of high-value commodities, such as meat, ethanol, sugar, oilseeds and cotton. In 2023, these two regions are expected to be the main net exporters in volume terms for most commodities (Table 1.1). Oceania is also anticipated to keep a positive trade balance in value terms, mainly because of the increased demand for sheep meat and dairy products from the expanding middle class in the Middle East and Asia.
Figure 1.12. Value of net-exports positive in Americas, Oceania and East Europe

Real value of net-exports of agricultural commodities

Note: Net exports are calculated by weighing exports and imports by the international reference prices for the period 2004-2006 for the agricultural commodities included in this Outlook.

Source: OECD and FAO Secretariats.

Eastern Europe, which is projected to become a surplus region from 2013 onward, is anticipated to maintain a small positive trade balance by realising its export potential in cereals and oilseeds. Ukraine in particular will become a key player, as it is expected to become the leading exporter of grains and oilseeds in Europe, surpassing the European Union and staying ahead of the Russian Federation. It will also be the only country outside the Americas to maintain a positive trade balance for meat through the outlook period.

The positive overall trade balances in the Americas, Oceania and Eastern Europe are matched by overall trade deficits in the remaining regions. Western Europe will display on average a negative trade balance with flat exports due to low production growth, a stable domestic demand for high value products and a strong currency. The rapidly growing population and shift in diets in Africa result in increasing food imports (Box 1.8). The largest demand for imports is generated in Asia, which is expected to exhibit a trade deficit in 2023 for all commodities, except rice, vegetable oils and fish. This development is greatly influenced by China, which will import large quantities of most commodities. India will remain one of the leading exporters of cereals and rice and is also projected to become a major exporter of meat and cotton keeping it in an overall trade surplus situation for agricultural products. Agricultural trade will be affected by government policies, including those pertaining to public stockholding, an issue that forms part of the post-Bali WTO agenda (Box 1.9)
Table 1.1. The largest trade deficits in volume terms in 2023 will occur in Asia and Africa

Volume of net-exports in 2023 ('000 tonnes)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Africa</th>
<th>Asia and Pacific</th>
<th>Europe</th>
<th>Latin America and Caribbean</th>
<th>North America</th>
<th>Oceania Developed</th>
<th>Other Developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>-44 987</td>
<td>-49 963</td>
<td>45 788</td>
<td>-7 074</td>
<td>46 206</td>
<td>18 329</td>
<td>-8 299</td>
</tr>
<tr>
<td>Rice</td>
<td>-18 052</td>
<td>21 083</td>
<td>-1 368</td>
<td>-1 192</td>
<td>2 419</td>
<td>299</td>
<td>-2 637</td>
</tr>
<tr>
<td>Coarse grains</td>
<td>-22 851</td>
<td>-63 999</td>
<td>50 402</td>
<td>21 795</td>
<td>53 574</td>
<td>4 154</td>
<td>-19 595</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>-3 494</td>
<td>-98 449</td>
<td>-11 469</td>
<td>57 748</td>
<td>58 323</td>
<td>2 921</td>
<td>-5 185</td>
</tr>
<tr>
<td>Protein meals</td>
<td>-4 461</td>
<td>-27 206</td>
<td>-19 586</td>
<td>49 715</td>
<td>8 963</td>
<td>-2 669</td>
<td>-4 912</td>
</tr>
<tr>
<td>Beef</td>
<td>-877</td>
<td>-2 105</td>
<td>-1 110</td>
<td>3 341</td>
<td>42</td>
<td>2 224</td>
<td>-1 147</td>
</tr>
<tr>
<td>Pork</td>
<td>-714</td>
<td>-2 625</td>
<td>1 715</td>
<td>-376</td>
<td>3 621</td>
<td>-362</td>
<td>-1 280</td>
</tr>
<tr>
<td>Sheep</td>
<td>53</td>
<td>-790</td>
<td>-1 40</td>
<td>9</td>
<td>-71</td>
<td>1 032</td>
<td>-40</td>
</tr>
<tr>
<td>Poultry</td>
<td>-2 192</td>
<td>5 234</td>
<td>877</td>
<td>3 677</td>
<td>4 710</td>
<td>57</td>
<td>-1 729</td>
</tr>
<tr>
<td>Fish</td>
<td>-3 323</td>
<td>9 625</td>
<td>1 822</td>
<td>2 015</td>
<td>-3 406</td>
<td>-220</td>
<td>-2 769</td>
</tr>
<tr>
<td>Fish meal</td>
<td>43</td>
<td>-1 418</td>
<td>-7</td>
<td>1 398</td>
<td>125</td>
<td>-28</td>
<td>-1 12</td>
</tr>
<tr>
<td>Fish oil</td>
<td>56</td>
<td>-1 243</td>
<td>-1 189</td>
<td>296</td>
<td>4</td>
<td>-12</td>
<td>30</td>
</tr>
<tr>
<td>Butter</td>
<td>-161</td>
<td>-413</td>
<td>80</td>
<td>-22</td>
<td>98</td>
<td>476</td>
<td>-39</td>
</tr>
<tr>
<td>Cheese</td>
<td>-219</td>
<td>-633</td>
<td>879</td>
<td>-284</td>
<td>318</td>
<td>518</td>
<td>-365</td>
</tr>
<tr>
<td>Skim milk powder</td>
<td>-387</td>
<td>-1 241</td>
<td>640</td>
<td>-367</td>
<td>826</td>
<td>642</td>
<td>-95</td>
</tr>
<tr>
<td>Whole milk powder</td>
<td>-618</td>
<td>-1 372</td>
<td>379</td>
<td>-46</td>
<td>4</td>
<td>1 656</td>
<td>-21</td>
</tr>
<tr>
<td>Vegetable oils</td>
<td>-8 775</td>
<td>5 447</td>
<td>-2 366</td>
<td>8 362</td>
<td>235</td>
<td>-386</td>
<td>-2 279</td>
</tr>
<tr>
<td>Sugar</td>
<td>-11 684</td>
<td>-17 342</td>
<td>-591</td>
<td>38 337</td>
<td>-4 511</td>
<td>3 636</td>
<td>-4 475</td>
</tr>
<tr>
<td>Cotton</td>
<td>1 620</td>
<td>-7 164</td>
<td>48</td>
<td>927</td>
<td>2 562</td>
<td>1 035</td>
<td>741</td>
</tr>
</tbody>
</table>

Note: For each commodity, the blue shaded areas indicate the regions with largest net exports, with the darkest blue shaded area representing the region with the largest net exports. Conversely, the grey shaded areas indicate the areas with the smallest net exports, with the darkest grey shaded area representing the region with the smallest net exports (largest net imports).

Source: OECD and FAO Secretariats.
Box 1.8. Dealing with rising food imports: Policy options for West African countries

Despite its vast agricultural potential, Africa has remained a net importer of agricultural products in the last three decades. In 1980, Africa had a balanced agricultural trade when both exports and imports were at about USD 14 billion, but by 2007 its agricultural imports exceeded exports by about USD 20 billion (FAOSTAT). The increase in agricultural and food imports has been particularly striking for basic foodstuffs such as dairy products, edible oils and fats, meat and meat products, sugars, and especially cereals, implying that food imports have been playing an increasingly important role in ensuring food security. For Low-Income Food-Deficit countries, persistently high and rising import bills can have serious macro-economic and social impact. Moreover, rising imports reduce incentives to invest in increased food production.

Grain deficit is being increasingly filled by wheat and rice imports. For example, per capita wheat consumption in West Africa in 2007-09 was nearly double its average levels in 1994-96, while per capita demand increased by over 70% in Central Africa during the same period. Similarly, between 1961 and 2006, rice consumption in SSA increased at a rate of 4.5% p.a. while rice production grew at 3.2% p.a. In West Africa, per capita rice consumption increased from about 30 kg in the early 1990s to about 45 kg in 2010, a 50% increase over 20 years. Nigeria, South Africa, Ivory Coast and Senegal rank among the world’s ten leading rice importing countries.

A recent FAO study entitled “Why has Africa become a net food importer,” concluded that population growth along with low and stagnating productivity in food and agricultural production, and policy distortions, poor infrastructure and weak institutional support, were the main reasons for the increase in the food-trade deficit in Africa.

A case study was carried out for Senegal, one of the leading cereal importing countries in West Africa. The study used annual import data (FAOSTAT data) covering the period 1960-2012 to determine endogenously the most important years when structural breaks occurred in wheat and rice imports. The test identified a break in total wheat imports and per capita wheat imports in 1997 and 1996, respectively, while 2001 and 2002 emerge as the most significant break-years for total rice imports and per capita rice imports, respectively. These years correspond to significant policy shifts in Senegal, starting with the devaluation of the local currency (the CFA Franc) in 1994. Policy measures adopted included a full liberalisation of import in 1996 (rice trade was highly regulated by the State and imports were subject to quotas until 1996) and the implementation of the regional Common Exterior Tariff (CET) in 2000, leading to a drop in rice import tariff from 38% to 10%. These reforms led to a significant increase in cereal imports.

The case study also provided projections of rice demand, supply and imports in Senegal under alternative scenarios for the period 2013-22 using the FAO-OECD Aglink-Cosimo model. Simulated policies included a 30% increase in rice and coarse grains yields (optimistic scenarios) as well as stagnant yields scenario (pessimistic). In addition, a doubling of the rice CET to 20% was simulated. The baseline scenario assumes that current production and consumption trends and policies are maintained. Rice imports are projected to expand by about 30% under the baseline scenario. The scenario with the biggest reduction in rice imports is a combined additional 30% increase in rice and coarse grains yields over the simulation period. Production of rice and coarse grains is expected to increase by 71% and 37%, respectively, compared to the base year levels.

Interestingly, doubling the rice import tariff to 20% has little impact on rice production and imports. Under this scenario, rice imports are projected to decline by 5% compared to the baseline scenario. A higher tariff rate is needed to have any significant effects on rice consumption and imports. The limited impact of the simulated tariff increase reflects the low price elasticity of rice demand due to its convenience of processing and preparation for the urban consumer. As underlined by several studies, the switch to rice consumption in West Africa is driven by long-run structural factors including employment patterns and urbanisation, although dramatic short term changes in relative prices can amplify the phenomenon.

3 FAO (2011), Why has Africa become a net food importer?, FAO, Rome.
Public procurement for the maintenance of food stocks proved to be a difficult issue to resolve at the 9th World Trade Organization (WTO) Ministerial Conference held in Bali in December 2013. A proposal submitted by the G33 group of developing countries had argued that procurement at administered (above market) prices from resource-poor, low-income farmers for the purpose of public stockholding with the objective of food security should not be subject to limitations imposed by the WTO Agreement on Agriculture. The main argument was that the existing flexibilities under the WTO Agreement, which allow developing countries to count the resulting producer support against their bound total Aggregate Measurement of Support (AMS) or de minimis limits, do not provide developing countries with sufficient “policy space” for addressing their food security concerns. At the same time, it was argued that the existing rules were asymmetric in their treatment of countries, with historically high levels of support in some countries having provided them with greater latitude to use trade-distorting domestic support. The proposal was opposed by some WTO members, who argued that such policies could distort global markets and negatively impact food security in other developing countries, and also needed to be considered in the overall context of the Doha mandate to substantially reduce trade-distorting subsidies.

An interim mechanism was agreed at Bali whereby Members will refrain from challenging, through the WTO Dispute Settlement Mechanism, those developing countries with existing public stockholding programmes which breach their domestic support commitments, provided specific conditions are met. The agreed outcome was for this interim mechanism to exist until a permanent agreement is concluded, with a work programme set up with a view to producing such an agreement by the 11th WTO Ministerial Conference in 2017. A number of transparency obligations and safeguard provisions were introduced as part of the mechanism in an effort to limit potential negative effects on other members. These included additional information and reporting obligations and the requirement that countries operating such programmes ensure that they do not adversely affect the food security of other members.

Determining the market impacts of government food stockholding policies is complicated by the fact that schemes are designed in pursuit of different objectives and implemented using different instruments. In some cases, the objective may be to maintain an emergency reserve to protect against domestic supply shocks, reflecting a reluctance to rely entirely on international markets to ensure adequate food availability. Such emergency reserves generally involve purchases at market prices; food security programmes operated along these lines are not constrained under WTO rules. In other cases, stockholding policies involve purchases at prices higher than prevailing market prices, and in this case WTO limitations on domestic support do apply. Public stocks may be held as part of a domestic price stabilisation policy, or to stimulate production and incomes. Targeted distribution of stocks to urban and rural poor consumers in developing countries at below market prices is without restriction under WTO rules. The domestic implications of public stockholding schemes depend critically on the extent to which intervention prices on either the producer or consumer side differ from prevailing market prices, the volume of intervention, and on how responsive producers and consumers are to changes in price incentives.

The extent of the impact on external trade of government stockholding at administered prices depends, in part, on the size of the country’s market and on the magnitude of the operation and, hence, the price distortion that is created by the procurement programme. Evidence from the national statistical authorities of India and the Philippines suggests that in India 33% of domestically produced rice will be procured for public stocks, while in the Philippines the share is likely to be only 2%. Where procurement is significant, a reduction in net exports could be observed during the procurement period as products that are otherwise destined for export are diverted to stocks. Equally, imports could be reduced if an increasing share of consumption is covered by products entering markets through the government food distribution programmes. The release of stocks can also have important implications. The scale and timing of release, especially if unpredictable and not factored into traders’ decision making, can significantly influence price levels and volatility, both domestically, and, if the country is a significant trader, internationally.

Geographical separation of demand and supply spurs growth in trade

Relative to the 2011–2013 base period, trade volumes of all commodities in the Outlook are projected to rise, but as Figure 1.13 shows, the growth rates vary widely across commodities. The traditional global grains export leaders will continue to dominate the market. The United States will remain the top wheat exporter despite a slight decline of its exports, while the Russian Federation is expected to increase exports by nearly 8 Mt to pass the European Union and Australia to become the world’s third largest exporter by 2023. Egypt, the Middle East and Indonesia are anticipated to account for almost 25% of total wheat
imports by the end of the outlook period. Coarse grain exports continue to be similarly concentrated, with the United States expanding its share to 30% by 2023. The most significant gains are anticipated in Ukraine which will position the country in fourth place closely behind Argentina and Brazil.

Imports will be dispersed around the globe without any emerging dominant importer. Rice trade will continue to expand relatively quickly in the next ten years, albeit at slower rates than the previous decade. Thailand is projected to regain its leadership from Viet Nam as the world’s largest rice exporter. All other traditional exporters (Viet Nam, India, Pakistan and the United States) are also expected to increase their exports, while least developed Asian countries such as Cambodia and Myanmar are anticipated to become major rice exporters as well. Increased import demand will generally be generated in Africa, which is expected to remain a net importer of rice, as local producers are not expected to meet growing domestic demand.

![Figure 1.13. Skim milk powder and poultry to show largest growth over the outlook period](image)

Source: OECD and FAO Secretariats.

Over 90% of oilseeds exports are generated in the Americas. The United States, Brazil and Argentina will remain the principal exporters, but Canada, Uruguay and Paraguay are expected to increase their role. Ukraine is projected to be the only country outside the Americas exporting large quantities of oilseeds. More than 60% of all vegetable oils exports continue to originate from Indonesia and Malaysia, as these two countries contribute significantly to an almost 30% growth of global vegetable oil trade over the outlook period. Imports of vegetable oils are much less concentrated, with the European Union, China and India leading the charts.

In the sugar market, exports will originate from a few countries while imports are fragmented over the world. Brazil will remain the largest exporter, supported by a falling currency, with Thailand in second place. Australia is projected to become a growing sugar exporting country, contingent on the projected investments in its sugarcane area. At the beginning of the outlook period, China and Indonesia are, after the European Union, the leading importers of sugar. However, over the projection period, Indonesia is expected to have the biggest deficit and become the leading sugar importer, followed by China and the United States. Sugar imports into the European Union and the United States are controlled by their domestic market regimes. The new EU sugar regime, in which sugar and isoglucose quotas are abolished,
will result in lower EU imports as sugar beet production is expected to expand (Box 6.1 in the sugar chapter).

Global meat trade patterns will stay stable, with poultry expected to account for 42% of total meat trade, followed by beef (31%) and pork (22%). North and South America will dominate poultry exports, while the biggest importers are expected to be Africa, Asia and the Middle East. Asia will import by far the greatest share of beef, most of which is supplied by South America. India is expected to continue exporting beef to developing regions, notably low priced buffalo meat, and is projected to become the largest bovine meat exporter by the end of the projection period. For pork, the greatest share of additional import demand will come from Asia and Sub-Saharan Africa, while the bulk of exports will originate from North America and Europe. Interestingly, countries in Asia, as an aggregate, will not only be the largest producers of pig meat, but also the largest importers. The region will also import the greatest share of additional sheep meat, which is exported from Oceania.

The bulk of export growth in dairy originates in the United States, European Union, New Zealand and Australia. The European Union will remain the main cheese exporter, but its growth rate is slower than New Zealand’s, the United States’ and Australia’s. The United States is the largest exporter of SMP, while India is expected to increase its exports considerably over the next decade. The main destinations for dairy products are developing countries, especially in Asia and Africa. In the case of cheese, the developed countries still dominate imports, but the developing countries are closing the gap. WMP imports by China, which skyrocketed in recent years, are expected to slow down.

Fish and fishery products are expected to be highly traded, with about 37% (including intra-EU trade and 32% if excluding it) of world fishery production exported. Developed countries continue to be the main importers of fish for human consumption, with their share in world imports projected to remain above 50% in quantity terms. Developing countries represent two-thirds of world exports in fish for human consumption, with more than half of exports in 2023 originating from Asia. In terms of fishmeal, on the other hand, the developing countries will be the main importers, reflecting the high demand for fishmeal from aquaculture production.

Prices: Global supply and demand projections point to slowly declining real prices

The model underlying the OECD-FAO Agricultural Outlook simultaneously simulates the domestic markets for all its individual country modules and world markets for all commodities in which the national imports and exports are cleared by international reference prices. Since the Outlook price projections are predicated on the key assumption of normal production conditions and the absence of unforeseen market shocks, such as droughts and animal disease outbreaks, prices are a reflection of expected market fundamentals during the outlook period. Domestic and international prices are determined simultaneously, but the degree by which they are connected varies by country and commodity. Countries with dominant trade shares may be considered as price setters in a particular market, and thus their marginal cost of production plays an important role in the future course of global prices. Trade volumes of minor traders are assumed to influence international markets only slightly so international reference prices transmit the signals from the global level into their domestic markets. Countries with very small interactions with the global market are considered somewhat independent of international prices and vice versa. Their domestic market conditions are most relevant for setting prices paid by their producers and consumers. The Outlook focuses mostly on international prices, but for any analysis of individual country markets, their relationship with the global market should be carefully examined (Box 1.6 for a discussion on the determinants of food price movements). The following summary of developments in international reference prices highlights the important features of each global commodity market in the coming decade.

1. Including fish meal on a fish equivalent basis.
Near record prices in 2012 resulted in strong production responses around the world in 2013, creating surplus market conditions for the commodities covered in this *Outlook*. Most prices subsequently eased in 2013, hence *Outlook* price projections are taking off from a correction period which is expected to persist for one or two more years, depending on the commodity.

International prices of major cereals are projected to remain under downward pressure in 2014/15 (Figure 1.14). Wheat prices decrease further through the first three years of the outlook period, due to ample production prospects until 2016/17. This decline slows production growth over the second half of the projection period, and wheat prices will recover. This recovery is anticipated to stay below the projected inflation rate: In real terms wheat prices decrease in the coming decade by about 1% p.a., remaining around 13% below the average of the previous decade (Figure 1.15). For coarse grains, the production response to the high prices in recent years is expected to be especially strong in the United States, the Russian Federation and Argentina. Global demand will not be able to absorb this supply at current prices. Based on this expected surplus in international markets, coarse grains prices will experience considerable decreases in the early years of the outlook period, before rebounding to about USD 230/t from 2017/18 onward. Adjusted for inflation, coarse grain price in 2023 is expected to be very close to the current level.
The international reference price for rice (Viet Nam) eased in 2013 as a result of the large supplies accumulated earlier this decade. These large inventories, which were accumulated by exporting counties through domestic support schemes, will keep the market in a surplus situation for several years and consequently weigh on international prices. The world price is predicted to recover in the second half of the projection period and reach about 400 USD/t in 2023. All grain prices decline in real terms, and they will fall below current levels at the end of the projection period (Figure 1.15).

The ease of substitution of land between coarse grains and oilseeds in the United States influences the price movements expected for oilseeds. Because of the significant fall in coarse grain prices described above, a shift in land to oilseeds is anticipated in 2014/15 which should contribute to further declines in the prices of oilseeds. Over the medium term, market conditions of the two oilseeds products – meal and oil – are expected to differ, leading to diverging price projections. In the oil sector, a strong demand for food and fuel will push the price to increase as of 2015/16. The price of protein meal will not increase as much, because of the joint nature of both products global meal supplies will be ample keeping prices flat. In real terms, all three prices are expected to fall compared to the very high levels of recent years.
World sugar prices are expected to follow a moderately upward trend, and they continue to follow a familiar “sugar cycle”. Brazil’s cost of production and the relative profitability between sugar and ethanol production determine the general level of world sugar prices over the outlook period, while the shape of the cycle is mostly driven by specific market conditions in sugar producing countries in Asia. Sugar prices are projected to stay far below their recent peaks, with nominal raw sugar price oscillating around USD 400/t. The white sugar premium is projected at nearly USD 100/t, yet narrowing over the decade.

Similar to the prices of their feedstock, world ethanol and biodiesel prices continued their decline in 2013. Real ethanol prices are expected to increase slightly over the outlook period as they will be influenced by market-driven demand, due to strong crude oil prices, and policies in place, especially in the United States and in Brazil. Profitability of the ethanol sector should improve slightly in the coming years, because the margin between feedstock and ethanol prices is expected to increase in real terms. With biodiesel demand being mostly policy and not market driven, biodiesel prices are expected to follow the evolution of vegetable oil prices.

Cotton prices are driven by macroeconomic developments, market policies, technological progress in the man-made fibre sector and preferences in textile demand. After a 2010 cotton price spike, driven by macroeconomic volatility and policy changes in key countries, prices have declined significantly in recent years but cotton prices are expected to remain relatively stable during 2014-23 as the assumptions regarding policy and macroeconomic stability do not indicate any future price run-ups. A certain cyclical price behaviour is caused by the projected production patterns of major producers, but by 2023, world cotton prices are expected to be lower than in 2011-13, in both real and nominal terms.

To properly reflect conditions in the global market for beef and pork, the Pacific and Atlantic market segments need to be considered separately. For each segment a market clearing price is projected. Prices follow similar projection paths, but they differ in level, with the Pacific price generally above the Atlantic, because of sanitary and phytosanitary measures that prevent beef from the Atlantic region to access the more lucrative markets in the Pacific region. Poultry and sheep meats are traded in single international markets. Prices of beef and sheep meat, which are produced more on pasture and are hence less feed grain dependent, increase from 2014 throughout the projection period, ending above current levels. Beef prices follow a customary cycle that reflects herd management in important producer countries. Prices of sheep meat, a relatively small sector, rise continuously nominally, but stay flat in real terms. By contrast, pork and poultry prices reflect the decline in feed prices in the near term. Nonetheless, meat-to-feed price margins are expected to improve compared to those experienced when feed costs reached their peak. Because of a strong meat demand, meat prices fall relatively less than feed prices, before stabilising along with them in two to three years. After accounting for general price inflation, real meat prices will average higher than in the previous decade, although they trend marginally down from their current highs.
Figure 1.15. In real terms, prices for livestock, dairy and ethanol are higher than in the previous decade

Per cent change in average real prices relative to different base periods 2011-2013 and 2004-13

Source: OECD and FAO Secretariats.

The outlook for dairy product prices starts from a very different situation. Milk and dairy product prices increased strongly in 2013 due to reduced production in major countries from increasing feed costs. In the near term, prices of all dairy products are expected to decline sharply as production in the major dairy exporting countries expands in to the current high prices and feed costs decrease. Over the medium term, production growth from increasing dairy herds and rising yields will be able to more than satisfy the continued growth in demand, especially in developing countries. Due to this broad production base, it is expected that real dairy product prices will decline slightly over the next ten years. Within the dairy sector, butter prices will be flat in nominal terms, while cheese prices are expected to continue on the growth trend of the previous years.

Higher prices and higher production costs are expected to prevail in the fisheries sector in the next ten years due to a strong demand for protein, high feed costs, limited production growth of captured fisheries and high prices of alternatives like meat and dairy products. Fish prices are differentiated between captured and aquaculture products. The average prices of wild fish for human consumption, which will remain under restrictive production quotas, are projected to increase twice as fast as the price for aquaculture fish during the outlook period. Future prices for individual fisheries commodities could significantly differ from one another due to supply swings caused by changes in catch quotas, disease outbreaks in the aquaculture sector as well as fluctuations in feed costs.
Box 1.10. Macroeconomic factors influencing food prices

The 2007-08 food price increase period generated a renewed interest in understanding food price behaviour, their determinants, dynamics, and transmission across markets. A wealth of research has since been produced. The general consensus is that there was no single factor responsible for the price surge, but rather a set of various elements which collectively explained most of the increase. Where research diverges is on the contribution of each of these factors. Most cited drivers leading to the price surge include: unfavourable weather conditions that prevailed in some of the major grain producing countries/regions in 2006 and 2007, the rise in energy prices, increases in demand for biofuels, depreciation of the United States dollar, slower productivity growth, low grain stock levels, and market speculation. Each of these factors has been researched in detail. One characteristic of the price surge, was that it was broadly based across the commodity markets. Those factors associated with supply shocks are likely to be less correlated across food crops at world level, and as a result less likely to explain such common movements in food prices. Instead, factors that are common across commodities are more likely to explain the rise in aggregate food prices. Such common factors are likely to be demand related and macroeconomic in nature (Gilbert, 2010).

In order to provide some empirical evidence linking demand related factors to food price movements, a set of pairwise Granger causality tests were applied using the FAO food price index (FFPI) and a selection of cross cutting factors. These included, i) changes in the value of the United States dollar relative to a broad group of major currencies (XR), ii) the United States money supply (M2), as a measure of world liquidity, iii) imports of goods and services into China (CHINAIMP), as a proxy for aggregate demand growth in emerging economies, and iv) crude oil prices (OIL), as a measure of energy prices. The Granger causality test is an econometric tool that determines whether one time series is useful in predicting the value of another series. The analysis spans from January 1980 to November 2013.

Results showed that Granger causality was established for the FFPI, with respect to all four factors, meaning that XR, M2, CHINAIMP, and OIL, caused changes in the food price index over the sample range. When the analysis was carried using maize prices or wheat prices instead of the food price index, a causal relationship was not established in several cases (Table 1.2). For example, the statistical tests could not detect a causal link between maize or wheat prices and the exchange rate. However, given that the exchange rate caused the overall food index (FFPI), it means that its effect is more pronounced on most of the food crops comprising the Food index, and less so on commodities such as wheat and maize. In the case of oil prices, a causal relationship was detected between WTI and the Food price index, as well as between West Texas Intermediate (WTI) and maize, and WTI and wheat prices. Oil prices impact food prices through production costs, but also through increased demand for food crops as biofuel feedstock.

Several implications can be drawn from this analysis. First, there is evidence that demand related factors such as rising demand from emerging markets, changes in United States exchange rate, the US money supply, and oil prices (with their effect on demand for feedstock), help explain food prices movements. Second, appropriate policies to mitigate the impact of high food prices may require multilateral coordination, given the global nature of the determinants of food prices. Third, oil prices do have an impact on food prices, but the nature of that relationship has probably changed over recent years with the emergence of biofuels. Still, the extent to which biofuels impact food price remains a subject of discord amongst researchers. Finally, macroeconomic data is critical to an agricultural market outlook exercise, given their contribution to commodity prices.
Table 1.2. Granger Causality tests

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Common factor</th>
<th>$X^2$</th>
<th>Prob**</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFPI</td>
<td>OIL</td>
<td>13.72</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>XR</td>
<td>8.48</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td>M2</td>
<td>13.05</td>
<td>0.0015</td>
</tr>
<tr>
<td></td>
<td>CHINAIMP</td>
<td>14.92</td>
<td>0.004</td>
</tr>
<tr>
<td>Maize</td>
<td>OIL</td>
<td>7.64</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>XR</td>
<td>2.17</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>M2</td>
<td>0.49</td>
<td>0.065</td>
</tr>
<tr>
<td></td>
<td>CHINAIMP</td>
<td>26.04</td>
<td>0</td>
</tr>
<tr>
<td>Wheat</td>
<td>OIL</td>
<td>10.69</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>XR</td>
<td>2.88</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>M2</td>
<td>9.04</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>CHINAIMP</td>
<td>38.66</td>
<td>0</td>
</tr>
</tbody>
</table>

* Khi 2.
** Value of p.

3 The FFPI index aggregates price changes of 23 traded agricultural commodities, including wheat (10 price quotations) and maize (1 price quotation).
4 Trade weighted US Dollar Index: Broad (TWEXBMTH), United States Federal Reserve.
5 West Texas Intermediate, WTI.

Uncertainty analysis

Rather than forecasting what will occur in the future, the baseline projects future outcomes conditional on a specific set of assumptions about the policies in place, the responsiveness of market participants and the future values of exogenous market drivers, such as weather conditions or the macroeconomic environment. As a complement to the baseline, uncertainty analysis (partial stochastic analysis) is undertaken. Stochastic analysis gives an indication of the range of possible outcomes around the baseline, given the variability observed in previous years for key agricultural and macroeconomic drivers. Partial stochastic analysis aims to identify such key risks and uncertainties most likely to affect the projection. It involves performing multiple simulations with different values of selected exogenous variables and studying their impact on selected endogenous variables like prices, production or trade. It also allows the policy maker to select specific sources of uncertainty and quantify the likely range of market variation that derives from these identifiable sources of uncertainty. This year, special efforts were made to identify the impact of uncertainties surrounding milk yields in Oceania (reflecting milk yield uncertainties from grass-fed livestock systems) on milk production and world dairy product markets.

Sources of uncertainty analysed

Major sources of systematic uncertainty in agricultural markets (i.e. macroeconomic conditions and yields) are treated stochastically, and their effects are analysed. The analysis is only partial in that it does
not capture all the sources of variability that affected agricultural markets in the past. For example, uncertainty related to animal diseases is not captured. The selection of which variables to treat stochastically aims to cover the major sources of uncertainty for agricultural markets whilst keeping the analysis simple enough to be able to identify the main ones in each market.

- **Global macroeconomic drivers**: Values of 32 variables: real Gross Domestic Product (GDP), the Consumer Price Index (CPI) and the GDP Deflator in the United States, the European Union, China, Japan, Brazil, India, the Russian Federation and Canada; national currency-US dollar exchange rates for the last seven of these countries or regions; and the world crude oil price are assumed uncertain.

- **Agricultural yields**: Uncertainty affecting the yields of 17 crops in 20 major producing countries is also analysed, giving a total of 78 product-country-specific uncertain yields (see Methodology for further explanation).

The uncertainty coming from macroeconomic conditions and crop yields is analysed jointly and separately. Three scenarios are presented: (i) macroeconomic uncertainty, (ii) yield uncertainty and (iii) combined macroeconomic and yield uncertainty. Figure 1.16 illustrates for the world coarse grain price the corridor of future values based on the combined macroeconomic and yield uncertainty. The indicator used to represent and compare the impact of uncertainty on projected outcomes is the coefficient of variation (defined as the standard deviation divided by the mean) in the last projection year, 2023 (CV2023). The CV is calculated from values lying between the 10th and the 90th percentiles of the outcomes in 2023.

**Figure 1.16. Uncertainty around the world coarse grain price**

![Graph showing uncertainty around the world coarse grain price](Image)

**Source**: JRC-IPTS, European Commission.

**Relative impact of uncertainty on market outcomes, by commodity**

**Arable crops**

For arable crops, the effect of yield uncertainty works through production and is transmitted to trade and prices (Figure 1.17). Macroeconomic uncertainty affects (i) input costs (through the production cost, crude oil prices and the GDP deflator), (ii) competitiveness (through exchange rate variation) and
(iii) consumption (from uncertainty in GDP growth and consumer price indices). Worldwide, arable crop production (cereals and oilseeds) is more affected by yield than by macroeconomic uncertainty for the last year of the projection period. For consumption, by contrast, the effect of macroeconomic uncertainty is slightly larger than that of yield uncertainty because consumption is directly affected by shocks to GDP and the consumer price index. Supply shocks are also not entirely transmitted to consumers for the following reasons: (i) arable crop stocks serve as a buffer, and (ii) there is substitution between the different coarse grains, wheat and oilseeds, especially for animal feed and, to a lesser extent, in biofuels. Concerning the uncertainty effect on trade, cereals (wheat, coarse grains and rice) are generally more affected by yield than by macroeconomic uncertainty, while oilseeds are more affected by macroeconomic uncertainty. The main sources of uncertainty affecting trade are yields and, to a lesser extent, exchange rates for exporting countries, while for importing countries they are exchange rates and demand conditions. The uncertainty in world market prices is transmitted from domestic markets via trade flows, and is determined by shocks to demand and supply, especially in important trading countries, and changing relative prices between domestic and world markets. Macroeconomic uncertainty has a greater effect on world market prices than yield uncertainty.

Figure 1.17. Uncertainty in the world wheat market in 2023 by scenario (CV2023, in %)

Source: JRC-IPTS, European Commission.

Protein meals and vegetable oils

Vegetable oils are more affected by macroeconomic and yield uncertainty than protein meals. Uncertainty in oilseeds yield has a direct effect on the quantities available for crushing, while macroeconomic uncertainty affects both demand and supply. Protein meal demand is subject to uncertainty coming from meat and dairy production, which are affected by macroeconomic variables. Vegetable oil demand is closely linked to biodiesel production, which is less strongly affected by macroeconomic uncertainty since consumption is often dictated by mandates. Exchange rate uncertainty affects not only vegetable oil trade but also oilseeds trade. For both protein meals and vegetable oils, macroeconomic uncertainty affects trade via the exchange rate.

Biofuels and sugar

The development of the sugar market is closely linked to biofuels, in particular ethanol in Brazil. The production and use of ethanol and biodiesel are more responsive to macroeconomic uncertainty than to
yield. Indeed, macroeconomic uncertainty directly affects both consumption and trade of biofuels because there is substitution between ethanol and biodiesel, the level of the substitution depends on the relative prices. Furthermore, mandates serve as a direct link between crude oil and biofuel consumption, such that uncertainties surrounding the world crude oil price are directly transmitted to the biofuels markets, and to the sugar markets. Additionally, the uncertainty coming from GDP growth affects demand for fossil fuels on which the mandates are based.

**Meat and dairy**

The effect of macroeconomic uncertainty on supply and demand for meat and dairy products is bigger than the effect of yield uncertainty. This is largely because (i) meat and dairy product demand is more elastic than demand for crop products, leading to greater impacts from income and domestic price variations, and (ii) macroeconomic uncertainty has an impact on feed costs, which are directly linked to production. For meat, uncertainty from macroeconomic variables affects traded volumes much more than yield uncertainty, particularly in the case of pork (Figure 1.18). Accordingly, the effect of yield uncertainty on world market prices is very low compared to macroeconomic uncertainty. In the case of dairy products, production costs are important for these manufactured goods, thus the cost of production index plays a significant role.

**Figure 1.18. Comparing uncertainty by commodities in world trade (exports) in 2023 by scenario (CV2023, in %)**

![Graph comparing uncertainty by commodities in world trade (exports) in 2023 by scenario (CV2023, in %)](source: JRC-IPTS, European Commission).

**Milk world market price uncertainty**

The above analysis covers the impact of overall uncertainties on world markets. It is, however, also of interest to analyse specific types of uncertainty. This section focuses on dairy markets and in particular on two of the largest dairy exporting countries, New Zealand and Australia. In 2023, the shares of these two countries in world market exports are projected to be around 60% for butter and WMP, 29% for SMP and 17% for cheese. With such important shares of dairy exports, it is interesting to investigate the possible transmission of uncertainty surrounding milk production in these two countries to world dairy markets. Various factors can affect milk yield, including grass and fodder availability, feed composition, season of calving, frequency of milking and disease. As those factors are not modelled in Aglink-Cosimo, the approach is to use the historical milk yield variation as a measure of uncertainty in milk production.
Four scenarios are presented here: (i) New Zealand and Australia milk yield uncertainty only, (ii) all crop yield uncertainty (milk yield in Oceania excluded), (iii) macroeconomic uncertainty and (iv) joint milk yield, crop yield and macroeconomic uncertainty. Two new scenarios [(i) and (ii)] are introduced in order to see solely the effect of milk yield uncertainty without being offset by other sources of uncertainty, i.e. crop yield. As in the analysis for the overall uncertainties, the coefficient of variation in 2023 (CV2023) for the outcomes lying between the 10th and 90th percentiles is used to describe market uncertainty.

Milk yield uncertainty in Australia and New Zealand only has a significant effect on domestic milk production (2.6% and 1.5% respectively). Moreover, given the importance of Oceania in world dairy markets, this uncertainty also has an effect on world dairy trade and market prices. However, as shown in Figure 1.19, at the global level, milk production is more sensitive to macroeconomic uncertainty than to yield (crops or milk) uncertainty. This is due to the multiple effects of macroeconomic uncertainty on the dairy sector. In the first place, it affects feed costs, notably via exchange rate and crude oil price, as well as through other dairy production costs. In addition, GDP and CPI uncertainty affects demand. This is of particular interest in large importing countries such as China for milk powders or Russian Federation for cheese, the demand for which represents a considerable share of world market demand. Finally, macroeconomic uncertainty has an effect on relative prices (domestic/world market), thus directly affecting world imports and exports.

The consequences of macroeconomic uncertainty for world dairy prices are considerably greater than those of yield uncertainty (Figure 1.20). Milk yield uncertainty in Australia and New Zealand directly affects the export supply of these countries, resulting in variability of less than 1% in terms of CV2023 in the world market price for cheese and SMP and around 1.5% for that of butter and WMP. Crop yield uncertainty throughout the world also affects world dairy products prices by between 1.6% and 2.5%, through its impact on feed cost. Therefore, the impacts of both scenarios (i.e. milk yield uncertainty in New Zealand and Australia only and crop yield uncertainty worldwide) on world market prices are of a similar small magnitude.
Figure 1.20. Uncertainty of world market prices in 2023 by scenario (CV2023, in %)

Table 1.3. Uncertainty of world production, consumption and trade of dairy products, by scenario (CV2023, in %)

<table>
<thead>
<tr>
<th>CV2023 (%)</th>
<th>World production</th>
<th>World consumption</th>
<th>World trade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yield (milk)</td>
<td>Yield (crops)</td>
<td>Macro</td>
</tr>
<tr>
<td>Cheese</td>
<td>0.0</td>
<td>0.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Butter</td>
<td>0.0</td>
<td>0.2</td>
<td>2.4</td>
</tr>
<tr>
<td>Skim milk powder</td>
<td>0.1</td>
<td>0.3</td>
<td>0.6</td>
</tr>
<tr>
<td>Whole milk powder</td>
<td>0.2</td>
<td>0.2</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Source: JRC-IPTS, European Commission.

Conclusion

This analysis shows how partial stochastic analysis can be used to supplement the information provided by the deterministic baseline, by identifying which baseline variables are more affected by the uncertainty associated with a given set of exogenous variables. The results are based on the past pattern of variability in yields and macroeconomic drivers. For crop yields, variability observed over the last two decades has been used; it is greatest in Eurasia, South America and Australia and smallest in the European Union, the United States and China. Macroeconomic uncertainty, based on observed forecast errors, is greater in Brazil, Russian Federation, India and China (BRIC). However, it should be borne in mind that past trends may not continue in the future. For example, climate change could bring more yield variability,
or economic growth patterns observed in recent past might change. This analysis does not capture these possible developments.

Overall, the consequences of the uncertainty coming from macroeconomic indicators are larger than those coming from yield variation. Yield uncertainty mainly affects the supply of agricultural commodities, but regional fluctuations may compensate each other. However, changes in macroeconomic variables affect both the demand and supply sides. Production and consumption are less affected by uncertainty than trade and prices. The commodities more exposed to uncertainty are those with more linkages to the macroeconomic indicators, e.g. meat (strong link to GDP) and biofuels (strong link to crude oil prices).

Dairy markets are principally affected by macroeconomic uncertainty. Important sources of uncertainty in these markets are economic developments in importing countries such as China and Russian Federation from the demand side, which are greater than yield uncertainty. Contrary to what might have been expected, uncertainty linked to production, even in major exporting countries such as New Zealand and Australia, has a marginal effect (one to two percentage points of variation) on the world market prices of dairy products.
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Feeding India: Prospects and challenges in the next decade

Abstract

This chapter reviews the prospects and challenges facing India’s agriculture and fish sectors in the next decade. It briefly reviews sector performance, outlines the current context for markets, provides detailed quantitative medium term projections for the ten-year period 2014-2023, and assesses key risks and uncertainties. India’s main challenges in promoting sector growth and reducing its large number of food insecure people are discussed in the context of its various policies to address them, including minimum support prices, trade policy, input subsidies and its new National Food Security Act (NFSA). The chapter outlines a relatively positive scenario in which recent trends of higher production and consumption continue, offering India considerable potential to reduce the number of food insecure people over the next decade. The key risks to this scenario include India’s macro performance, its ability to effectively implement NFSA and the sustainability of productivity growth.

Introduction

Last year, the Outlook focussed on the agricultural and food prospects facing the world’s most populous country, China. This year the Outlook turns its attention to India, the country with the world’s second largest population, and the largest in terms of number of farmers and rural population. Perhaps, most importantly, India currently has the largest number of food insecure people, about one-quarter of the world’s total. Like China, India’s markets have witnessed considerable transformation in recent years, with huge gains in production and productivity. But unlike China, India has sustained a positive surplus in agriculture and food trade, and with its larger arable land base, its predominantly vegetarian diet and more slowly urbanising society, concerns that sustained economic development will draw heavily on world markets have been mute. Rather, major concerns have centred on food insecurity in the presence of trade surpluses, and how to invigorate agriculture to promote growth and employment in populous rural communities, where unlike the experience of most countries, the size of average land holdings continues to decline.

India’s policy effort to support farmers, promote rural development, and at the same time address food insecurity has been, and is now, very significant. A range of supply side programmes such as input subsidies for fertilisers, irrigation, electricity and farm credit, coupled with investments in irrigation, are designed to encourage higher yields and production. A range of market support prices are set to cover costs and improve farmer returns. High food subsidies help poor consumers: in September 2013, India enacted a new National Food Security Act (NFSA), which is now implementing the most ambitious “right to food” programme yet to be applied in history, covering over 800 million people and providing 60 kg of food grain per person each year at prices that are about 10% of current retail prices for food grains. A major question facing the Outlook is how these policies will impact Indian and potentially international food markets, and how they will contribute to meet India’s objectives of increasing production and reducing food insecurity.

2. See FAO (2013) for estimates.
In the last decade, India has experienced rapid economic growth, and while growth is anticipated to slow, it may stay high for some time. Agricultural growth has also risen in the past decade, supported by solid increases in crop yields, and with both increased cropping intensity and greater area devoted to food crops. Potential yield gaps remain, and concerns about the sustainability of growth in production are mounting. Rural labour costs are rising, water supplies are being depleted and smaller farm sizes due to fragmented land holdings potentially impede the capture of economies of scale. Yet, high production growth is anticipated. On the demand side, India remains largely vegetarian, and both calorie and protein consumption have remained low compared to levels in developed countries. How diets change in the next decade may have important implications for domestic and international commodity markets.

This chapter reviews the performance of India’s agriculture over the past decades, noting its strong production growth and the reduction of food insecurity in the presence of sizable population growth. It describes projections for major agricultural commodities, set against anticipated macroeconomic, demographic and resource conditions. Finally, the chapter concludes with a review of important risks and uncertainties facing India’s agriculture over the next decade, and what these may mean for both domestic and international markets.

The performance of India’s agriculture

Agriculture has played an essential role in India’s economic development, growing about three percent each year on average over the last forty years. Besides providing food to a growing population, agriculture has provided income to rural areas, released labour for downstream industry, provided savings for investment and has increased demand for industrial goods. It also is the source of raw material for a large number of domestic industries and has provided an important source of foreign exchange.

However, despite its growth, the role of agriculture in India’s economy has been declining sharply as other sectors, particularly services, have grown more quickly. Primary agriculture accounted for about 14% of national gross domestic product (GDP) in 2012, down from close to 30% in 2000. But, while there has been a reduction in the share of agriculture in GDP, a commensurate reduction in its employment share has not taken place. Primary agriculture still employs around half of the Indian population, and it is the main driver of employment in rural areas, where 68% of the population live (Figure 2.1).

Figure 2.1. Agriculture’s share of national employment remains large in India

This important role of agriculture was stressed in India’s recent *Economic Survey for 2012-13*, which noted the fact that a declining share of the agriculture and allied sectors in a country's GDP is consistent with the normal development trajectory of any economy (Government of India, 2013a). But it stressed that fast agricultural growth remains vital for jobs, incomes and the food security of the population. The role of agriculture will remain significant in the medium term, particularly owing to concerns over food security, employment and rural poverty. Agriculture will continue to be a major source of employment in the future, which challenges policy makers to raise the incomes of millions of Indian rural households. However, a key challenge to reducing poverty in rural areas will be to raise productivity in agriculture, which the data indicate is much lower than in the rest of the economy.

**Growth in agricultural output has been strong**

As measured by the FAO’s agricultural production index, production growth, net of intermediate production of seed and feed, increased about four times over the last 50 years. In the years prior to the start of the Green Revolution in India (Box 2.1), which is considered to be in the late 1960s, per capita output was declining. Since then, the increase in aggregate terms has been one of the most significant globally, but in per capita terms growth has been much more modest. Crop production remains most significant in India, given its largely vegetarian diet, but livestock production has grown more quickly from its small base. It is noteworthy that per capita growth in agriculture has been most significant in the period after the year 2000, and especially after 2005-06. The reasons for increased growth have been ascribed to measures taken under the National Food Security Mission of 2007-08, the National Horticulture Mission and the Rashtriya Krishi Vikas Yojana (National Agricultural Development Scheme).³

| Table 2.1. Growth of agriculture in India increased in the last decade (% p.a) |
|---------------------------------|----------------|--------------|--------------|--------------|--------------|--------------|
| **Total**                       |         |         |         |           |         |           |
| Agriculture                     | 1.8     | 2.8     | 3.5     | 2.8        | 3.9     | 3.0        |
| Crops                           | 1.9     | 2.5     | 3.3     | 2.6        | 3.9     | 2.8        |
| Livestock                       | 1.3     | 3.6     | 4.2     | 3.6        | 3.9     | 3.8        |
| **Per capita**                  |         |         |         |           |         |           |
| Agriculture                     | -0.3    | 0.4     | 1.3     | 1.0        | 2.4     | 1.1        |
| Crops                           | -0.2    | 0.2     | 1.1     | 0.8        | 2.4     | 0.9        |
| Livestock                       | -0.9    | 1.3     | 2.0     | 1.8        | 2.4     | 1.9        |

Note: Based on net production indexes from FAOSTAT, compound annual rates.


India is the top producer of milk, pulses and jute in the world. It ranks second in the production of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. India also is a leading producer of spices, fish, poultry, livestock and plantation crops. Agricultural commodity production in India rose significantly over the past six decades: the production of food grains increased from around 50 Mt in 1950-51 to over 263 Mt during 2013-14, a five-fold increase in six decades. This phenomenal growth, however, was marked by phases of stagnation, such as the period from 1996-97 to 2004-05 when real prices fell, and periods of rapid growth, which have been experienced since that year. From 2004-05 to 2012-13, cereal production increased 24% and oilseed production increased 20%. Higher growth has been experienced in sectors which are more market oriented, such as the production of pulses, fruits and vegetables which together have increased by 40%.

3. The measures are discussed in the section on Agricultural Policy.
Faster output growth is occurring in the higher value added sectors. As a predominantly vegetarian population, livestock production has remained relatively small, although it has been growing more rapidly than crop production, albeit from a small base. Milk production, from the buffalo and milk cow herd and from the goat herd, has grown rapidly since the initiation of the “Operation Flood” programme in the early 1970s. Milk production increased over six times, from 20.8 million tonnes in 1970, to 133 million tonnes in 2012. Production of beef from the buffalo herd has recently been undertaken for export shipments, putting India into the top three bovine meat exporters in the world (Box 7.3 in Chapter 7). As the second largest producer of fish in the world, India’s production has grown almost four times since 1980, including a 12-fold increase in aquaculture production during this period.

Box 2.1. Transforming Agriculture: India’s Green and White Revolution

India’s agriculture has been transformed by two major events: The Green Revolution, which significantly increased yields of the country’s major staple crops, wheat and rice, and the White Revolution that transformed the country’s dairy sector. Both events are described below.

The Green Revolution began in India with the introduction of semi-dwarfed, high-yielding varieties of wheat in 1967 and rice in 1968. To ensure market support, the Food Corporation of India and the mechanism of market support prices were established in the mid-1960s. Favourable policies in the form of price and procurement support as well as input subsidies encouraged farmers to adopt the new varieties and to invest in their land. The Green Revolution spread largely in areas with favourable agro-climatic conditions, i.e. irrigated areas where wheat and paddy were mainly grown. The success of the Green Revolution was remarkable. From a net importer of food in the 1950s, India transformed itself during the last four decades: From a mere 82 Mt of food grain produced in 1960-61, India in 2013-14 produced a record 263.2 Mt of food grains, mainly attributed to the significant rise in rice and wheat output.

One striking feature of the Green Revolution was the adoption of double-cropping, i.e. planting two crops or more per year on the same land. The earlier practice of one crop per year was dependent on the monsoon rainfall. For the second crop, huge irrigation facilities, such as dams, were built. Simple irrigation techniques, like the digging of tube wells for extracting groundwater, were also adopted on a massive scale.

During the 1990s, there was a shift from investments in capital assets, such as irrigation, power and rural infrastructure, to subsidies on inputs like power, water and fertiliser and to minimum support prices. This has led to
regional shifts in the production of food grains.

However, higher production has had repercussions. As the Green Revolution spread mainly in favourable areas, yield gains were distributed unevenly throughout the country. In addition, the high yielding varieties of rice and wheat led to mono-cropping in some areas, which increased the susceptibility to biotic and abiotic stresses (e.g. pests and droughts). The natural resource base is eroding. Ground water, particularly in the northern Indian states of Haryana, Punjab and Western Uttar Pradesh, is depleting fast. In Punjab, the upper layer of groundwater is exhausted and farmers are now investing in installing more powerful pump-sets to extract water for irrigation. Various advisories have been issued against growing water intensive paddy in Punjab and Haryana. A comprehensive approach to food insecurity includes protecting the production base by sustaining the natural environment.

India’s White Revolution transformed India’s dairy sector. In the 1950s and 1960s, India relied heavily on milk imports, and the total per capita availability of milk was 113 g a day in 1968. Dairy farmers had only a few animals and were struggling to get their highly perishable product to the markets in the urban centres. Against this background, the Indian government decided to “flood India with milk” and launched Operation Flood in 1970. Operation Flood aimed to increase milk production, connect milk producers and consumers and raise the income of dairy farmers.

Operation Flood addressed three different levels: i) at the farm-level, dairy farmers were organised into co-operatives. Co-operatives were provided with advanced technologies, such as modern animal breeds that produced more milk. ii) At the district level, co-operative unions were formed, which owned and operated milk processing plants as well as storage and transport equipment. The unions also provided animal health services. iii) At the state level, state federations conducted and co-ordinated the nation-wide marketing of milk.

Operation Flood took place in three phases. In the first phase (1970-1980), one million dairy farmers were covered and focus was on serving the market of the country’s metropolis. In the second phase (1981-85) about ten million dairy farmers were part of the programme and all major cities of India were covered, and in the last phase of the operation (1985 to 1995) nearly seven million dairy farmers were targeted.

The results of the dairy policy were notable: From 1988-89 to 1995-96, milk production rose from 42 million litres to 67 million litres a day. Today, India is the largest producer of fresh buffalo and goat milk and the second largest producer of fresh cow milk in the world. Most of the milk produced is consumed within the country. Milk is an essential source of protein in the predominantly vegetarian diet of many Indians. Today, every Indian consumes about 250 g of milk per day.


Progress, but a large food insecurity problem remains

According to the 2011 census, the population of India was 1.21 billion people, an increase of 364 million people in the last two decades. FAO (Figure 2.3) estimates that the number of undernourished people in India dropped from a high of 262 million in 1993-95 to a low of 206 million in 1997-99. The number increased to 246 million in 2004-06, but higher agricultural production and stronger economic progress resulted in a reduction of about 33 million undernourished people to an estimated 213 million by 2010-12. This progress occurred despite the addition of some 94 million people to India’s population during that time frame, indicating more rapid progress in reducing food insecurity. However, with about one-quarter of the world’s food insecure people within India, improving its nutritional status remains a significant challenge. Undernourishment has a significant impact on child development, which in turn influences adult productivity and economic growth. UNICEF reports that, in 2005-06, 43% of Indian children under-five years were moderately and severely underweight, and 48% were stunted due to chronic undernourishment, down from 58% in 1992-93 (UNICEF, 2014). India is unlikely to meet the Millennium Development Goal target of reducing by half the percentage of undernourished people by 2015. The number of food insecure has remained high despite India’s rising trade surplus in cereals.
Figure 2.3. Undernourishment in India


The average composition of diets in India is illustrated in Figure 2.4, which demonstrates the extent to which the population is vegetarian. The livestock and fish sectors provide only 9% of calories and 20% of protein intake. Cereals provide more than 50% of both calorie and protein intake in both rural and urban India, although survey data point to a declining contribution from cereals (NSSO, 2012). Those foods contributing to increased intake of calories are vegetable oils, fruits and vegetables. Sugars appear to represent a proportionately large component of calorie intake. Pulses are an increasing source of proteins, now accounting for almost 13% of protein intake.

The role of cereal consumption in food security is highlighted by dietary evidence. The Planning Commission of India has taken note of this issue in the 12th Five-Year Plan Document (2012-2017), which expresses concern that falling cereal consumption per capita since the mid-1990s “is the main reason why per capita calorie intake has not increased despite rising income. Even poor people are reducing the share of income spent on all foods in order to meet other non-food needs. In such a situation, where there is a disjunction between such a basic requirement of human development as nutrition and other consumer demands, there is a need to ensure that minimum nutrition requirements are met” (Government of India, 2013c, Chapter 12, p. 17). This is an important aspect which underlies the rationale of India’s new Food Security Act of 2013, which strives to increase the consumption of cereals (Box 2.5) through targeted subsidies while maintaining market support prices to farmers.
Figure 2.4. Estimated daily calorie and protein intake by food item in India, 2009


In fact, progress in both calorie and protein intake has been slow. From 1970 to 2004, average daily calorie intake per capita has fluctuated in the range of 1950 to 2350 kcal. Protein intake also fluctuated but with a small trend increase over the range of 49 to 55 grams. But from 2005, calorie and protein intake have shown continuous improvement, increasing from 2252 kcal and 54.1 grams respectively to an estimated 2500 kcal and 61.5 grams by 2013. Relative to OECD, or developed country averages, it has not changed much in the last three decades, as noted in Figure 2.5, but some increase has occurred in recent years. Average intake of calories in 1980 in India was about 63%, and by 2013 it was 73% of OECD levels. For protein, intake was 50% of OECD levels in 1980 and 59% by 2013. While some progress is evident over time, the extent of the difference has not changed rapidly. However, there does appear to be an upward trend in this ratio since the middle of the last decade.

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4. Actual estimates by FAO are officially provided only to 2009. These have been extended by extrapolation using consumption data used in this Outlook by the OECD and FAO Secretariats.

5. This reference is provided as a benchmark only for comparison purposes not an indication of what calorie or protein intake should be.
India’s agricultural resources are large

Human resources

Labour in rural areas available to agriculture in India is large. India remains dominantly rural, with some 68% of its population residing in rural areas, as compared to the world average of 49% (2012). Long term world population projections indicate a cross over point for rural and urban populations around 2045. While the urban population is now growing at a faster rate than the rural population, as documented in the recent decennial census of 2011 (Government of India, 2014a), the rural population will be in the majority for a considerable time. The quality of India’s labour is increasing, with over 97% of its youth finishing primary school. India expects to achieve 100% youth literacy by 2015 (Government of India, 2013d). This will help improve the effectiveness of India’s extension services and programmes (Government of India 2013e).

In 2011, cultivators (land owners and tenants) and agricultural labourers represented almost 55% of the Indian labour force: 50% for men and 65% for women. The share of cultivators is declining, while that for agricultural labour is rising (Table 2.2), indicating on-going change in land tenure.
Table 2.2. Share of agricultural labour and cultivators in population in India

<table>
<thead>
<tr>
<th></th>
<th>2001 Total</th>
<th>Rural</th>
<th>Urban</th>
<th>2011 Total</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cultivators (% of total workers)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persons</td>
<td>31.7</td>
<td>40.2</td>
<td>2.8</td>
<td>24.6</td>
<td>33.0</td>
<td>2.8</td>
</tr>
<tr>
<td>Male</td>
<td>31.1</td>
<td>42.0</td>
<td>2.5</td>
<td>24.9</td>
<td>35.2</td>
<td>2.7</td>
</tr>
<tr>
<td>Female</td>
<td>32.9</td>
<td>37.1</td>
<td>4.1</td>
<td>24.0</td>
<td>28.8</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Agricultural labour (% of total workers)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persons</td>
<td>26.5</td>
<td>33.0</td>
<td>4.7</td>
<td>30.0</td>
<td>39.3</td>
<td>5.5</td>
</tr>
<tr>
<td>Male</td>
<td>20.8</td>
<td>27.5</td>
<td>3.4</td>
<td>24.9</td>
<td>34.4</td>
<td>4.6</td>
</tr>
<tr>
<td>Female</td>
<td>38.9</td>
<td>43.0</td>
<td>10.7</td>
<td>41.1</td>
<td>48.5</td>
<td>9.0</td>
</tr>
</tbody>
</table>

Note: Cultivators are landowners or tenants. Agricultural labourers work for wages in farms. 

**Land**

India has the largest area of arable and permanently cropped land in the world, estimated at 169.6 Mha in 2011 (FAO, 2014), marginally ahead of the United States at 162.7 Mha. The country also has the largest area of irrigated land, estimated at 63.2 Mha. While land resources are large, India’s high population density means that land resource endowment on a per capita basis is actually less than the world average. Increasing urbanisation has limited the gross area under cultivation, with increasing pressure from demand for land for non-agricultural purposes. This means that higher aggregate production in the future will come from yield growth and increases in the cropping intensity rather than an expansion in agricultural area.

As a tropical country, India supports a diverse range of crops. Depending upon the availability of water, cropping activities continue year-round. The extent of multiple cropping in India is among the highest in the world. In general, there are two distinct cropping seasons: Kharif (July to October) and Rabi (October to March).

Data from the Agricultural Census indicate that there were about 138 million agricultural holdings in India in 2010-11, of which around 117 million were small and marginal farmers with holding sizes of less than 2 hectares. The average holding size has declined from 2.3 ha in 1970-71 to 1.33 ha in 2000-01, and 1.16 ha in 2010-11. Small and marginal farmers account for more than 80% of total farm households, but their share in operated area is around 44%. Large holdings (10 ha and above) account for 0.7% of the total household farms and 10.9% of the total operated area. There are therefore significant land inequalities in India. Access to land is affected by inheritance practices, limited legal literacy and attitudes towards women’s ownership and control of land (OECD, 2014). Indian law guarantees equal access to land for women and men, but women own only 10.9% of agricultural land. Lower access to land has an impact on agricultural productivity, because it influences access to institutional credit, extension services and other agricultural inputs (Rao, 2011, Tara Satyavathi et al., 2010).

**Water**

India may have a large annual water supply, but water cannot be fully utilised due to topographical and other constraints, including high losses to evaporation and evapo-transpiration. Large temporal and spatial variations in rainfall limit water availability. Most of the water is available during the monsoon period, but it often results in floods. Lack of access to irrigation is a major problem for farmers trapped in poverty, and it will be a critical issue in the future. India has one of the world’s largest irrigation systems but it also faces high levels of inefficiency, particularly for those relying on surface water sources, the
efficiency for which is estimated at 35-40%, as opposed to ground sources, whose efficiency is estimated at 65-75%. More serious is the problem of ground water depletion, which is viewed to be in crisis as a result of excess extraction, due in part to the lack of regulated use and power subsidies which lower extraction costs (Government of India, 2013e, p.29).

**Capital formation**

Investment as a percentage of agricultural output was 20% in 2011-12, up from under 15% five years earlier, and an average of only 10% in the 1990s (Government of India, 2013e, p. 7, 17). Public sector investment has risen slowly in the last decade, falling from as much as 50% of total investment in the 1980s to less than 15% in recent years. Private investment has risen more rapidly, almost doubling over the period 2004 to 2011, and rising to over 17% of agricultural output. Part of the reason for this is the provision of credit schemes by the government at favourable interest rates. They have helped foster a tenfold increase in credit in the decade prior to 2011. However, growth of capital on farms is hampered by the trend decrease in the size of land holdings. Small and marginal farmers who cultivate most of India’s land cannot afford to buy modern farm capital which requires larger size to reach the economies of scale necessary to justify its acquisition. India’s tractor density, at about 16 per 1 000 ha, is less than the global average of 19.

**Productivity growth has been key to increased production**

Estimates of total factor productivity (TFP) for Indian agriculture provide important insights into the nature and drivers of productivity growth, although results vary depending on the methodology and level of aggregation of the analysis (Kumar et al., 2013). Studies show that while technical progress has been the key driver of productivity change, productivity growth in India has not been consistent over time. Production efficiency improved in the 1980s, plateaued in the early 1990s, and then declined in the period from 1997 to 2003, likely due to weather shocks. This time pattern of productivity change is evident in changes in crop yields (a partial measure of productivity) over time, as noted in Figure 2.6. Yield growth has resumed after 2007.

![Figure 2.6. Annual change in yields of wheat and rice in India](image)

Note: Lines in black are smoothed curves fit to yield changes.

A study by Gautam and Aggarwal (2013) analysed yield gaps in paddy and wheat. Using a crop model to simulate the potential for popular and established rice and wheat cultivars in different parts of India, the study generated three different yield scenarios: i) a biological potential yield (PY) based only on varietal characteristics without constraints in the growing environment, ii) an attainable yield (AY), which
introduces water management into the simulation based on the current level of irrigation development in each state and, iii) a “realisable” yield (RY), which is the research station or experimental yield recorded for a given cultivar in the official varietal release database. Realisable yields (RY) should be close to the AY, yet they should still reflect soil problems, pests, other management problems and local conditions, because some biotic and abiotic stresses cannot be controlled even on an experiment station. All of these yields can then be compared to actual or farm yields (FY) to establish the size of yield gaps. Figure 2.7 shows the all-India weighted (production weights) averages for RY, AY, and FY, providing an aggregate picture of yield gaps for rice and wheat and the potential to increase actual yield.

![Figure 2.7. Yield gaps for rice and wheat, all India](image)


The study also found that yield gaps vary considerably across states, and some areas have little scope for further improvement. West Bengal - not a traditional wheat-growing area - is an outlier that has exceeded its expected performance. Maharashtra and Gujarat seem to have exhausted their potential with the current wheat technology, whereas Punjab and Haryana still have some room to increase yields. West Bengal and Punjab are also close to their potential for paddy, but most other states have significant potential yield advances to exploit (Gautam and Aggarwal, 2013).

India’s trade surplus in agricultural commodities continues to grow

India is among the leading exporters of agricultural products, with a trade surplus that has grown from USD 3.6 billion in 2000 to an estimated USD 22 billion in 2013 (Global Trade Information Services, 2014). Rice accounts for the bulk of exports, followed by cotton and fishery products. Exports of wheat and coarse grain vary, and have often reached high levels, and exports of protein meal are rising. Recently India has become one of the top bovine meat exporters (Box 7.3). On the other hand, India continues to be

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6. The biological potential reflects purely exogenous climate factors and varietal characteristics, but no other biotic or abiotic stresses (considered manageable), and hence represents a theoretical physical optimum. Attainable yield incorporates local soil factors and water control (area irrigated) to identify what is attainable given current level of water management but assuming that all other factors can be (at least theoretically) controlled.

7. Data refer only to Chapters 1-24 of the trade classification.
the largest importer of edible oils and pulses in the world, and alternates as a major sugar importer or exporter.

For a country as large and populous as India, changes in trade can be small in relation to domestic consumption/production, but large in the context of international markets. This raises the issue of market integration, and the degree to which prices of key commodities in India follow or cause price movements in international markets. The evidence presented in Box 2.2 suggests that for some commodities such as rice, Indian markets impact on global markets, but for the most part the connection between the domestic and international markets is weak or non-existent. Weak connection between markets is due to policy structures in India, such as market support prices, intervention programmes, export restrictions and tariffs which sever market linkages (Gulati et al. 2013).

**Figure 2.8. India's trade surplus in agricultural and fish products is rising**

![Graph showing India's trade surplus in agricultural and fish products from 2000 to 2013.](source)

Box 2.2. Domestic and international market integration

The degree to which prices in different markets move together is an indication of how efficiently trade occurs between them. Within India, Sekhar (2012) found that the commodity markets that do not face inter-state or inter-regional movement restrictions like pulses or vegetable oils appear well-integrated, while those that do have such restrictions, such as rice, do not show integration at the national level. With respect to domestic and international markets, as indicated in the graphs, and as tested using statistical methods, the interrelationship of markets is weak. Domestic prices illustrate lower volatility than international markets, a feature which is the result of India’s market and trade policies, which include market support prices, tariffs and export restrictions. Statistical tests for causality indicate that Indian rice prices may impact those in international markets.

Figure 2.9. Interrelationship of domestic and international markets in India
Sugar (top left figure), Vegetable oil (top right figure), Wheat (bottom left panel) and Rice (bottom right panel)

Table 2.3. Indexes of market connection (IMC)

<table>
<thead>
<tr>
<th></th>
<th>Rice</th>
<th>Wheat</th>
<th>Sugar</th>
<th>Vegetable oil</th>
<th>Maize</th>
<th>Soybean</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMC</td>
<td>77*</td>
<td>21</td>
<td>39</td>
<td>36</td>
<td>30</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: Estimations over the period 2000-2013. Prices in India are wholesale prices converted to USD, and restricted least squares regression of relation PD= (1+b1)*PD(-1)+b2*(PI-PI(-1))+(b3-b1)*PI(-1), yields coefficients such that IMC=(1+b1)/(b3-b1) provides an indicative measure of market connection. An IMC of 0 indicates highest connection between markets, and higher values lower connection (Timmer, 1984). In the case of rice, the estimated relationship is not statistically significant, meaning no market connection from international markets; Granger causality tests indicate an inverse connection from domestic to international markets may be noted.


Agricultural policy

For almost 60 years, India’s agricultural policy has been guided by Five-Year Plans, the latest of which is the 12th (2012-17). The Plan’s broad vision is “Faster, Sustainable, and More Inclusive Growth,” leading to broad-based improvement in the economic and social conditions of people and achieving inclusiveness by both delivering benefits directly to the poor and excluded groups, and increasing their ability to access employment and income opportunities (Government of India, 2013c). As per the Plan, the higher GDP growth of 8.2% assumed envisages 4% growth in the agriculture and allied sectors. Some of the key priorities are to improve the economic viability of farming with stable prices and a minimum income for farmers, to encourage diversification, increase investments, reduce environmental degradation, and enhance food security by further production diversification into oilseeds, pulses, livestock and fish. Importantly the 12th Five-Year Plan continued the important National Food Security Mission (NFSM), National Horticulture Mission and the Rashtriya Krisha Vikas Yojana (RKVY) programmes, which have had a large impact on the agricultural sector, along with initiatives to increase farm support prices, investments, input subsidies for credit, fertilisers, and food distribution.

There are four broad policy instruments which the Indian government has employed to achieve its diverse objectives. These are market support policies, trade policies, input subsidies and food distribution subsidies.

(i) Market support policies

The Agricultural Prices Commission was set up in January 1965 to advise the Government on price policy for agricultural commodities. The basis for setting up the Commission was to develop a balanced and integrated price structure in the perspective of the overall needs of the economy and with due regard to the interests of the producer and the consumer. Currently the Commission (renamed Commission for Agricultural Costs and Prices) sets Minimum Support Prices (MSP) for 24 commodities and a Fair and Remunerative Price (FRP) for sugarcane. For most products, other than tariffs, there is no effective mechanism to ensure that prices do not fall below the MSP. Procurement is used for some products, rice and wheat in a few states such as Punjab, Haryana, Uttar Pradesh, Chhattisgarh, Andhra Pradesh, and to some extent in Madhya Pradesh and Rajasthan, and in a few other states for sugarcane, cotton and jute. Procurement has led to higher public stocks in recent years, creating challenges for stock management and for redistribution and the prevention of product waste.
The MSPs for all commodities increased sharply after 2007-08. Prior to this year, the MSPs for all commodities were flat for over a decade. For food grains, the MSP for paddy and wheat was higher than that for coarse cereals and maize. For pulses, the MSPs were increased in 2008-09, at a rate higher than that for food grains. However, this has not translated into larger areas planted under pulses, because the risks associated with their cultivation are very high. In comparison, paddy cultivation does not involve substantial risks and farmers are also assured of procurement by government agencies, whereas this is not the case for pulses.

(ii) Trade policy

The operation of MSPs may also rely on tariff/border measures. Tariffs for food grains range from 51% for wheat to 80% for rice. For vegetable oils, tariffs are low at 2.75%. Meat tariffs are 31%, while those for dairy products are 36%. Applied tariffs on a number of commodities were lowered during the prices spikes after 2008. However, export bans were also implemented for rice and wheat to assure stable domestic supplies. The impacts of these bans are evident in the charts of Box 2.2. They indicate a calibrated trade policy designed to stabilise prices in domestic Indian markets. In addition to these, some non-tariff barriers also exist, such as sanitary and phyto-sanitary measures which may affect India’s trade.

India has been an active participant in the World Trade Organization (WTO), and a key member of both the G33 and G20 groups of negotiating countries. Its stance with respect to the agriculture negotiations reflects its objective to safeguard the livelihoods of its 650 million people who are reliant on a primarily smallholder based agricultural sector. In this context, it has been one of the main proponents of the introduction of an effective special safeguard mechanism (SMM), resistant to significant reductions in bound tariffs for key commodities and the main proponent in seeking dispensation to undertake commodity procurement at above market prices for food stockholding for the purposes of food security.
(iii) Input market policies

Input policies play a very important role in India’s agriculture. In particular, policies affecting seed distribution, fertilisers, electricity, water and farm credit have considerably increased input use in the last decade. From 2000 to 2011, annual seed distribution increased from 0.86 to 2.8 Mt. Fertiliser use rose from 16.7 to 27.7 Mt over the same period, implying an increase in application from 90 kg/ha to 144 kg/ha. Electricity use rose from 84.7 to 119.5 gigawatt hours in the period 2000-2009. Agricultural credit increased from USD 12 billion in 2000 to USD 84 billion by 2011 (NCAER, 2013a). Investments in irrigation in the last decade resulted in an increase in irrigated area from 58 Mha in 2001 to 63 Mha in 2010 (FAO, 2014).

The Indian seed sector is one of the most dynamic in the developing world. The New Policy on Seed Development (1988) liberated seed markets, because it allowed for the import of seed and germplasm for research purposes and lowered import duties on seed and seed processing equipment. Private sector investments in agricultural research and development increased significantly in the aftermath of the reform. The Plant Varieties Protection and Farmers Rights Act (2001) allowed plant breeders of new varieties to capitalise on their research investments, while allowing farmers and researchers to use protected varieties for their purposes. Improvements have also been made in seed testing and certification, thereby increasing the quality of seed. Today, approximately 400 to 500 private seed companies are registered in India (Government of India, 2014c). The private sector generally focuses on high value, low volume crops, like hybrid varieties of cotton, sunflower, maize and vegetables, while the public sector dominates the production of high volume, low value crops, like wheat, rice and pulses (Rabobank, 2001). In recent years, the seed sector expanded further owing to the fast adoption of genetically modified cotton varieties.

Although India’s seed industry underwent major changes in the past decades, the majority of farmers continue to rely on farm-saved seeds. However, seed replacement rates, i.e. the frequency with which farm-saved seed are replaced by quality seeds, are increasing. Seed replacement rates vary by crop and region. For example, the percentage of the area sown with quality seeds of wheat in the total wheat area sown in India increased from 13% in 2001 to 33% in 2011. The seed replacement rate for rice in India doubled from 19% to 40% over the same period (Government of India, 2014c). This increased use in quality seed can contribute to increases in agricultural productivity. This rate can be expected to increase further with rising yield differences between quality and farm-saved seed.

India is the world’s second largest importer of fertiliser, importing over 40% of its domestic use. As a means of increasing crop yields, India has undertaken a programme to subsidise fertilisers on the basis of nutrients. Under the New Pricing Scheme (NPS) a maximum retail price (MRP) applies to nitrogen fertilisers (mainly urea), such that producers buy at the MRP, and sellers are refunded the difference between the estimated delivery cost and the MRP. Other components such as phosphate and potassium fertilisers as well as various composites, are covered under the Nutrient Based Subsidy (NBS) and per kilogramme subsidies apply based on market conditions. They are provided equally to both domestic and imported products. There has been a concern that with a fixed MRP for nitrogen, depending on market prices for the other components, the subsidy/support structure has affected the mix of fertilisers applied to crops, notably a relatively high application of nitrogen (NCAER, 2013a). As prices rose dramatically in recent years, market prices of nitrogen were held down by the support structure and market prices of other components rose. The fertiliser subsidy has accounted for about 37% of total subsidies that the government has provided to agriculture, and is anticipated to cost Indian Rupees (INR) 681 billion (USD 11.4 billion) in 2014-15 (Government of India, 2014d)
Figure 2.11. Fertiliser subsidy in India

Note: BE - budget estimate, P&K - phosphorus and potassium.

Apart from the subsidy on fertilisers, power subsidies are another major component of agricultural policy. Electric power, which is used to provide energy for pump sets, is used extensively on Indian farms and the state governments provide generous subsidies to farmers to irrigate their crops. Figure 2.12 shows the size of the power subsidy in agriculture in nominal terms.

Figure 2.12. Electricity subsidy in agriculture in India

(iv) Food distribution

India has provided food distribution of wheat and rice at favourable prices through its Public Distribution System (PDS) for food grain. This has involved the distribution of products that have been procured by the Department of Food and Public Distribution at minimum support prices. Prior to 2013, distribution was made separately to qualifying groups in rural and urban areas depending on their income status (over or under the poverty line) and if they belonged to severe poverty group of about 10 million persons, known as Antyodaya-Anna-Yojana (AAY). In the total, this food distribution was provided to about 30% of the Indian population. For those over the poverty line, rice could be bought for INR 8.3/kg, for those under the poverty line the price was INR 5.65, and for those in AAY the prices was INR 3.0. For wheat the distribution prices for these groups were INR 6.1, 4.15 and 2/kg, respectively. The effective cost of the food subsidy depends on the difference between procurement and distribution prices, the size of distribution entitlements per household and the costs of distribution. In the last ten years, the costs of the PDS have increased substantially as minimum support prices were raised, from about USD 5 billion in 2002-03 to almost USD 14 billion in 2012-13.

In September 2013, a new National Food Security Act was enacted that will substantially enlarge India’s food distribution programme (Box 2.5). As of early 2014, the programme has been implemented in a number of states, and it remains to be implemented in others. The programme extends the previous distribution programme for wheat and rice. The NFSA now provides up to 5 kg per person per month for 67% of the population at prices of INR 3/kg for rice, INR 2/kg for wheat and INR 1/kg for coarse grain. This programme, if fully implemented, would be the largest food distribution programme ever to be undertaken. Further analysis of the programme is deferred to the next section of this chapter where policies are discussed as they may affect the Outlook.

The outlook for India’s agricultural sector

The growth of India’s agricultural production has more than enabled its food supply to keep pace with growing demand in recent decades. However, despite growing supply, India’s major challenge, recognised nationally and internationally, is the need to reduce food insecurity. With its National Food Security Mission of 2007-08, India has undertaken a number of substantive policy actions to further increase agricultural output and policies have been enhanced to promote its wider distribution. This section examines the prospects for India’s commodity sectors over the next decade and attempts to provide a framework against which the various challenges may be examined. It first reviews the key factors and constraints which may affect the outlook for India, then looks at the prospects for each of its major commodity sectors.

Key factors and constraints underlying India’s outlook

Any projection for any country’s agricultural sector needs to rely on numerous hypotheses/assumptions concerning the environment surrounding the sector. These include macroeconomic conditions, the international sector, domestic social trends, and very importantly in the case of India, the policy environment.

*Income growth lower, but maintains stimulus over the medium term*

A key factor underlying the outcomes for India’s agricultural sector over the next decade is the performance of the economy at large. This includes economic growth, price inflation and exchange rate performance. In these domains, India’s economy performed generally well in the last decade, alongside Brazil, Russia and China in the BRIC group of emerging countries. In the last decade (2004-13), per capita real GDP grew at a compound rate of almost 6% p.a., and inflation was 7.3% p.a. India’s real exchange
rate - its nominal rate adjusted for inflation compared to that in the United States - appreciated substantially from 2000 to 2011, before depreciating in the past two years, as the economy cooled down. These conditions were very supportive of India’s agricultural development, providing higher incomes to support consumption, a favourable investment climate and more resources for the government to undertake policies and programmes.

According to the International Monetary Fund projections of fall 2013, India’s economic performance in the coming decade is anticipated to slow somewhat from that of the previous decade. This *Outlook* assumes that India’s per capita output growth will average almost one full percentage point lower, at 5.2% p.a., which should still offer a stimulus to incomes and consumption over the next decade. This growth implies that average output per head will be over 50% higher at the end of the decade than it is now, providing considerably more resources for consumption and investment. The depreciation in its real exchange rate, which reduces the terms of trade, is anticipated to remain at current levels. Inflation in the nominal GDP price deflator is anticipated to fall to an average 6% p.a. in the next decade. A key risk for India is that economic growth, which has slowed down in the last two years, will not resume at higher rates into the medium term. This risk and its implications are assessed further in the section of this chapter which discusses risks and uncertainties facing the outlook for India.

![Figure 2.13. Macroeconomic indicators in India](image)

*Figure 2.13. Macroeconomic indicators in India*

Per Capita GDP Growth (left) and Real Exchange Rate (right)


Slower population growth may provide a dividend

For many emerging economies, growth in population has fallen in the past decades and urbanisation has proceeded at a very fast pace. This was certainly true of China, Thailand and other Asian economies. India’s population growth in the previous decade was 1.3% p.a., a rate which is still higher than the global average. However, population growth is anticipated to fall to just over 1% in the next decade. While this may reduce aggregate demand pressures, it may also provide dividends in the sense of proportionately more population in the workforce which may provide more resources on a household basis, and hence higher consumption growth. However, India’s rural population remains large relative to the total population (68%), and as such this may mean less change in dietary composition than might be experienced in other countries. In most countries, the consumption profile of the rural population is quite
different to that in urban areas, in terms of diet diversification, and less dynamic in terms of change toward more processed and diverse foods.

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**Box 2.3. Short-and long-term macroeconomic challenges for India**

The important macroeconomic challenge for India over the next decade is to create more productive jobs for its almost 500 million workforce – especially the 10-12 million annual youthful entrants. This is a critical challenge since the agricultural sector still accounts for almost half of total employment and has been destroyed jobs as productivity is very low. Meanwhile net job creation in the manufacturing sector has slowed down.

From 2010 to 2013, the Indian Rupee (INR) depreciated by about 40% in nominal terms relative to the US Dollar, and about 17% in real terms. This has increased inflation and placed increased pressures on public and private finances. India’s monetary policy framework has now assigned a higher weight toward containing inflation, but containing inflation will require reducing the public fiscal deficit and dealing with supply constraints that are limiting economic growth. These constraints impede the economy from responding to the boom in competitiveness provided by real depreciation. India has passed a new land acquisition law which may promote investment, but implementation of the new National Food Security Act will be fiscally costly and, along with the oil subsidy and other programmes, may keep the deficit high. Rupee devaluation has increased the costs of India’s oil and fertiliser subsidy, given the large size of its imports, and how the programme is structured.

After growing by a large 7.8% annually from 2000 to 2010, India’s economy slowed to an average growth rate of 5.2% from 2010 to 2013. Stronger agricultural growth and public sector consumption have failed to compensate for sluggish industrial production, investment and exports. This is a substantial slowdown compared to previous years, and the question is whether and when recovery will occur. Persistent high inflation and low productivity have contributed to a loss of competitiveness. High government transfers through social security schemes also raised wages, especially in rural areas; rural real wages that had been flat earlier showed a substantial rise after 2007 when high food inflation and rural employment programmes set in.

The economy is expected to recover in the medium term and to achieve average growth of 6.3% p.a., which is lower than that of the previous decade. Real INR depreciation combined with a projected increase in external demand should increase exports. Higher investment should also stimulate growth as new government infrastructure programmes and the Land Acquisition Law reduce business uncertainty. Boosting growth and making it more inclusive will require addressing structural bottlenecks, in particular gaps in energy, transport and water infrastructure, overly stringent labour regulations and the shortage of skills. Tax reforms should raise more revenue, being less distortive for growth and redistributing more from the rich to the poor.


**Will productivity growth overcome resource constraints?**

Land available for cropping, which is arable land including permanent crops, peaked in 2000 at 171 Mha, and has declined since to 169.7 Mha in 2011. It is anticipated that agricultural land will continue to decline slowly over time. However, around 25-30 Mha may be left fallow each year. Consequently, while the land base continues to decline, management options for land may affect the quantity cropped in any given year. Without change in fallow land and cultivable waste, it appears that any further increase in crop production must come as a result of increased crop yields. While the number of crops per year could be increased further, India’s cropping intensity is among the highest in the world.

According to the Indian Council for Agricultural Research (ICAR) and the National Academy for Agricultural Sciences, of the 141 Mha which are under cultivation in India, about 100 Mha are at risk of becoming increasingly difficult to farm owing to increasing cropping intensity on fragile soils, inappropriate application of fertilisers, inadequate application of manure, reduced organic carbon and severe nutrient deficiencies (ICAR, 2010). These effects are heavily felt in those states that benefited most
from the Green Revolution, e.g. Punjab, Haryana, Uttar Pradesh and Bihar, which produce almost half of India’s food grains.

Not just land, but water supply is also under stress. Loss of agricultural land for non-agricultural uses is prompting the adoption of more input-intensive farming practices. But this reduces the availability of irrigation water. As a result, the exploitation of ground water has reached critical levels in many parts across the country. Excessive and improper use of agro-chemicals is causing water pollution (Divja and Belagali, 2012). However, the per hectare use of agro-chemicals is much less in India than it is in many other countries.

India has traditionally had abundant rural labour. However, recently the population engaged in farming has declined, and labour has become more expensive (Chand and Srivastava, 2014). After remaining stagnant for a long time, rural wages have been increasing since 2008-09 (Figure 2.14). The increase in wages has also been due to the MGNREGA Scheme which is underpinning the labour market. Higher real wages have triggered capital investment in the economy, which in turn helped to increase labour productivity by some 50% from 2005 to 2011. Sustaining these changes will require extensive new investment, which the Planning Commission has described as unsustainable without further increases in the productivity of new capital.

Figure 2.14. Real rural wages are rising in India

Due to a number of factors, India’s crop yields increased at a relatively fast pace in the last decade, and in particular from 2005. For example, during the period 2005 to 2013, national average yields for rice, wheat and coarse grains increased at 2.0%, 2.6% and 2.7% annually respectively. An important question is whether such a pace can be sustained over the next decade. The previous section noted that in some states, actual yields were not far from their potential, realisable level, while in other states a considerable gap remains. Further, some neighbouring countries have higher yields, and it appears that sustaining high yield growth may well be possible. This Outlook is optimistic in assuming the yield growth will remain robust over the next decade, particular if the current policy set remains in place (see discussion below).

8 Mahatma Gandhi National Rural Employment Guarantee Act, which guarantees 100 days of work to every rural household.
One caveat to this optimistic scenario suggesting lower yield growth is associated with climate change which is beginning to show its impact. According to one study, climate change is projected to reduce timely sown, potential irrigated wheat yields by about 6% by 2020. In the case of late sown wheat, the projected decrease is 18%. Similarly, it is estimated that climate change may reduce potential irrigated rice yields by 4% and rain-fed rice yields by 6% by 2020. These projected impacts appear large over such a short time frame, but do point to factors which may aggravate yield fluctuations and thereby influence food security levels (Shetty et al. 2013).

**Policies will play a critical role in market outcomes**

Agriculture and food distribution policies will play a critical role in the next decade, if the current settings are maintained. This *Outlook* assumes that current legislation will remain in place, and it is appropriate to outline what influence they may have in affecting outcomes over the next decade. This policy set is diverse and pervasive, and following the experience of growth following the National Food Security Mission of 2007-08, the policy environment potentially stimulates both the demand and supply sides in certain sectors, particularly for food grains. Three important policy considerations concern i) market support prices, especially for rice and wheat, ii) input programmes, especially for fertiliser and iii) the new National Food Security Act of 2013. The *Outlook* assumes no change in India’s trade policy.

i) **Market support prices**

Market support prices have been increased annually according to estimated changes to farm costs of production. Figure 2.15 below provides the projection for MSPs in USD, relative to the international reference prices projected in this *Outlook*. The interesting point to note is that under the assumptions/conditions of the projection, market support prices may provide support for wheat and rice which is broadly similar to price levels prevailing in international markets. This, however, depends on anticipated inflation rates, exchange rates and, of course, quality differences. The second point of interest is that MSPs remain at higher real levels compared to those prevailing prior to 2007, and therefore continue to stimulate higher production levels.

The MSP for the other 22 commodities are also assumed to increase according to increases in production costs. However, since these programmes are not usually backed by an effective procurement mechanism as exists for rice and wheat, production preferences for the latter two are assumed to broadly sustain area allocation to these commodities.

9. MSPs are actually set on the basis of many factors, supply and demand. For this projection, MSPs have been indexed to production costs following cost of production index in the Aglink-Cosimo model, adjusted for 1% growth per year in productivity.
Figure 2.15. Market support prices in India and world prices for rice and wheat

Note: Minimum Support Price (MSP) for paddy rice is adjusted to milled basis. Market margins of 15% are added to MSP. The world reference price for wheat is US Gulf HRW, and for rice is Viet Nam 5%.


ii) Fertiliser

The fertiliser subsidy is assumed to continue in its current form, with constant MRP for nitrogen-based fertiliser and subsidies for the respective nutrients. This structure poses challenges for the fertiliser industry as noted in Box 2.4. Assumed high crude oil prices in this Outlook imply that related fertiliser prices will remain high in the coming decade.

Box 2.4. The fertiliser industry in India: Its challenges and prospects in the next decade*

Mineral fertilisers play a crucial role in Indian agriculture. Increasing use of fertiliser, coupled with high yielding seeds and irrigation has transformed Indian agriculture.

India is the second largest consumer of fertiliser in the world next to China, although on a per hectare basis, the use of fertiliser is still lower than in many countries. Indian fertiliser consumption recorded a phenomenal growth in India during the past decades, growing more than 12 times from 2.3 Mt in 1970-71 to 28.1 Mt in 2010-11. However, total nutrient consumption fell in the past two years, falling to 27.8 and 25.5 Mt in 2011-12 and 2012-13, respectively. Fertiliser use will need to expand in the future, to 30.5 Mt by 2021/22 and 37.4 Mt by 2031/32, partly reflecting the production requirements foreseen by the National Food Security Act.

Favourable policies led to substantial addition to domestic production capacity of nitrogenous and phosphatic fertilisers until the late 1990s. India became self-sufficient in urea production in early 2000. Since then, however, no brown field or green field projects have been commissioned. Policies focused more on containing the level of subsidy. Investment policy in 2008 for urea led to a small addition in existing capacity of about 2.5 Mt.

Rising consumption and stagnant/slow growth in indigenous fertiliser production has led to increasing dependence on imports. Currently, India imports about 17 Mt of finished fertilisers and 12 Mt of raw materials in nutrient equivalent terms.

Government policies will continue to play a critical role in future for better use of fertilisers. The fertiliser industry emphasises that full reform of the sector is necessary, so that prices of nutrients promote more balanced use. An
investment policy for urea is needed to encourage new capacity, requiring the availability of gas to sustain existing production and to support new capacity. The Government of India has the intention to implement a direct transfer of subsidy to the farmers in the next few years in place of the current system of transfer through the fertiliser industry. This will encourage the industry to take independent commercial decisions and focus on innovation in fertiliser products and services to the farmers.

* This box is based on inputs provided by the Fertilizer Association of India, under the direction of Director General Satish Chander.

The result of India’s support/subsidy for fertiliser is a projection of sustained low fertiliser prices in the future which will continue to stimulate fertiliser application, including relatively high nitrogen application. The comparison of movements in fertiliser prices between India and global markets is noted in Figure 2.16.

![Figure 2.16. Movements in fertiliser prices, India vs World](image)

Note: Prices indexed to 1 in 2005, world fertiliser price index from the World Bank. India’s fertiliser price is calculated from nitrogen, phosphate and potassium according to the same composition.

Source: OECD and FAO Secretariats.

### iii) Food grain distribution

The NFSA (Box 2.5), is being implemented across India. This Outlook has assumed that the Act will remain in effect over the next decade, to 2023-24. Its implications need to be assessed for a clear understanding of its potential impact on markets. It should be noted that the NFSA extends an already large food distribution programme, which previously covered about 30% of India’s population.

The NFSA may be examined from the point of view of both consumers and of government finances. For consumers, data on the consumption profile of the average recipient of NFSA food grain is not available. If it is assumed that the average recipient consumes 75 kg of rice, 62 kg of wheat and 21 kg of coarse grain (average per capita disappearance in 2013), then the programmes provision of 60 kg p.a. of food grain would cover about 38% of an individual’s consumption. If no change in consumption mix is assumed, this means effective subsidisation of 28 kg of rice at a price of INR 3/kg (USD 0.047/kg), 24 kg...
of wheat at a price of INR 2/kg (USD 0.031/kg), and 8 kg of coarse grain at INR 1/kg (USD 0.015/kg). At retail prices for rice, wheat and coarse grain of about INR 31.8 (USD 0.59/kg), INR 19.6 (USD 0.36/kg) and INR 24.2/kg (USD 0.38/kg) respectively, the net saving for the average recipient is about INR 1 674 (USD 26) per year in 2013. Assuming no change in the offer prices, in the rates of inflation and of the USD exchange rate, the effective subsidy in this projection rises to INR 3 076 (USD 29) p.a. per person by 2023.

An important question for the *Outlook* concerns the demand effects of the NFSA on food consumption in India which are not fully understood, yet, given that the programme started at the end of 2013. A detailed analysis of the NFSA is beyond the scope of this *Outlook*, but anticipating its overall impact on markets is nevertheless required. The approach adopted in performing the projection is to establish a base projection, using simplifying assumptions, and then examine the implications of an alternative approach to test sensitivity. This is reported in the last section of this chapter.

Impacts of a subsidy programme consist of price and income effects. As noted above, the offer prices are low, but since the coverage limit of 60 kg per person per year is well under the average consumption profile of most people in India, it means that at the margin the effect on cereal consumption with respect to these prices may be close to zero. This is because consumption beyond 60 kg still faces the full retail price. Of course, the distribution of consumption around the average may imply that some people face the marginal price at the subsidised rate, such those in the AAY group which are entitled to a family subsidy limit of 35 kg/month. But overall, the impact on consumption for most people would be from the income saved by access to the cereals at the much lower prices and not to the price incentive to buy more at the margin. The question then is how consumers will allocate the additional net income provided by the programme.

Accounting for the income effect of NFSA on consumption is also contentious. Some research on food consumption behaviour in India suggests that the marginal income expenditure elasticities for some goods such as cereals are negative (Kumar, 2013). This would imply that the programme effect may be to reduce cereal consumption and use the additional income to buy other goods. Against this perspective, the model used in the preparation of the *Outlook* employs a demand system with positive income effects. These elasticities vary by product, and in the case of cereals, the value is small at 0.13 in 2013. However, these model estimates are national in scope and refer to the “average” consumer, while the NFSA is targeted by income and location. With income inequality and with budget shares for commodities that differ significantly by income scale, using the model without adjustment may underestimate the impact of an income subsidy for consumption goods with a higher budget share for consumers in lower income brackets (such as cereals).

In the context of this discussion some simplistic assumptions have been used in accounting for the impact of the NFSA. These assumptions specify shifting the demand functions of the projection model upward by a factor reflecting the percentage of additional product that is bought at current retail prices with

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10. This is a simplified assessment, purely as an example to illustrate possible costs. The allocation of products by recipients does affect programme costs.

11. The estimates of per capita consumption provided by FAO using commodity balance sheets data indicate 158kg/person. Household consumer expenditure data for 2011 indicate 144 kg/person (NSSO, 2013).

12. This analysis abstracts from important issues of waste, or programme inefficiencies which may mean that people do not receive the full benefits of the programme.

13. India has a Lorenz ratio of about 0.38 which implies a disproportionate number of people with incomes less than the average income used in the model. Expenditures on various food groups vary significantly over the income distribution, and by rural or urban location. For example, cereal expenditures as a share of total expenditures varied from 19% among the poorest in India to 3% in the highest class in urban areas.
the share of the income savings from the programme. The share used is determined by the food expenditure shares at the median income. This approach implies, for example, that a 25% share of the subsidy would buy about 14 kg of the average basket of cereals at 2013 prices. As the NFSA extends previous programme benefits from about 30% to 67% of the population, the net effect in this example would be to raise per capita national average consumption by about 3%. The projections for the other commodities have been also adjusted in a similar way, and accordingly the demand functions for pulses, milk products, vegetable oil, sugar, meat products, and fruits and vegetables are shifted by 2%, 2%, 3%, 1%, and 2% respectively. An alternative approach would be to allocate the income savings across all items. In that case, with food expenditure shares in India at 42%, the shifts noted would be reduced accordingly. If a fully behavioural model were available which included income distributional dimensions, different results could be estimated.

The impact on the government finances of the NFSA is considerable. The programme represents a substantive up-scaling of the previous programme, and while offer prices are set initially only for three years, if MSPs are inflation adjusted, the programme costs will also inflate over time. Adjusted for inflation, real programme costs (at 2013 prices), evaluated at projected MSP procurement prices less programme offer prices, are estimated to rise from around INR 1.1 trillion (USD 19 billion) in 2014, to around INR 1.3 trillion (USD 22 billion) by 2023. It is important to note that analyses of procurement and distribution, including its costs and impacts on both consumption and welfare, are conditional on programme operation. The procurement of 55 Mt of cereals and its distribution to an estimated 834 million people involves substantial infrastructure and coordination to prevent waste, product degradation and failure in reaching intended recipients.

14. The expenditure shares use the average of urban and rural, as found in NSSO (2013).
Box 2.5. India’s National Food Security Act, 2013

The National Food Security Act was adopted by the Indian Parliament on 10 September 2013 and extends to the whole of India. It foresees that every person belonging to a priority household is entitled to receive 5 kg of food grains per month at subsidised prices. Subsidised prices for rice, wheat and coarse cereals should not exceed INR 3, 2 and 1 per kg, respectively, for a period of three years. After that, prices may be adjusted by the Central Government. Addressing food security based on a rights based approach rather than a welfare approach is a major change in Indian food policy. The Ministry of Finance allocated INR 1.15 trillion in the 2014-15 budget to the implementation of the National Food Security Act, which is approximately 1% of India’s GDP.

Eligible households will comprise up to 75% of the rural population and 50% of the urban population. This means that India’s National Food Security Act could cover up to 834 million persons, or 67%, of the Indian population. The programme is, therefore, regarded as the largest food security programme in the world. Households covered under the “Antyoda Anna Yojana” scheme - a programme for the poorest of the poor - are entitled to 35 kg of food grains per household per month at the above-mentioned prices. Special entitlements shall also apply to pregnant and lactating women and children up to the age of 14. For example, every pregnant women and lactating mother will be entitled to get food free of cost during pregnancy and six months after childbirth. Cash benefits of INR 1 000 per month would be provided for the first six months to meet increased food requirements of pregnant women. Children in the age group of six months to six years would be given food free of cost, and every child aged 6 to 14 years will be entitled to one free daily meal to be received at school. Special focus is also given to vulnerable groups in the remote areas of India. The state governments will be responsible for identifying priority households in rural and urban areas. The list of eligible households will be available publicly. The eldest woman (older than 18 years) in every eligible household will receive the ration cards for the household. In addition, reforms will be undertaken to make the public distribution system effective and transparent. These measures include the application of modern information and communication technologies and the use of biometric information for eligible households. Every state government will form a State Food Commission to monitor the implementation of the Food Security Act. The composition of the State Food Commission is regulated by the Food Security Act: it will consider experience, gender and caste. The act also makes provisions for vigilance committees and grievance redress mechanisms.

The Indian government will be responsible for procuring food grains to a central pool through the state agencies. The National Food Security Act specifies that 54.93 Mt of food grains will be distributed through the Public Distribution System (PDS) to all 35 Indian states per year. Additional allocations will have to be made by the government under other welfare schemes (8 Mt), buffer stocks (5 Mt) and the open market sale scheme (5 Mt). The total procurement will be approximately 70 Mt, which is 7 Mt higher than the amount procured during 2011-12 (Chand and Birthal, 2011). The central government will also be responsible for allocating food grains from the central pool to the different states, providing transportation and storage facilities. The state governments, on the other hand, will be implementing and monitoring the Food Security Act.

The National Food Security Act has been heavily debated within India. Some scholars argued that the act is more inclusive than current programmes, and eligible households will be more aware of their entitlements. This will make the PDS system more effective, because exclusion errors and leakages are better addressed (Drèze, 2013). Others stated that a further increase in procurement levels may aggravate the procurement challenges currently experienced, relating to infrastructure, stocking, transport, leakages and governance. These challenges would have to be addressed with substantial financial investments in market infrastructure. The central procurement of cereals may also crowd out private sector or state government initiatives that might be better tailored to local needs (Gulati et al., 2012).

Sources:
The commodity outlook for India 2014-23

Overview

The major question concerning the outlook for India, in the context of the policy environment and conditioning assumptions surrounding the outlook for its economy, is whether India will continue its recent increases in production, and if so will they serve higher domestic consumption, or larger exports. During the next decade, will India make gains toward reducing its number of food insecure people? The projections of this Outlook are affirmative. India’s agriculture production growth will likely slow from the rapid pace of the previous decade, but it will still advance at more than double the rate of population increase, and consumption will advance at a similar pace. If international prices evolve as projected, all else being equal, India may export historical quantities at prices close to MSP levels. However, if the consumption of rice and wheat do not rise as projected, stock accumulation or trade would need to absorb production increases. In turn, higher exports particularly for rice, would depress international market prices and Indian exports could then not be achieved without subsidy, also reducing export revenue. The interaction of Indian agriculture’s development and the government’s policies have made India’s agriculture an important influence on world markets.

A corollary to the question of how India’s food security situation will evolve is the efficacy of government programmes. With rising price supports, how effective will input subsidies and food distribution programmes be in reducing food insecurity? These programmes may be key to increased production and consumption, but they absorb a large share of national finances. What are the opportunity costs of such programmes in terms of foregone alternative investments, for example? Assessing these questions is beyond the objective of this Outlook which is more to assess the implications on markets of sustaining existing policies. Summary indicators derived from the commodity projections included in the Outlook portray a cautiously optimistic scenario for the next decade. The measure of net agricultural production (commodity production less required inputs of seed and feed), evaluated at 2004-06 international reference prices, indicates growth in output 2.9% p.a. over the next decade, which is in line with historical growth of India’s agriculture sector (Table 2.1). It is, however, less than the very robust growth of 4.6% p.a. which was witnessed in the decade 2004-2013.

The projection for aggregate consumption is also positive, as indicated in Figure 2.1. Based on food consumption projected in the Outlook by major commodity, average calorie and protein intake show a continuous rise to 2,830 kcal/day and 70 g/day by 2023, up from 2,450 kcal/day and 61 g/day, respectively, in the 2011-13 base period. These increases continue the trend that appears to have started around 2004-05, but they rise at a faster pace. It may appear counterintuitive that production is set to grow more slowly, but consumption more quickly. The reason for the result is that some of the increased production in the last decade went for both export and stock rebuilding, while in the Outlook the projection indicates more is used for increased consumption. Risks to this result are discussed in the final section of the chapter.
Figure 2.17. India’s calorie and protein consumption projected to increase

Source: OECD and FAO Secretariats.

**Cereals**

*Production growth strong, but slower than recent trend*

Production of cereals may attain 282 Mt by 2023, as annual growth is anticipated to slow to 1.5%, with area remaining at near current levels. Yield growth remains robust, if slightly lower than the previous decade, at 1.7% p.a. Higher growth in cereals has been encouraged by the market support prices for rice and wheat which have been increased in recent years and are projected to be increased in line with increases in costs of production over the outlook period. However, higher production is the result of higher yields, as increases in the area harvested will be mainly allocated to other crops (Figure 2.19).

India is the second largest producer and consumer of rice in the world. Production is anticipated to reach 124 Mt by 2023, growing at a rate of 1.4% annually, led by yield growth of 1.9% p.a. Several programmes such as National Food Security Mission, Rashtriya Krishi Vikas Yojana and Bringing Green Revolution in Eastern India are being implemented by the government of India to increase the production and productivity of cereals and pulses in the country.

The production of wheat in the country has increased significantly from 75.1 Mt in 2006-07 to over 95 Mt in 2014. It is projected to attain 112 Mt by 2023, growing by 1.6% p.a. in the next decade, underpinned by yield growth at 1.7% p.a. Flat area growth compares to recent trends which have seen wheat area increase from 28 Mha in 2006-07 to almost 30 Mha in 2013-14.

Coarse grain production may reach 49 Mt by 2023, growing at 1.7% p.a. over the projection period, and as with wheat and rice, is mostly due to yield growth. In India, coarse grains are comprised of sorghum (*Jowar*), pearl millet (*Bajra*), maize, finger millet (*Ragi*) and other small millets which are mainly grown in rain-fed conditions. These crops are grown in arid and semi-arid areas under low rainfall (200-600 mm), where fine cereals like wheat and rice cannot be grown profitably. Millets have more food, feed and fodder value, and they are more environmentally friendly and resilient to climate change. A majority of millet grains contain higher protein, fibre, calcium and minerals than fine cereals. Therefore, these are now being called “nutri-cereals” and are experiencing higher prices in recent years.
Figure 2.18. Crop area increases in India, but not for cereals

Source: OECD and FAO Secretariats.

Figure 2.19. Cereal production and stock to use ratios in India

Source: OECD and FAO Secretariats.

With such a strong orientation of the Indian diet toward cereals, and with policy on both the supply and demand sides oriented to increasing both production and consumption of cereals to enhance food security, a key question in the *Outlook* is how cereal food consumption will evolve over the next decade. The projections of this *Outlook* are optimistic, assuming that the income effect of the NFSA will lift rice and wheat consumption. Per capita cereal food consumption is projected to rise to 164 kg/person by 2023, compared to the base period quantity (2011-13) of 155 kg/person, or an increase of 5.8%. It is projected that per capita food consumption of rice, wheat and coarse grains will attain 78.8, 65.5 and 20.4 kg respectively. If this consumption level for cereals is attained, it would be a turnaround in the trend of diets.
of the India population experienced in the last decade. A key challenge will rest with the NFSA, and in particular the procurement and distribution systems that will provide about 55 Mt of cereals annually to an estimated 834 million people. Implications on markets if consumption does not increase as projected are assessed in the final section of this chapter.

**Figure 2.20. Per capita consumption of cereals to rise in India**

![Chart showing per capita consumption of cereals](chart)

*Source: OECD and FAO Secretariats.*

The important consequence of rising food consumption for rice and wheat is that increased production will largely be sold in the domestic market. A key concern, however, is the rapid build-up of stocks in recent years to near historical highs. The *Outlook* anticipates that stocks will remain high given the transaction requirements of the NFSA. Wheat, rice and coarse grain exports, which will be residual to supply and demand developments, are nevertheless projected to be higher in the next decade reaching over 17 Mt by 2023.

**Figure 2.21. Indian cereal exports may rise over the outlook period (2014-2023)**

![Chart showing cereal exports](chart)

*Source: OECD and FAO Secretariats.*
Oilseeds and oilseed products

Oilseed production has grown more slowly than for most other crops. Area and yields have each increased about 0.8% p.a. in the last decade. Growth is anticipated to improve in the future with the encouragement of government programmes that aim to contain growth in vegetable oil imports. Oilseed output is projected to grow 2.6% p.a. India’s trade in oilseeds will remain negligible, but higher demand for vegetable oil, at 3.7% p.a., will require imports growing to a level of 17 Mt by 2023, continuing India’s position as the world’s largest vegetable oil importer. Conversely, with a small feed market, and despite a growing livestock and aquaculture feed demand, oilseed meal exports are also anticipated to grow to 7.4 Mt.

Source: OECD and FAO Secretariats.

Figure 2.22. Growth in oilseed area and yields in India

Source: OECD and FAO Secretariats.

Figure 2.23. Imports of vegetable oil continue to rise in India

Source: OECD and FAO Secretariats.
Pulses

Being rich in protein, pulses form a vital part of the, largely vegetarian, Indian diet. India holds the first rank in pulse production and consumption, and the country grows the largest varieties of pulses in the world, accounting for about 32% of the area and 26% of world production. The important pulse crops are chickpea, pigeon pea, urd bean, mung bean, lentil and field pea. Yield of pulses has increased from 0.63 t/ha in 2007-08 to 0.79 t/ha in 2012-13. However, average productivity of pulses in India still remains below the world’s average.

Pulse production has registered an increase from 15 Mt in 2007-08 to a record level of 18.4 Mt in 2012-13. Production is projected to attain 23 Mt by 2023, with annual growth in both area and yield at rates of 1% and 2% respectively. Food consumption, which grew at the rapid pace of 5% p.a. in per capita terms, is projected to grow at 3% p.a. over the next decade. As a result of excess demand, imports are anticipated to grow to a level of 5.1 Mt by 2023.

Sugar

Sugar production rose 4.7% p.a. in the last decade, and it is projected to rise at 2.2% p.a. in the next ten years, supported by growth in sugarcane yields. Sugarcane is the primary source of sugar in India, and it has witnessed growth but with substantial cyclical variation in production, depending on weather conditions and prices farmers receive for sugarcane. Since 2009-10, the Statutory Minimum Price (SMP) has been replaced by the Fair and Remuneratory Price (FRP). However, state governments have announced mandatory state advised prices for sugarcane which have usually been higher than the SMP/FRP, but payments to farmers are often delayed. This has resulted in uncertainty of returns which caused production fluctuations. As a result, with low import tariffs, India’s trade position may reflect shortages or surpluses, and, given its market size, may influence international markets. In view of past cyclical behaviour, a production cycle in the Outlook has been maintained.

The demand for sugar and by-products continues to grow, with per capita consumption projected to increase at 1% p.a. in the next decade, down from 1.6% p.a. in the last ten years. Consumption of molasses increased at almost 5% p.a. in the last ten years, largely due to higher demand for biofuel/ethanol.
production for which it is the major feedstock. In the next decade, molasses consumption is anticipated to be moderate as ethanol demand growth subsides.

**Figure 2.25. Indian sugar production grows, but remains cyclical**

Vegetables and fruit

The *Outlook* does not cover fruits and vegetables in the wider international market. These sectors are, however, among the fastest growing and are now valuable sectors, particularly in agricultural zones favourable for production, such as in India. Indeed, the estimates of gross production value indicate that as a sector, the fruit and vegetable sector is one of India’s most valuable sectors, exceeding that of cereals in 2012 (FAOSTAT). The highest valued items are mangoes, bananas, potatoes, tomatoes and onions. In the next decade, India’s vegetable and fruit production is anticipated to grow 3.3% p.a. and 3.4% p.a., respectively, after having grown by 6.0% p.a. in the last decade (Figure 2.26), mainly as a result of expansion in area to almost 19 Mha. Growth in the vegetable and fruit sectors offers considerable opportunities for increased diversification of agricultural income and nutrition in the future.
Figure 2.26. The vegetable and fruit sectors in India are growing at a fast pace

Source: OECD and FAO Secretariats.

Cotton

India now produces almost 25% of the world’s cotton output and has a major influence on international cotton markets. In the past, India was also an important exporter of cotton textiles, but is less now because of the rise of other exporters, especially China. The adoption of *Bacillus thuringiensis* (Bt) genetically modified cotton, along with high yielding hybrids and increased irrigation, has underpinned further development of India’s cotton sector. Cotton production increased rapidly from 2.3 Mt in 2000 to 6.3 Mt in 2013. With area projected to increase 4.2% p.a. and yield 1% p.a., India’s cotton production may attain 9.2 Mt by 2023.

For cotton, the issue is how to continue the modernisation of production and bring yields closer to global norms. India’s cotton yield in 2011-13 averaged 0.5 t/ha, compared to the global average of 0.8 t/ha. In terms of domestic demand for textile production, the question is whether India can capture higher international market shares, particularly from China where wage costs are rising. Based on demographics and industrial wage developments, India may capture more clothing trade from China in the future, but China’s infrastructure and supply chain developments may help to maintain its advantage. Spinning cotton is much more capital-intensive than cutting and sewing apparel or garments, and China may continue spinning for even longer, as the United States did right up to 2000. In consideration of these issues, with higher production, India is projected to increase its cotton exports to more than 2 Mt by 2023, assuming no action is taken by government to limit exports.
Biofuels

India is the fifth largest producer of ethanol in the world, and the ninth largest biodiesel producer. Ethanol production has risen from 1.5 billion litres in 2002 to 2.7 billion litres in 2013. Biodiesel production increased from non-existent to 300 million litres over the same period. India’s National Biofuel Policy aims to replace 20% of its petroleum fuel consumption with biofuels by the end of its 12th Five-Year Plan (USDA, 2012). Ethanol production has been used primarily for non-fuel purposes, made from its large availability of molasses derived in the production of sugar. Based on 2013 estimates, the share of ethanol in petrol was still only 2.5%. Early projects to develop jatropha based biodiesel production have not been as promising as expected.

Ethanol production is projected to rise to 3.2 billion litres by 2023, up 29% from the base period 2011-13. The production growth is limited by the availability of feedstock in the current projection, unless Indian sugar and molasses production increases more than projected in the outlook period. As a result, ethanol’s share of petrol consumption over the outlook period will not rise above 3%. Biodiesel production is projected to remain low, rising by 150% to 730 million litres by 2023.
Figure 2.28. Growth in India’s biofuel production limited by feedstock availability

Source: OECD and FAO Secretariats.

Meat

A crop-livestock mixed farming system prevails in most parts of India. Livestock is a significant source of income to rural households. With higher incomes, the consumption of products such as milk, meat, egg and fish has also risen, providing increased and more diversified incomes for farmers.

In the last decade, meat production increased by 3.9% p.a., led by a large 7.8% p.a. increase in poultry production. Meat production is projected to continue its fast growth at 3.1% p.a. to 2023, with poultry again dominating meat production. Strong demand for poultry meat reflects increasing diversification of diets and growth in income, but also cultural factors which are not favourable to bovine meat or pig meat in diets. Increased poultry consumption is among the fastest growing source of protein for the Indian population, although the traditional vegetarian diet will likely mean that per capita meat consumption will never reach anywhere near levels of other countries. In retail weight terms, India’s per capita consumption may reach 4.3 kg/person by 2023, which compares to a world average of 36 kg/person and 94 kg/person in the United States.

An important development is the growth of bovine meat production from the buffalo herd, expressly for exports (Figure 2.30, and Box 7.3). Exports of bovine meat increased at a rate of 13.8% p.a. over the last decade. They are projected to rise to over 2 Mt by 2023, making India the largest bovine meat exporter in the world. The potential exists for even greater exports, given the number of buffalo animals in India.
Fish and seafood

India contributes around 6% to global fishery production, and it is the second largest producer of fish in the world. About 60% of the fish comes from inland waters, while the rest originates from marine waters. India’s fishery production has grown 4.3% p.a. over the last decade, led by growth in aquaculture at 5.0% p.a. Aquaculture in India plays a major role in food security. At present, more than 90% of its production consists of freshwater finfish, in particular carps, which are almost fully consumed domestically. Shrimps and prawns from brackish water represent about 7% of the production and are mainly exported. In general, aquaculture is practised with the utilisation of low to moderate levels of inputs, especially organic-based fertilisers and feed. The impressive growth of aquaculture production has
generated substantial socio-economic benefits, such as increased nutritional levels, income, in particular to rural households, employment and foreign exchange. It also brought vast un-utilised and under-utilised land and water resources under culture (FAO, 2005). Fish production is set to grow 1.3% p.a. in the next decade. Aquaculture production will grow at 2.1% p.a. and overtake capture fisheries in total fishery production.

Fish is the largest source of protein for consumers within the meat-fish group, with per capita fish consumption at 5.9 kg/person in 2011-2013, and expected to grow 0.9% p.a. over the outlook period to reach 6.8 kg in 2023. The growth in aquaculture production will be mainly destined to domestic consumption.

**Figure 2.31. Aquaculture production dominates growth in fish production in India**

*Source: OECD and FAO Secretariats.*

**Figure 2.32. More Indian fish production going for export**

*Source: OECD and FAO Secretariats.*
**Dairy and dairy products**

In the early 1970s, India started the “Operation Flood” programme, and since then has increased milk production six-fold (see also Box 2.1 above). Milk production is an important source of income for millions of farmers. With an estimated production of 140 Mt of milk in 2013, India is the largest producer of milk in the world. Milk yields remain low by western standards, and the size of the cow herd is large, consisting in 2011 of some 45 million dairy cows, 38 million buffalo cows, 32 million goats, for a total of 115 million head. This number is projected to increase to 143 million by 2023. Milk production is projected to grow to 202 Mt by 2023, growing at a rate of 3.7% p.a. This is a considerable increase which, if attained, would make a major contribution to improved diets. However, even at this pace of growth, India’s average consumption of milk and milk products will still be below those of Western Europe and Pakistan.

![Figure 2.33. Milk output and yield growth continue strongly in India](image)

Source: OECD and FAO Secretariats.

For the most part, India consumes fresh dairy products. One exception is butter (ghee), the production of which has been growing quickly at 3.7% p.a. Butter production is projected to grow 4% p.a. over the outlook period. This growth will also provide excess non-fat solids which will result in additional skim milk powder production that will be exported, primarily to Asian markets.

**Risks and uncertainties**

The outlook for India is relatively optimistic as India makes considerable policy effort to attain key objectives of reducing food insecurity, and raising farm and rural incomes. The projection shows higher agricultural output and consumption on a per capita basis and higher intake of calories, protein and other nutrients. The *Outlook* also suggests that India will continue to be a net exporter of food commodities. Exports of certain commodities such as rice, coarse grain, bovine meat, vegetable meal and cotton will likely be rising from current levels.

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15. In these estimates, milk includes milk from all sources.
What are the key risks to this fairly optimistic future for India’s agriculture? Aside from climate or yield shocks which may alter the base scenario, three alternative scenarios illustrate potential future issues. The first is associated with macroeconomic performance. If the economy does not resume higher economic growth, demand will not expand at the rates indicated in this Outlook. Second, an important risk is whether India’s National Food Security Act will impact on food grain consumption as indicated in this Outlook. If the impact is less than estimated, excess production stemming from higher MSPs for wheat and rice will need to be stored or exported, with consequences for domestic and international markets. Third, if productivity growth does not continue at rates indicated by this Outlook, production will not increase as indicated. The consequences of lower supply would be lower exports, higher imports, or higher domestic prices and lower consumption. These risks are examined in three separate scenarios using the Aglink-Cosimo model which has been used to generate this Outlook.
(i) Lower growth scenario

A scenario was assessed in which growth in India’s GDP was decreased to 4% p.a. from the assumed average of 6.2% p.a. Lower growth may also impact other macroeconomic outcomes such as inflation and the exchange rate, but for purposes of this scenario, these have been assumed to remain unchanged. The result from this scenario is that per capita incomes would be 19% lower by 2023 than in the outlook. The implications are that consumption falls compared to the base projection, resulting in lower domestic prices, and hence lower production, lower imports, but higher exports. Demand effects vary according to the income elasticities of each product, and for example consumption of cereals falls 1.5%, milk 10%, vegetable oil 13% and poultry 10% (Figure 2.34). With calorie and protein intake reduced by 5% in this scenario, the gains in food security noted in the projection would be at risk. Economic growth is obviously critical to achieving food security objectives. The scenario also leads to lower imports of vegetable oil and higher exports of wheat, rice and coarse grain result in marginally lower international market prices. One scenario result illustrated in this case is that with weaker markets, domestic wheat prices fall to MSP levels, causing public stocks to build as additional wheat is procured to support prices.

![Figure 2.34. Lower GDP growth would reduce consumption gains in India](source: OECD and FAO Secretariats.)

(ii) Income effect of NFSA

A scenario was undertaken to assess the assumption made in the projection regarding the additional income effect of the NFSA. This scenario involves removing the shifts to the demand functions for each of the commodities as specified in the projection, and replacing them with a shift in income in those functions by the estimated size of the additional income provided by the subsidy and allowing the elasticities of demand to allocate the effect of the subsidy across all goods households consume. The size of the effective income subsidy provided by the programme is about 1% of per capita income in 2013, and this was used in the simulation. As Figure 2.35 shows, the effect is lower consumption across all commodities depending on the size of the income elasticities for each product. The implication is that if the cereal subsidy is diluted by spending on other commodities, the food consumption and food security impacts are less than projected.
(iii) Lower yield scenario

The projection is for yields continue the strong performance achieved in the previous decade, given a very supportive policy framework including higher MSPs and input subsidies. One question is whether such yield growth is sustainable and what would be the consequences, if these are not attained in a context of domestic demand growth. Accordingly, a yield scenario was conducted in which the growth of yields for each crop was reduced by one-half percent per year from those projected. Lower output results in higher prices for cereals, as illustrated in Figure 2.36. Higher prices result in lower food consumption, lower exports but higher imports. The scenario underscores the importance that future growth in productivity will have in achieving India’s food security objectives. Lower exports of rice, wheat and coarse grain result in higher world prices of about 6%, 1.5% and 1%, respectively.
Conclusions

The Outlook portrays a relatively optimistic scenario in which India will sustain recent production and consumption growth on a per capita basis over the next decade. The scenario is one for which India has considerable potential to reduce food insecurity.

While remaining largely vegetarian, Indian diets will diversify. Cereal consumption is anticipated to grow, but greater consumption of milk and milk products, pulses, fruits, vegetables and vegetable oil will contribute to the improved intake of food nutrients. Fish and meat consumption will grow strongly, although from a very low base, also providing an important growing source of protein.

India’s policy effort will remain significant. Direct and indirect expenditures are estimated at USD 51 billion, or about 2.6% of India’s current GDP. These may increase depending on settings of specific policy variables such as minimum support prices for commodities and maximum retail prices for fertilisers. The new National Food Security Act, which is the largest right to food programme of its kind ever attempted, may absorb as much as 40% of expenditures. The programme is expected to contribute to a marginal rise in cereal consumption, but it will also impact the consumption of other foods and goods.

Subsidies to encourage greater use of fertilisers, pesticides, seeds, water, electricity and credit, and market support prices, have played a role in the annual growth in agriculture and fish output of 4.6% in the last decade. Higher investment has also led to expansion of output. Growth is projected to slow to 3% p.a. over the next decade, still enough to raise per capita supplies considerably. Stocks of cereals are projected to stabilise or rise modestly over the next decade, largely as NFSA will require higher stocks for transaction purposes. Higher production will also cause India’s trade surplus to widen modestly over the outlook period.

Key uncertainties in this scenario lie in India’s macro performance, productivity/yield growth and the viability of government programmes. Sustained high income growth is the most critical ingredient to realisation of the outcomes of the Outlook scenario. But so is continued strong productivity growth, which, given the policy framework, will be key to preventing higher domestic prices that would reduce consumption. While the NFSA will transfer income to the poorest segment of the population, the
procurement and distribution of 55 Mt of subsidised cereals to more than 800 million people, will present major challenges.
REFERENCES


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