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Agricultural Outlook
2010-2019

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AGRICULTURAL OUTLOOK
2010-2019

HIGHLIGHTS

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Foreword

The annual *Agricultural Outlook* is prepared jointly by the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization (FAO) of the United Nations. The projections and assessments provided in this report are the result of close co–operation with national experts in OECD countries, but also in several countries that are not members of the OECD, reflecting the combined knowledge and expertise of this wide group of collaborators. A jointly developed modelling system, based on the OECD's Aglink and FAO's Cosimo models, facilitates consistency in the projections. The fully documented outlook database, including historical data and projections, is available through the OECD-FAO joint internet site www.agri-outlook.org.

This report covers biofuels, cereals, oilseeds, sugar, meats, and dairy products over the 2010-19 period. The market assessments are based on a set of underlying assumptions regarding macroeconomic factors, agricultural and trade policies and production technologies. They also assume normal average weather conditions and long-term productivity trends. The *Outlook's* relatively stable price projections are highly conditional on these assumptions, and on the continuation of domestic policies and policy settings. For instance, an agreement of the Doha round of multilateral trade negotiations would likely have a considerable impact on the prospects for agricultural markets as contained in this assessment. Nevertheless, the *Outlook* presents a consistent view on the evolution of global agricultural markets over the next decade and provides a baseline for further analysis of alternative economic or policy assumptions.

Agriculture has experienced significant shocks in recent years due to high fluctuations in oil prices, commodity price spikes, food security fears and resultant trade restrictions, not to mention the most serious global economic recession since the 1930s. After a run up in prices, a rapid fall followed as supply and demand reacted to high prices and the beginning of the global economic crisis. In 2010, the economic turmoil eased and commodity prices increased from 2009 levels. Looking forward, the macroeconomic assumptions conditioning the commodity projections are more positive as compared to last year's report. The anticipated return to global economic growth, rising population, the emerging biofuel markets, but also a higher cost structure are expected to underpin the international commodity markets and prices over the outlook period. Developing countries are expected to be the driving force behind the expected growth in agricultural production, consumption and trade. However, the projections for the Least Developed Countries imply increased reliance on international markets and growing exposure to commodity price changes and fluctuations in import bills.

As high price volatility threatens farm viability, food security and needed investment, the fluctuation of commodity prices is an issue for many governments concerned about its impact on domestic producers and consumers. A section of this report discusses the issue of price volatility and price transmission from the international to domestic markets, and analyses certain policy options that address volatility at both the domestic and international levels. The report also identifies other trends and issues that will have an important impact on the agricultural sector and commodity markets in the future, such as developments in the fisheries sector, food security concerns, climate change and future policy directions as discussed at the OECD Agriculture Ministerial Meeting held in Paris in February 2010.

Table of contents

Tables

Figures

Acronyms and Abbreviations

ACP	African, Caribbean and Pacific countries
AI	Avian influenza
AMAD	Agricultural Market Access Database
ARS	Argentian peso
AUD	Australian dollars
AUSFTA	Australia and United States Free Trade Agreement
BN	Billion
BNGY	Billion gallons per year
Bnl	Billion litres
BNLY	Billion litres per year
BRIIC	Emerging economies of Brazil, Russian Federation, India, Indonesia and China
BRL	Real (Brazil)
BSE	Bovine Spongiform Encephalopathy
Bt	Billion tonnes
BTL	Biomass to liquid
CAD	Canadian dollar
CAFTA	Central American Free Trade Agreement
CAP	Common Agricultural Policy (EU)
CCC	Commodity Credit Corporation
CET	Common External Tariff
CIS	Commonwealth of Independent States
CNY	Yuan (China)
COOL	Country of Origin Labelling
CMO	Common Market Organisation for sugar (EU)
CO_2	Carbon dioxide
CPI	Consumer Price Index
CRP	Conservation Reserve Program of the United States
Cts/lb	Cents per pound
Cwe	Carcass weight equivalent
DBES	Date-based export scheme
DDA	Doha Development Agenda
DDG	Dried Distiller's Grains
Dw	Dressed weight
EBA	Everything-But-Arms Initiative (EU)
ECOWAP	West Africa Regional Agricultural Policy
ECOWAS	Economic Community of West African States
EISA Act	Energy Independence and Security Act of 2007 (US)
EPAs	Economic Partnership Agreements (between EU and ACP countries)
ERS	Economic Research Service of the US Department for Agriculture
Est	Estimate
E85	Blends of biofuel in transport fuel that represent 85% of the fuel volume
EU	European Union
EU-15	Fifteen member states of the European Union
EU-10	Ten new member states of the European Union from May 2004
EU-27	Twenty seven member states of the European Union (including Bulgaria and Romania from 2007)

EUR	Euro (Europe)
FAO	Food and Agriculture Organization of the United Nations
FCE Act	Food, Conservation and Energy Act of 2008 US Farm Bill
FMD	Foot and Mouth Disease
FOB	Free on board (export price)
FR	Federal Reserve (US central bank)
FSRI ACT	Farm Security and Rural Investment Act (US) of 2002
FTA	Free Trade Agreement
G-10	Group of ten countries (see Glossary)
G-20	Group of 20 developing countries (see Glossary)
GAL	Gallons
GDP	Gross domestic product
GDPD	Gross domestic product deflator
GHG	Green House Gases
GLB	Gross land balances
GMO	Genetically modified organism
Ha	Hectares
HFCS	High fructose corn syrup
HI	Hectolitre
HS	Harmonised commodity description and coding system
IEA	International Energy Agency
iLUC	Indirect land-use change
INR	Indian rupees
IPCC	Intergovernmental Panel on Climate Change
Kg	Kilogrammes
KRW	Korean won
Kt	Thousand tonnes
La Niña	Climatic condition associated with the temperature of major sea currents
LAC	Latin America and the Caribbean
Lb	Pound
LDCs	Least Developed Countries
LICONSA	Leche Industralizada
Lw	Live weight
MCI	Multiple cropping index
MERCOSUR	Common Market of South America
MFN	Most Favoured Nation
Mha	Million hectares
Mn	Million
MPS	Market Price Support
Mt	Million tonnes
MTBE	Methyl tertiary butyl ether
MXN	Mexican peso
NAFTA	North American Free Trade Agreement
NLB	Net land balances
NZD	New Zealand dollar
OECD	Organisation for Economic Cooperation and Development
OIE	World Organisation for Animal Health
p.a.	Per annum
PCE	Private consumption expenditure
PIK	Payment in kind programme (US)

PPP	Purchasing power parity
PROCAMPO	Mexican Farmers Direct Support Programme
PRRS	Porcine reproductive and respiratory syndrome
PSE	Producer Support Estimate
Pw	Product weight
R&D	Research and development
RED	Renewable Energy Directive in the EU
RFS	Renewable Fuels Standard in the US, which is part of the Energy Policy Act of 2005
Rse	Raw sugar equivalent
Rtc	Ready to cook
RUB	Russian ruble
Rwt	Retail weight
SFP	Single Farm Payment scheme (EU)
SMP	Skim milk powder
SPS	Sanitary and phytosanitary measures
STRV	Short tons raw value
T	Tonnes
T/ha	Tonnes/hectare
THB	Thai baht
TFP	Total factor productivity
TRQ	Tariff rate quota
UHT	Ultra-heat treatment is the partial sterilisation of food by heating it for a short time
UK	United Kingdom
UN	The United Nations
UNCTAD	United Nations Conference on Trade and Development
URAA	Uruguay Round Agreement on Agriculture
US	United States
USD	United States dollar
USDA	United States Department of Agriculture
v-CJD	New Creutzfeld-Jakob Disease
VAT	Value added tax
WAEMU	West African Economic and Monetary Union
WMP	Whole milk powder
Wse	White sugar equivalent
WTO	World Trade Organisation
ZAR	South African rand

Outlook in brief

Agriculture has experienced a number of severe shocks in recent years with record high oil prices, commodity price spikes, food security fears and resultant trade restrictions, not to mention the most serious global economic recession since the 1930s. The greatest impact has been on the poor, especially in developing countries, with the world's hungry now estimated at over 1 billion people. Agriculture has shown remarkable resilience, particularly in the OECD area, with strong supply response to high prices and with continuing, albeit dampened, demand growth during the crisis. In 2010, a degree of normalcy has returned to many markets with production closer to historical levels and demand recovering. Still, many governments remain concerned about the potential for a repetition of significant shocks to such key factors as energy prices, exchange rates, and/or the macroeconomic performance of key countries and regions, and about the consequences that such shocks have on market volatility.

- The macroeconomic environment underlying the commodity projections is more positive than in the 2009 *Outlook*. It reflects the start of global economic recovery in late 2009 and a slow transition towards higher sustainable and non inflationary growth beyond the near term. A two-speed recovery appears to be underway characterised by weak and hesitant growth with high unemployment in many OECD countries and by stronger growth and faster recovery in the large developing countries which is slowly spreading to the rest of the developing world and helping to fuel world income growth. High energy prices have returned and are assumed to remain a feature of the period covered by this *Outlook*. A further increase in oil prices could be expected to increase input and production costs, having an impact on crop supplies, prices and trade flows, and reinforce feedstock demand for biofuels.

- Underpinning agricultural prices is increasingly a higher cost structure particularly in regions where energy inputs are used intensively. Global agricultural production is anticipated to grow more slowly in the next decade than in the past one, but in the absence of unexpected shocks, growth remains on track with estimated longer term requirements of a 70% increase in global food production by 2050. On a *per capita* basis, production growth in least developed countries is struggling to keep up with rapid population growth. Global sectoral growth will be led by the regions of Latin America and Eastern Europe and, to a lesser extent, by certain countries in Asia.

- Average crop prices over the next ten years for the commodities covered in this Outlook are projected to be above the levels of the decade prior to the 2007/08 peaks, in both nominal and real terms (adjusted for inflation). Average wheat and coarse grain prices are projected to be nearly 15-40% higher in real terms relative to 1997-2006, while for vegetable oils real prices are expected to be more than 40% higher. World sugar prices to 2019 will also be above the average of the previous decade but well below the 29-year highs experienced at the end of 2009.

- For livestock products, average meat prices in real terms, other than for pigmeat, are expected to surpass the 1997-2006 average over the coming decade initially due to lower supplies, higher feed costs and rising demand. Pigmeat real prices should stay relatively subdued due to an anticipated increase in supply from Brazil and China. Economic recovery will strengthen consumption of meats relative to cereals, particularly in developing countries, with most growth favouring cheaper meat - poultry and pigmeat - relative to beef. Average dairy prices in real terms are expected to be 16-45% higher in 2010-19 relative to 1997-2006, with butter prices showing most gains, supported by higher energy and vegetable oil prices.

- Biofuel markets depend heavily on government incentives and mandates, but prospects remain uncertain, due to unpredictable factors such as the future trend in crude oil prices, changes in policy interventions and developments in second-generation technologies. Continued expansion of biofuel production to meet mandated use will create additional demand for wheat, coarse grains, vegetable oils and sugar used as feedstocks.

- Developing countries will provide the main source of growth for world agricultural production, consumption and trade. Demand from developing countries is driven by rising per capita incomes and urbanisation, reinforced by population growth, which remains nearly twice that of the OECD area. As incomes rise, diets are expected to slowly diversify away from staple foods towards increased meats and processed foods that will favour livestock and dairy products. Also, with increasing affluence and an expanding middle class, food consumption in these countries should become less responsive to price and income changes, as is currently the case in OECD countries. This implies that larger changes in price and incomes will be required for consumption to adjust to any unforeseen shocks.

- For virtually all commodities the projected growth in imports and exports of developing countries exceeds that of the OECD area. Only exports of processed protein meals increase faster in the OECD area by 2019. The higher share of developing countries in trade is reflected in expanding South-South trade in addition to North-South trade. Nevertheless, OECD countries will continue to dominate exports in 2019 (shares in brackets) of wheat (52%), coarse grains (59%), pigmeat (80%), butter (80%), cheese (63%), whole milk powder (66%) and skim milk powder (74%). Developing countries will hold dominate shares in 2019 for: rice (88% share), oilseeds (56%), protein meals (80%), vegetable oils (91%), sugar (90%), beef (57%) and poultry (63%).

- Food prices remained high or "sticky" in many countries for an extended period after world primary commodity prices fell following the price surge of 2007/08. In 2009, the contribution of food price increases to inflation fell considerably from 2008, particularly in OECD countries, but still remains significant in some developing and emerging countries.

- Since the price spike of 2006-08, short term price volatility has increased considerably. However, the evidence is inconclusive as to whether and how price volatility has changed over the long term for the major food crops examined in this *Outlook*. What is clear is that the extent to which world prices are transmitted to domestic markets varies markedly by country and depends on the level of market integration. The transmission of international prices to domestic markets can be impeded by border measures, domestic price supports and infrastructure weaknesses.

- The *Outlook*'s relatively stable price projections result from the assumption of "normal" conditions. Uncertainties around weather, macroeconomic factors, policy interventions, and especially energy prices suggest that commodity prices will remain unpredictable. Many governments are concerned about price volatility even in the very short term, because it threatens both farm viability (low prices) and food security (high prices). High uncertainty also affects investment decisions. There are a number of policy options to consider at both the domestic and international levels.

- Governments can underpin farmers' risk management strategies by focusing on those unpredictable and unavoidable risks that may be rare, but have large consequences, and which farmers cannot manage themselves. Governments can also empower farmers to manage their own business risk and can provide good risk governance, including by creating effective markets and by not creating incentives for rent seeking in the form of ad hoc support and assistance.

- National and local emergency stockholding of key food security commodities, for food emergencies, particularly for low-income food importing countries, may increase confidence in the access to food in times of crisis and help stabilise local markets. Increased research, capacity building, and sharing of best practices to improve the functioning of emergency stock schemes are required. Whatever actions governments consider taking, it is always important to keep in mind the full set of policy measures, risks and possible responses for the targeted population.

- Market price support for agricultural commodities is a policy option that has clearly shown in many countries and over several decades to be inefficient and its use has declined. Price support masks market signals to producers, destabilises world markets and acts as a regressive tax on the poor by raising prices to consumers. Price support also skews support towards large producers and, encourages intensification with potentially adverse effects on the environment, and much of the benefit is either capitalized into fixed asset values (such as land or quotas), thereby raising production costs over time, or is transferred outside the farm. Such measures should be assessed against other less distorting alternatives, such as targeted direct income supports, investments in productivity enhancements, etc.

- At the international level, the uncoordinated policy actions of governments during the 2006-08 price spikes exacerbated volatility and impeded access to markets. There is a need for greater assurance of unimpeded access to global supplies and improve confidence in market functioning. While experience with international efforts to manage stocks has not been positive, options to reduce the unpredictability of food import bills should be explored.

- Organised commodity exchanges are useful and time-tested price discovery and hedging institutions, if they are regulated properly and attract sufficient volume to avoid monopolistic practices. They have facilitated commodity marketing in many developed countries and their expansion in developing countries is a welcome institutional development and a sign of market deepening.

Chapter 1

Overview

Introduction

The *Agricultural Outlook* is a collaborative effort of the *Organisation for Economic Cooperation and Development* (OECD) and the *Food and Agriculture Organization* (FAO) *of the United Nations* in Rome, bringing together commodity, policy and country expertise of both Organisations, and national government agencies to produce, with the aid of the Aglink-Cosimo model, a consensus view on a longer term assessment of global commodity markets. This assessment is not a forecast about the future, but rather a conditional scenario of what can be expected to happen under certain key assumptions concerning the macroeconomic environment over the coming ten years, and a continuation of current agricultural policy and trade settings around the world and specific external factors. The projections of production, consumption, stocks, trade and prices for the different agricultural products described and analysed in this report cover the years 2010 to 2019.

The setting

The last two years have witnessed considerable volatility in international commodity markets and global economic conditions. During this period many agricultural commodity prices rose to historically high levels that effectively shook the world out of its longstanding complacency about food availability and re-ignited concerns with food security. This was followed in rapid succession by an unprecedented global financial crisis, the start of a slowdown in global activity and then the rapid descent of the world economy into the deepest recession since the 1930s.

A pathway out of this economic abyss has now emerged with global economic recovery starting in late 2009. However, while the start of an economic turnaround is undeniable, growth is still not strong enough to conclude that a durable expansion is underway. The world is currently undergoing a two speed recovery. A rapid rebound in activity is taking place in the large developing countries, which is gradually extending to the rest of the developing world, while a more hesitant and fragile turnaround is underway in much of the OECD area. With the recovery primarily being driven by huge monetary easing and extensive fiscal stimulus packages, its sustainability will depend on how quickly confidence and private demand is restored, in a context of continuing high unemployment and rising energy prices. In any event, the transition to sustainable growth within the OECD area will be slow and likely protracted as robust recovery is still far from assured in a number of countries.

Agriculture has been more resilient to the economic downturn than many other sectors of the economy, but has not gone completely unscathed. Demand and trade in most commodities fell with the fall in GDP and this impacted more heavily on income sensitive products and consumption, as well as investments with tight credit, in the developing countries than in the OECD area. By the same token, with recovery advancing faster in the developing countries than in the developed world, this has led to a more rapid turnaround in agricultural demand and world trade. However, the aftermath of the recent turmoil in commodity, economic and financial markets will continue to be felt over coming years and this situation increases the uncertainty in assessing market prospects around the world over the coming decade. Agricultural markets, in the near term, will thus reflect ongoing adjustments to the period of peak prices, the lingering effects of the deep recession and the start of economic recovery. All these adjustments effectively cloud the picture for the outlook in the short term.

Despite this uncertainty, there remains in place a dynamic and highly predictable element at the heart of world agricultural markets. This is the inexorable shift underway at the core of agriculture towards an increasing role, and rising importance, of the developing and emerging economies in world agricultural production, consumption and trade. By and large, these countries are rebounding strongly from recession and with population growth rates that remain more than double those of the OECD area, will represent the major growth markets that will drive world agriculture forward over the next and coming decades. A return to higher global economic growth over the projection period together with continuing population gains, are expected to increase demand and trade and underpin prices for all agricultural products over the medium term Growth and activity remains particularly dynamic in much of Asia and Latin America, with domestic demand, production and trade expansion in China, India and Brazil driving growth in their regions not only in the near term, but throughout the period covered by this *Outlook*.

The underlying economic conditions for agriculture are now more favourable than they were at this time last year, following the start of economic recovery. However, considerable uncertainties remain in the short term concerning the strength and pace of recovery in returning to a period of sustainable growth. The key macroeconomic and other assumptions underlying the *Agricultural Outlook* are summarised in Box 1.1.

Box 1.1 The main underlying assumptions

Macroeconomic

- From the start of the *Outlook*, economic growth in the world and OECD area are in a recovery phase from the financial crisis and economic recession. The rebound in growth is expected to be more rapid in the developing countries and initially tepid and fragile in the OECD area and involving a longer transition period. Once the transition to sustainable gains is reached, the EU and US economies are expected to grow by 2% and 2.5% per annum, respectively to 2019; and with faster growth in some other OECD countries such as Korea, Turkey and Australia. Among the developing countries, the leading Asian economies have fared better than most and lead the world economic recovery. China and India's GDP are projected to grow by nearly 8% and 6.6% per annum, respectively. GDP growth in Brazil and Argentina averages 4.5% and 3% per annum to 2019. Agricultural trade is estimated to have declined sharply in 2009, along with general merchandise trade, and is expected to bounce back sharply from the beginning of the *Outlook* in 2010 and continue to grow in following years.

Figure 1.1. Macroeconomic trends
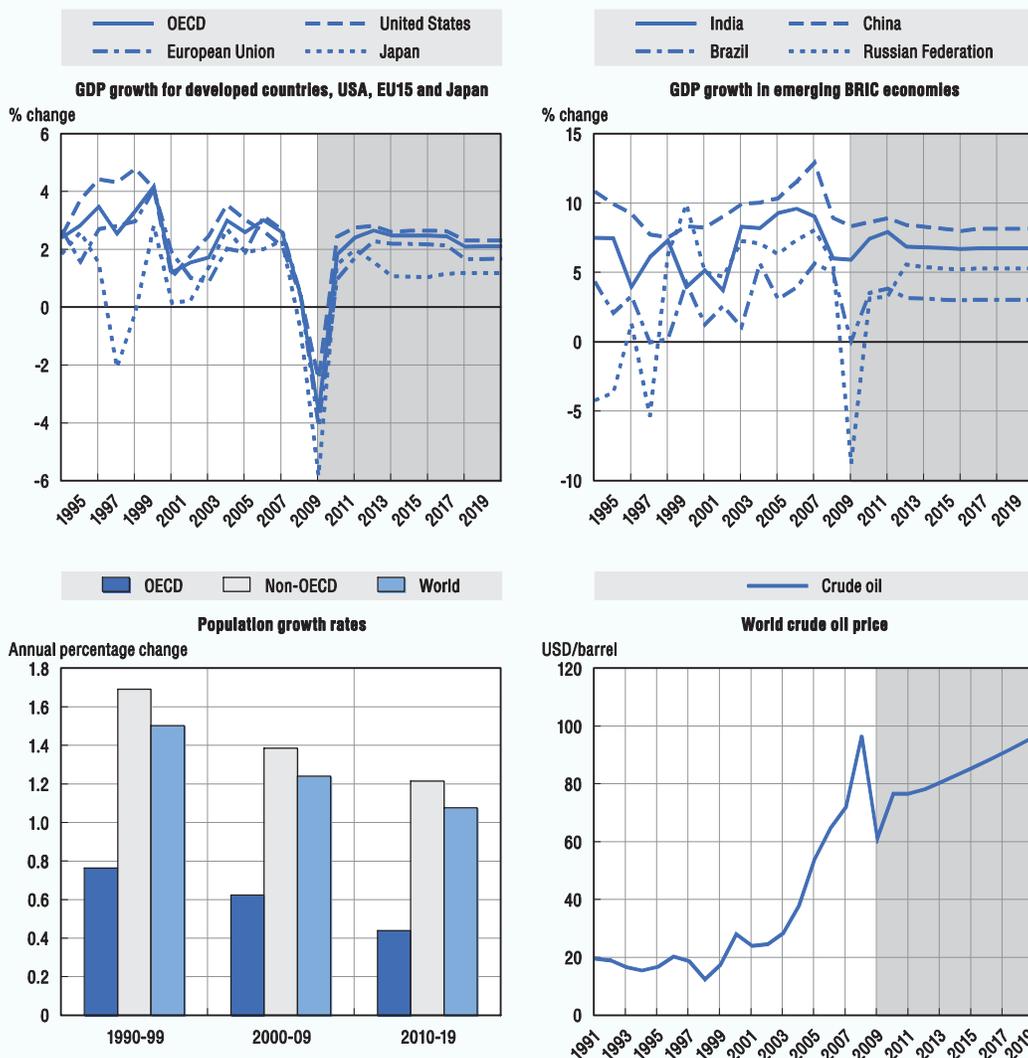
- The timing and implementation of government exit strategies to remove excessive liquidity from national economies and to reduce excessive budget deficits and restore fiscal balance are expected to occur in a period of strengthening private demand so that GDP growth is unimpaired.

- World population growth is expected to average 1.1% per annum to 2019, compared with 1.2% in the previous decade. Only slow population growth of 0.4% per annum is expected in the OECD area. Higher growth is expected in the developing countries, with the population of Africa as a whole growing at over 2% per annum. Continuing urbanisation trends and rising per capita incomes, emerging large middle classes and underlying population demographics collectively reinforce higher food demand in these countries.

- The global economic downturn has dampened inflationary pressures. As the OECD and world economy moves back into growth, Inflation is expected to remain subdued. Inflation is projected at levels close to 2% per annum throughout most of the OECD area to 2019. Higher inflation is expected in a number of emerging and developing economies such as the Russian Federation, Argentina, India and South Africa.

- Under the assumption of constant real exchange rates, the U.S. dollar strengthens against most currencies. The currencies of high inflation countries will depreciate most relative to the US dollar. Crude oil and energy prices are assumed to increase over the coming decade as global economic activity is restored. Crude oil prices are expected to reach over USD 96 per barrel in 2019 and to remain above the average level of the decade prior to the oil price spike.

Policy considerations

- Agricultural and trade policies play an important role in both domestic and international markets for agricultural commodities and food products. OECD and emerging economies have gradually reformed their agriculture policies over the past two decades. At the same time, non-agricultural policies, such as energy, environmental and rural development measures, have a growing impact on the agri-food sector.

- Provisions of current legislation concerning agricultural and trade policy are assumed to remain in effect over the outlook period. These include the provisions of the Food, Conservation and Energy Act of 2008 in the United States. For the European Union the outcome of the CAP Health Check of 2008 will continue in force in the European Union. Other provisions include mandates for renewable fuels such as in the EU and US based on agricultural feed stocks, blending provision for renewable fuels as mandated in Brazil for ethanol. In the US, the Energy Independence and Security Act of 2007 is complemented by the Renewable Fuel Standard Program (RFS2) Final Rule of the EPA (Environmental Protection Agency). For the EU, the Renewable Energy Directive (RED) specifies the share of renewable energy sources (including non-liquids) should increase to 10% of total transport fuel use by 2020. Countries are also assumed to comply with all existing bilateral and multilateral agreements, such as NAFTA and WTO agreements in effect in late 2009. Other assumptions included a continuation of longer term trends in productivity growth and average or normal weather conditions, *i.e.* absence of weather related supply shocks.

World markets at a glance

Prices to remain on a higher plateau

As was correctly anticipated in last year's *Agricultural Outlook*, international market prices for most agricultural products have retreated considerably in 2009 in response to a strong production response and lower demand due to the recent high prices and with the onset of the global recession. In a context where energy prices remain generally high by historical standards and expected to rise further with global economic recovery that is underway, the Outlook projects that most crop prices will remain at or above 2010 levels in the longer term. These will continue to exceed, in nominal and real terms (once adjusted for inflation), the average price levels in the decade preceding the price hikes of 2007/08. Apart from pigmeat, this is also true for livestock prices which remain above the average levels for the last decade, in real terms (Figures 1.1 and 1.2).

Overall, the *Outlook* foresees that nominal price of all commodities covered in the report will be on a higher plateau over the projection period, 2010 to 2019. However they will tend to remain below the recent peak levels of 2007/08. In the case of wheat, rice,

protein meals, cheese and skim milk powder, average prices over the projection period will be around 50% or more below the peak levels reached in 2007/08. As some commodities, such as sugar, beef and pigmeat did not undergo the same rapid run up in their prices in 2007/08, average nominal prices for the decade ahead will be about the same or exceed the levels of 2007/08 by 10-20%. For the entirety of agricultural products covered by this *Outlook*, however, average nominal prices over the projection period will exceed those of the previous decade prior to the period of peak prices. These price gains are expected to be highest for vegetable oils and butter at over 85% above those in achieved in 1996-2006. Of the products at the lower end of the nominal price increase scale, pigmeat prices will show the smallest increase, rising by just over 21% above the 1997-2006 average level, on average, over the period to 2019.

After allowing for inflation, prices in real terms are also expected, on average, to be much below their 2007/08 peak levels (Figure 1.2). The agricultural products that show the largest fall in real prices, when compared to their 2007/08 level, are: wheat, rice, oilseeds, protein meals, butter, cheese and skim milk powder. However, over the outlook period, real prices of all products other than pigmeat are expected to be above their average 1997-2006 level. Pigmeat prices are not anticipated to increase much beyond 2014 due to a fast increase in supply with high productivity gains in Brazil and China. The price increases, in real terms, range for crops from around 16% to over 40% above their average for the last decade. In the case of livestock products the increase over the average of the last decade are largest for dairy products. The average level of the crude oil price, in real terms, that is exogenously projected for the coming decade is also substantially below its 2007/08 peak, but still remains relatively high at 114% above the 1997-2006 average level.

Figure 1.1. Nominal commodity prices to remain above average levels of the previous decade but lower than 2007/08
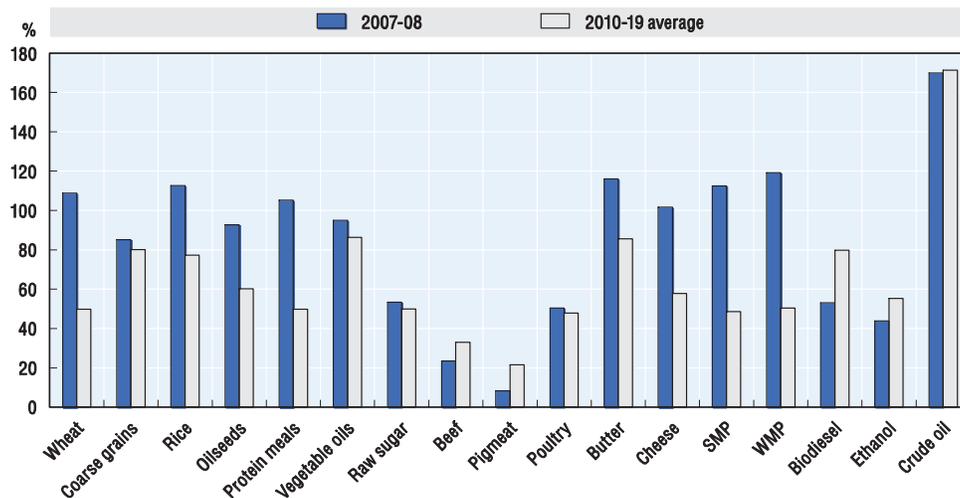
For biodiesel and ethanol the base period is 2001-06. The crude oil price projection is an Economic Department exogenous assumption.

Source: OECD and FAO Secretariats.

Figure 1.2. Most commodity prices in real terms to remain above the last decade's levels
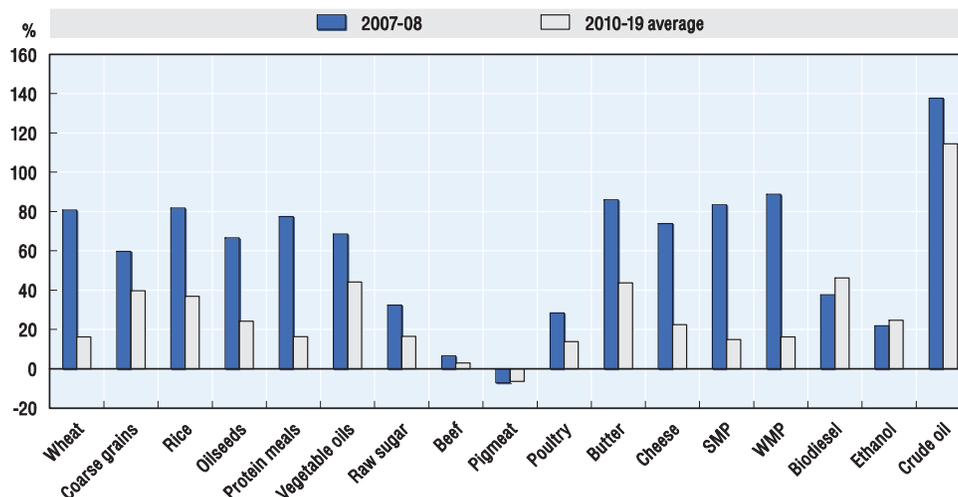
For biodiesel and ethanol the base period is 2001-06. The crude oil projection is an Economic Department exogenous assumption.

Source: OECD and FAO Secretariats.

Agricultural commodity markets increasingly driven by developing countries

Increased market integration, globalisation and rapid income growth over a number of years prior to the recent economic crisis, have enhanced the role and importance of key developing and emerging economies of the non-OECD region on world agricultural markets. This increasing influence associated with rising affluence and feeding expanding populations is being manifested in different ways on international markets with continued economic development and the resulting transformation of their economies. Initially the momentum arising from strong income growth boosts food demand and imports for a range of agricultural products and processed foods to feed large concentrations of people migrating from rural to mega urban centres. Subsequently it provides the impetus for the development of domestic production capacity, financed from either domestic savings or from growing foreign direct investment flows to these developing and emerging economies. Investment in manufacturing, processing and domestic production capacity is expected to be particularly strong in the "expanded" BRIIC countries of Brazil, Russia, India, Indonesia and China. It is also becoming a generally shared priority of other high growth emerging countries. One of the motivations behind such investments is to capture a growing share of the higher value added component of domestically consumed agricultural products.

At the same time OECD area agriculture is undergoing reforms that reflect changing circumstances and priorities and which are gradually modifying production incentives towards increased market orientation and any underlying comparative advantages. These evolving developments and trends are raising the profile of lower cost agricultural industries and sectors in the developing and emerging economies relative to their counterparts in the mature economies in the OECD area. In fact, for the OECD area as a whole, both production and consumption growth prospects for all the 15 agricultural commodities covered in this *Outlook* and listed in Table 1.1, are expected to be increasingly eclipsed by the group of developing, least developed and emerging countries

comprising the non-OECD region. As revealed in this table, the largest growth differentials are consistent across both production and consumption, reflecting the strong expansion in the high value added livestock meat products of beef, poultry and pigmeat, and of dairy products covering butter, cheese and milk powders. Apart from these products, high growth differentials also favour the non-OECD region for coarse grains, protein meals and sugar. In fact, in almost all cases, the majority of production growth for these products will be coming from outside the OECD area, where growth rates are 2-3 times larger than for OECD countries. The same situation applies for much of the consumption growth as well. As a result, the OECD area's share in global output and use for these products continues to decline over the projection period from 2010 and 2019.

Table 1.1 Production and consumption annual growth rates (least squares) 2010-2019

	PRODUCTION %			CONSUMPTION %		
	Total	OECD	NON-OECD	Total	OECD	NON-OECD
Wheat	1,1	0,8	1,3	1,2	1,0	1,3
Rice	1,0	0,3	1,1	1,1	0,6	1,1
Coarse grains	1,6	1,0	2,1	1,5	0,9	2,1
Oilseeds	1,9	1,3	2,2	1,9	1,4	2,2
Protein meal	2,2	1,5	2,5	2,2	1,0	3,2
Beef	1,5	0,5	2,2	1,5	0,6	2,1
Pig meat	1,7	0,7	2,3	1,8	0,7	2,3
Poultry meat	2,4	1,3	3,0	2,4	1,6	2,8
Milk	2,2	0,8	3,1	..	..	..
Butter	2,2	0,7	3,0	2,1	0,4	2,9
Cheese	1,8	1,3	3,1	1,8	1,3	2,9
Skim milk powder	1,0	0,3	3,0	1,0	0,2	1,9
Whole milk powder	2,5	0,7	3,8	2,5	1,0	2,9
Vegetable oils	2,9	1,7	3,2	2,8	2,3	3,1
Sugar	1,4	0,0	1,8	1,8	0,5	2,2

Source: OECD and FAO Secretariats.

Figure 1.3 shows the percentage increase in production of crops and livestock products over the projection period. Figure 1.3 indicates that that global production of crop products will increase by over 13% by 2019, when compared to the base period 2007-09, suggesting more ample supplies in the period ahead. The increases in projected production range from 14% for wheat to nearly 39% for vegetable oils. In terms of the OECD and non-OECD regions, production of oilseeds and vegetable oils increase the most for the former group of developed countries, and this is also true for the non-OECD countries, but with sugar also included amongst the crops showing the largest production expansion. For livestock products, the largest increase in global production is of whole milk powder which is projected to increase by 31% and for poultry and butter which grow by 29% and 28%, respectively, over the projection period, relative to the base period. Within the OECD area, cheese (14%), whole milk powder (12%) and poultry (11%) show the largest increases relative to the base period. For the non-OECD group of countries, the leading growth products are comprised of whole milk powder (48%), poultry and skim milk powder, (43%), butter (42%), and with cheese (38%) also showing rapid production increases to 2019.

It is interesting to see what the projections imply for agricultural production when disaggregated by countries and regions. This is shown in the next section.

**Figure 1.3. Change in production of crop and livestock products
(per cent change 2019 compared to 2007-09)**
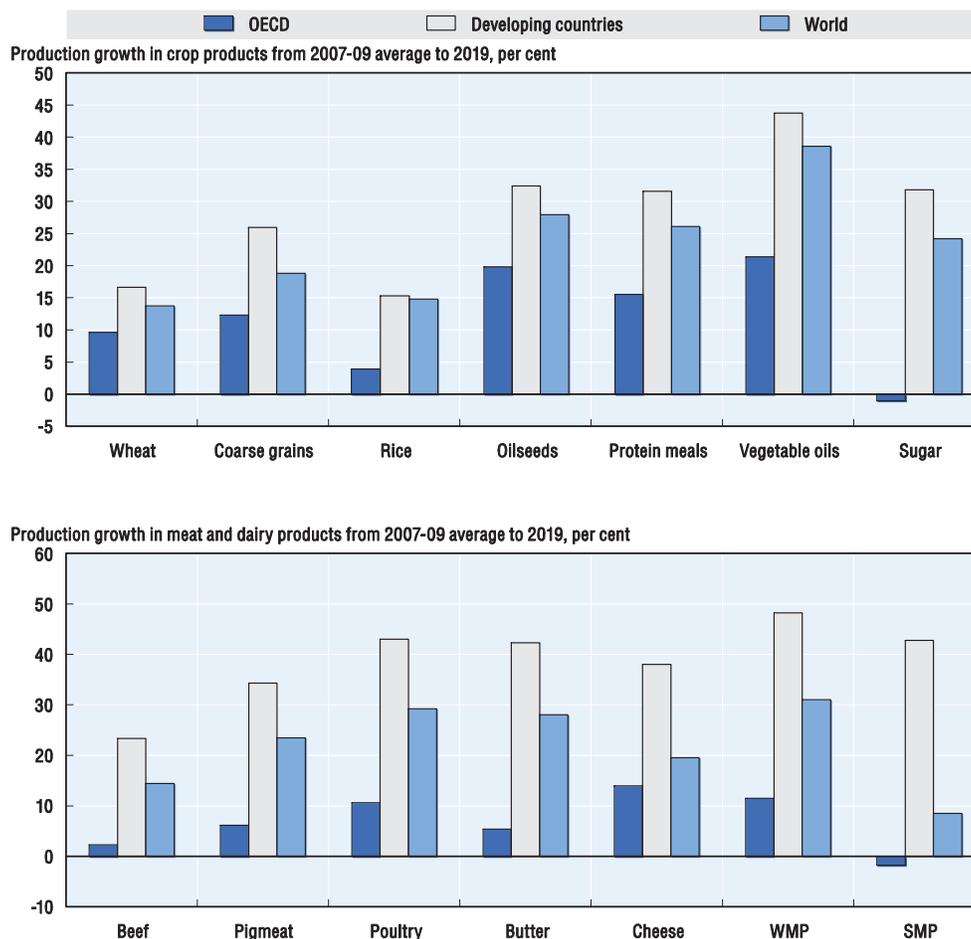
Source: OECD and FAO Secretariats.

Agricultural production by country and region

The *Outlook* provides extensive detail on balances for various commodities on a global, regional and country basis. Aggregation across commodities provides a summary measure of how the agricultural sectors of countries and regions or economic groups are performing. [1] In terms of the commodities covered in this *Outlook*, agricultural commodity sectors are performing quite differently across these groups, as noted in Figures 1.4 to 1.7.

Based on commodities of this *Outlook*, Brazil is the fastest growing agricultural sector by far, growing by over 40% to 2019, when compared to the 2007-09 base period. Russia and Ukraine are projected to grow 26% and 29%, provided plans and support measure by the respective governments proceed as indicated and bear fruit, marking a

significant recovery in production levels. China and India may also grow significantly by 26% and 21%, respectively. While Australia is projected to grow some 17%, this growth reflects an assumed return to more normal yields; over a longer period of comparison, Australia's production by 2019 is only some 7% higher than in 2000. Production growth in the US and Canada is projected in the 10-15% range over the same period. In contrast, over the same period, net agricultural output in the EU-27 will have grown less than 4%. These diverse trends reflect important developments in these countries which may be generating or inhibiting growth.

**Figure 1.4. Net Agricultural Production for selected countries
(index 2004-06=100)**
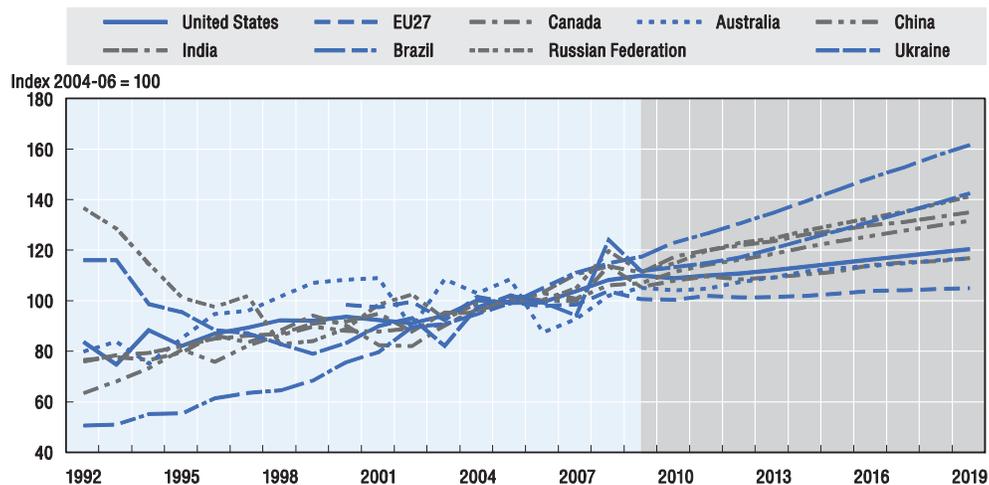
Source: OECD and FAO Secretariats.

By region, production measures, on a per capita basis, provide an interesting viewpoint on longer term developments in global agriculture and their potential implications for food supplies. As noted in Figure 1.5, per capita output has fallen in North Africa and the Middle East, largely due to limited water availability and policies in some countries such as Saudi Arabia to reduce highly subsidised wheat production. Production in the Sub-Sahara region of Africa is expected to be stagnant in per capita terms, as production barely keeps pace with population growth still averaging around 2.2% per year. In Western Europe, production is also stagnant. Growth in consumption on a per capita basis in this region will need to be met by imports. Latin America is the fastest growing production region, but in per capita terms Eastern Europe, is the fastest growing, because projections assume that in this region's population numbers will actually decline by over 3% over the outlook period.

**Figure 1.5. Net Agricultural Production for regions on a per capita basis
(index 2004-06=100)**
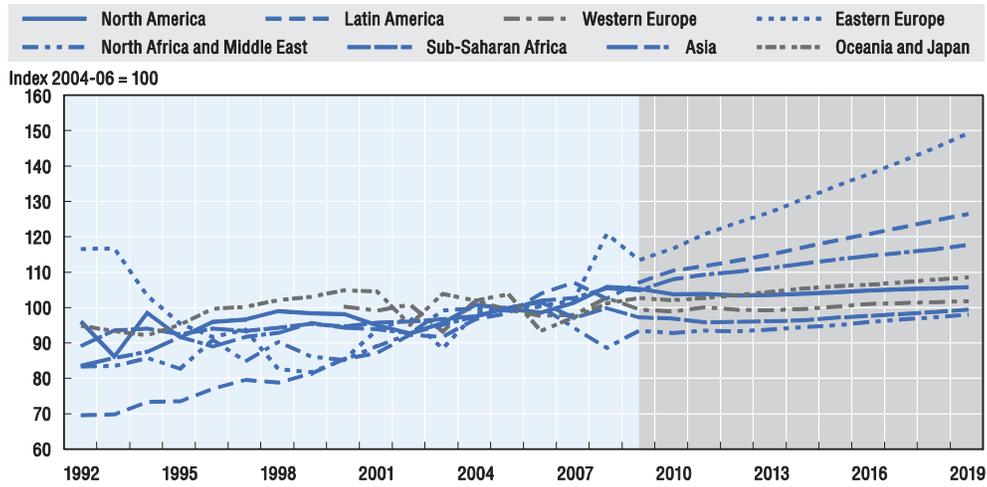
Source: OECD and FAO Secretariats.

Agricultural production is growing much faster outside the OECD area (Figure 1.6). While world net production of commodities covered in this *Outlook* will have grown 22% over the period to 2019, production in the OECD area is projected to grow only 10%. Some country groupings grow about three times as fast with Brazil, Russia, India, China (BRIC) group growing by 27%, LDCs by 33% and other developing countries by 29% to 2019. If measured in per capita terms, OECD agricultural production growth is minimal as is production growth by the LDC group.

**Figure 1.6. Net Agricultural Production for world and economic groups
(index 2004-06=100)**
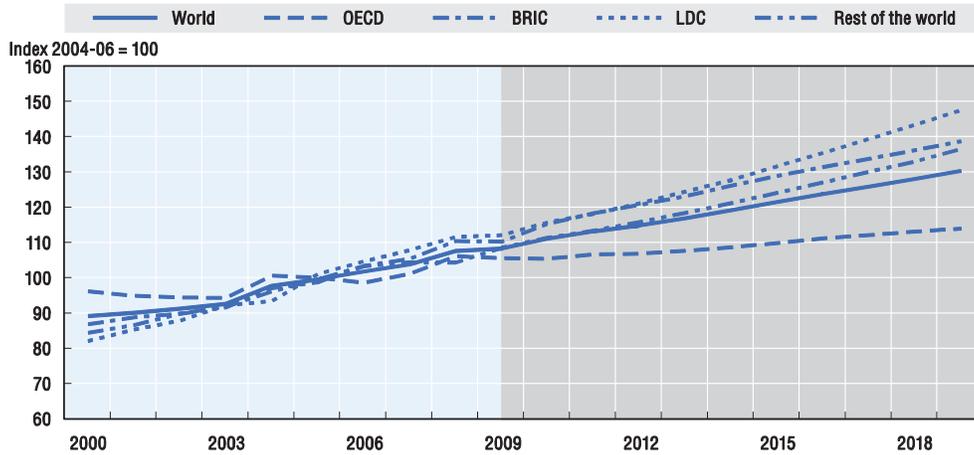
Source: OECD and FAO Secretariats.

If assessed in terms of annual changes in net production, some interesting patterns emerge, as seen in Figure 1.7. First, the historical annual variation of production in the OECD area exceeds the variation by other country groups. Second, it is notable that in response to the high prices of 2007/08, OECD production response was the largest, followed closely by BRIC countries, and LDCs. Production by the remaining countries of the rest of the world as a whole declined in 2008/09, largely due to weather elated production problems in larger countries such as Argentina. Third, it is also notable that agricultural production growth was also largely stagnant in most countries during the global recession, but declines were by and large less in agriculture than in the rest of the economy.

Figure 1.7. Net Agricultural Production for Economic Groups
(percentage change)
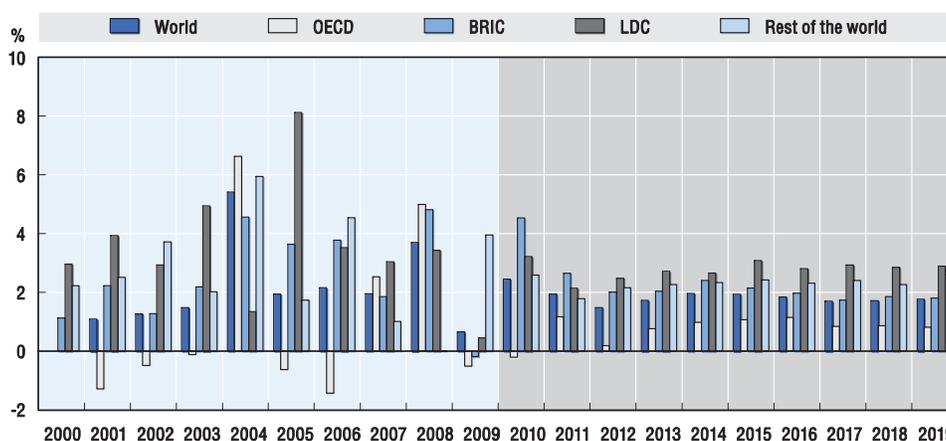
Source: OECD and FAO Secretariats.

Consumption trends

As in the case for production, world consumption of agricultural products is also being driven by the developing and emerging economies. These countries which are enjoying increased affluence with rising *per capita* incomes over a number of years, and with population demographics and continuing urbanisation to mega population centres also reinforcing demand, are leading to significant changes in consumption and dietary habits. This involves a transition from traditional staple foods and grains to more processed and prepared food products and convenience foods, containing a greater proportion of animal protein and with more fruits and vegetables, in national diets. Over time as food expenditures form a smaller proportion of household budgets, particularly for the swelling middle classes of the large developing and emerging economies, food consumption is expected to become less responsive to changes in prices and incomes similar to existing trends in many OECD countries. Consumption projections in the more mature markets of OECD countries show less growth. Here the quantities and composition of consumption are being driven more by population growth and its changing demographics with ageing as well as by concerns over diets and general health issues than by price or income considerations.

**Figure 1.8. Change in consumption of crop and livestock products
(per cent change 2019 compared to 2007-09)**

Consumption growth in crop products from 2007-09 average to 2019, per cent

Consumption growth in meat and dairy products from 2007-09 average to 2019, per cent
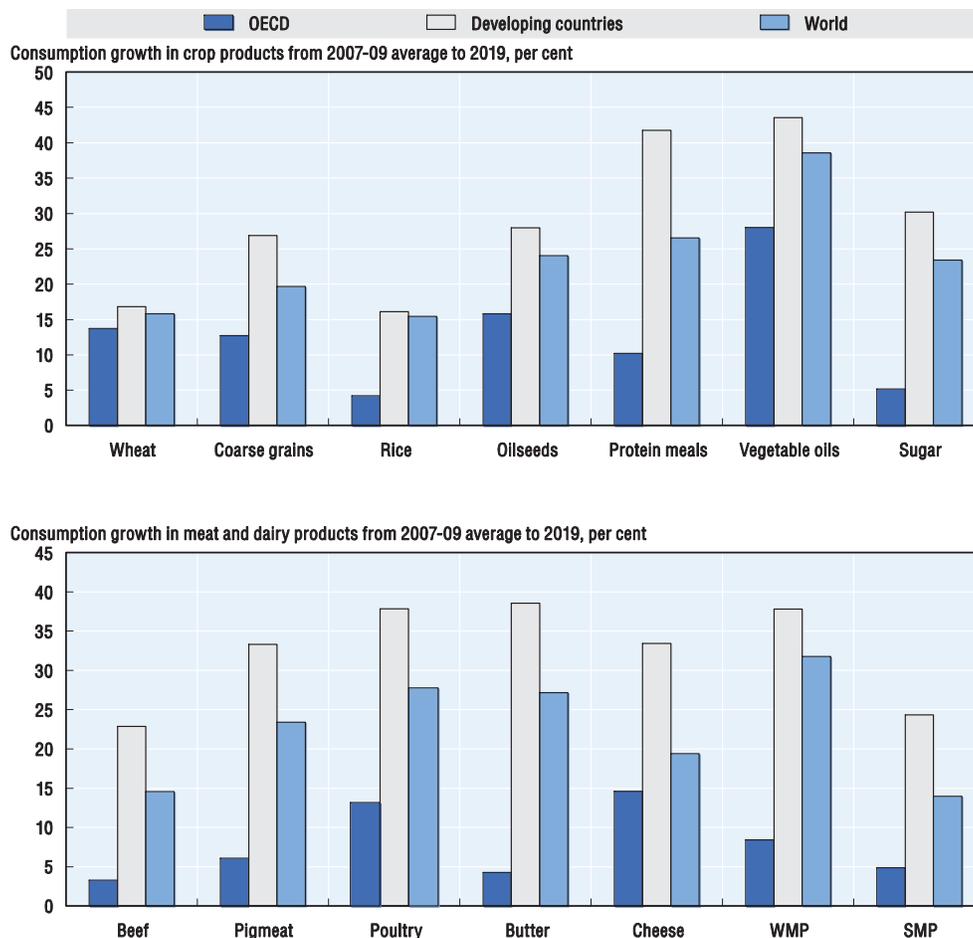
Source: OECD and FAO Secretariats.

Figure 1.8 shows the percentage increase in consumption of crop and livestock products over the projection period to 2019, when compared to 2007-09. It clearly illustrates that the consumption of agricultural products continues to grow rapidly in the non-OECD area but is slowing elsewhere. For crop products, consumption in the non-OECD countries shows the largest increase for vegetable oils (44%), protein meals (42%) and sugar (30%). In the case of protein meals, this reflects the growth in livestock industries to meet rising domestic demand for livestock products. For the other two commodities, a portion of the projected growth in use arises from increased use for food processing and manufacture. For the OECD area, vegetable oils (28%) head the list of consumption increases, followed by oilseeds (16%) and cereals (13-14%) by 2019. This consumption growth reflects a combination of changes including slowly rising demand for food, faster growth in feed use and also as feedstocks for expanding biofuels production. In the case of meat and dairy products, the fastest consumption increase for the non-OECD region occurs for dairy products of whole milk powder and butter (38%), followed by poultry (37%) over the period to 2019. While these changes represent a faster

increase in meat and dairy products use than in the OECD area, in a number of cases they are taking place from a smaller consumption base.

Trade developments

Trade flows and trade patterns in agricultural products also continue to evolve with increased south-south trade in addition to the traditional north-south trade. On the import side, the developing countries are becoming increasingly integrated into world agricultural trade and regional markets. While other countries such as China with a well established presence on international markets seek to diversify their sources of supply resulting in new economic interactions and trade between developing and other countries that are effectively reshaping world-wide flows of agricultural trade. In addition, developing country groupings which have become well integrated into the world trade infrastructure, are assuming greater prominence in international trade negotiations and their agendas. Apart from dominating import growth for most of the commodities in the *Outlook*, non-OECD countries also exhibit, with few exceptions, the strongest growth in exports; albeit from a low base for some commodities. Although exports may be growing rapidly for commodities such as dairy products, the non-OECD countries still remain very large net importers over the outlook period. Increasing export shares in almost all commodity markets is being achieved by a combination of strategies. Not only are they displacing traditional exporters and competitors with lower cost products or by growing faster, they are also becoming dominant in regional markets which can provide a springboard for further international market expansion. From Figure 1.9, non-OECD countries are projected to show the strongest percentage increase in exports by 2019, relative to the 2007-09 base, for oilseeds (59%), poultry (54%), wheat (50%), skim milk powder (43%), and cheese and vegetable oils (39%). On the other hand, OECD countries as a whole will tend to lose export shares in many commodities to non-OECD countries over the outlook period. For the OECD area the largest gain in exports by 2019 compared to 2007-09, are for protein meals (49%), vegetable oils (38%) and rice (16%). While the gains illustrated in Figure 1.9 underscore the dynamic growth underway in the trade of developing and emerging economies as a whole, relative to the OECD area's general contraction, they do not tell the whole story. Trade shares continue to be dominated in absolute terms by the OECD countries and their long established industries for a range of products (with projected global market share in 2019 shown in brackets) such as for: wheat (54%), coarse grains (60%), pigmeat (80%), butter (79%), cheese (65%), whole milk powder (66%) and skim milk powder (73%). For the developing and emerging countries, the products for which they show rapid growth and also hold dominate global trade shares, are as follows: rice (89%), oilseeds (57%), protein meals (81%), vegetable oils (92%), sugar (89%), beef and veal (56%) and poultry (66%).

The foregoing discussion suggests that there will be considerable additional production of agricultural products available to meet anticipated higher domestic and import demand for food and feed purposes over the coming decade to 2019. OECD agriculture will continue to supply a large share of the additional world food and feed supplies. However, in many instances, their lower growth prospects, higher cost and more limited resource bases relative to the new players on the block from the non-OECD region suggests that the contribution of the OECD area to global food balances will continue to decline and with an increasing orientation towards the higher value-added components of the food chain.

Figure 1.9. Exports of OECD and non-OECD countries to 2019
(per cent change)
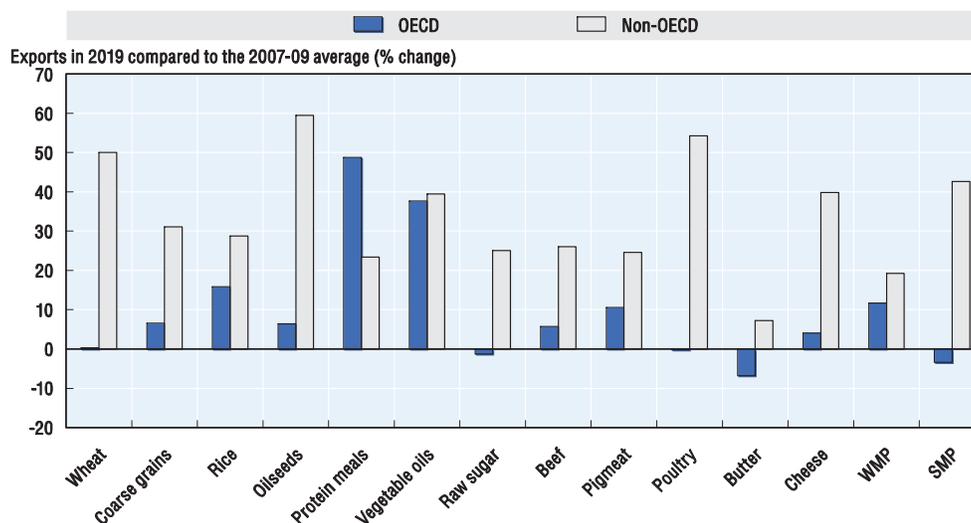
Source: OECD and FAO Secretariats.

Main trends in individual commodity markets

World commodity prices to remain high

With the exception mainly of sugar, agricultural commodity markets covered in this *Outlook* have calmed considerably with a return to more normal conditions following the turbulence of the last two years. Most commodity prices have fallen from price peaks at the start of the Outlook as a result of larger supplies becoming available and with continuing weaker demand in the aftermath of the economic crisis. With the start of economic recovery, the economic environment has now turned more positive than this time last year. Provided growth is durable and increases to levels offering sustainable gains over coming years, this should be supportive to a general strengthening of demand, trade and commodity prices over the *Outlook*. Stronger demand, with an anticipated return to higher growth following economic recovery and from increasing populations, should outpace production growth, on average, over the projection period to maintain all commodity prices on a higher plateau relative to the average of the last decade prior to the 2007/08 price surge. The projection of crop prices in nominal and real terms (once adjusted for inflation) is illustrated in Figure 1.11 and those for livestock products in Figure 1.12.

A longstanding feature of international commodity prices, including for agricultural products, is their high volatility in comparison to industrial goods and manufactures. This arises from the characteristics of agricultural products and comes primarily from the production side. Supplies of agricultural products are characterised by low responsiveness in the short term with realised production fluctuating due to weather and changes in relative prices, while demand grows steadily and remains fairly inflexible. Low elasticities mean that small shocks to production can have a large impact on price. The extent to which this price volatility is passed through to domestic markets depends on the degree of price transmission. The co-movement of world and domestic prices can be

obstructed by border measures, domestic price supports and infrastructure weaknesses that affect the degree to which domestic markets are integrated with world markets. The issue of price transmission and possible policy responses to international price risk and volatility are discussed more fully in Chapter 2 of this report.

Figure 1.10. Imports of OECD and non-OECD countries to 2019 (per cent change)
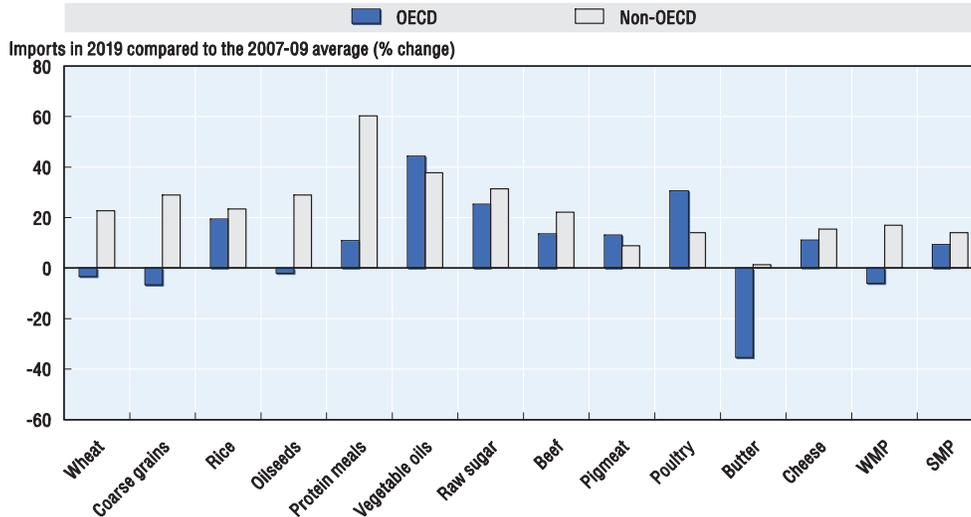
Source: OECD and FAO Secretariats.

The surge in crop prices to near record highs in 2007/08 was due to the contemporaneous occurrence of a panoply of contributing factors, which are not likely to be repeated in the near term. However, if history is any guide, further episodes of strong price fluctuations in agricultural product prices cannot be ruled out nor can future short-lived crises. This is particularly clear when considering the heightened linkages between crop and energy prices. The increased variability in crude oil prices should impact on crop prices through both demand and supply, even though the demand link is weakened in this *Outlook* by the increasing importance of quantitative biofuel mandates. In addition, with trends underway towards greater macroeconomic integration and increased globalisation, world financial and economic shocks will be increasingly transmitted through exchange rates onto domestic markets. These changes when sustained can profoundly affect the competitive position of nations wishing to trade on international markets, or to build domestic production capacity and thus also increase variability on world commodity markets.

Large supplies to keep cereal prices under pressure

The world wheat and coarse grain markets at the start of the *Outlook* are marked by a return to normality after two exceptionally turbulent seasons. A combination of a sharp recovery in supply, with bumper crops replenishing stocks and a slowdown in demand, driven by the high prices, reduced policy supports for biofuels in some countries, troubled financial markets and recession, forced international prices to lower levels at a fast pace. Stocks of wheat and coarse grains are expected to increase over the outlook period, although much of these will be located outside the traditional exporters and the stocks-to-

use ratio should remain relatively low when compared to the previous decade. This development is expected to underpin wheat prices to some extent but may also make them more unstable. The price of the benchmark US wheat (No. 2 Hard Red Winter, f.o.b. Gulf) is projected to increase to USD 225 per tonne by 2019, up 3% from the average in 2007-09. In real terms, however, wheat prices are likely to continue their long-term decline, albeit falling less rapidly and from higher levels. In the case of coarse grains, current projections for stocks and utilisation point to a somewhat tighter supply and demand balance during the early years of the projection period resulting in prices rising the fastest until 2016. The situation is likely to improve thereafter because of slower growth of use for ethanol production. By 2019, the price of the benchmark US maize (No. 2 Yellow, Gulf) is projected to reach USD 187 per tonne, almost unchanged from the average in 2009. A noteworthy feature is the drop in wheat to maize price ratio to a low ratio of 1.1-1.2, compared to 1.3-1.6 in the past, indicating a stronger upside potential for maize prices than for wheat.

World producers of cereals may take comfort in the fact that prices are likely to remain relatively strong compared to the previous decade, and consumers will find that prices are unlikely to reach the highs that provoked so much of the recent turmoil in food markets. However, an emerging feature which will not be of any benefit to producers or consumers is a continuation of price volatility in the coming years. Continuing instability will be a factor for all cereal markets as the linkages are strong enough to influence them all. Wheat markets are projected to be well supplied with production increases keeping pace with consumption which should even allow for some build-up of inventories. However, as regions known for their erratic yields, which bring about high production unpredictability, become more important players in world markets, sharp price swings are likely to become more the norm than an exception. Projections for coarse grains also point to a generally balanced situation. Although, in the case of maize, prices are seen to move closer to wheat, the faster increase in maize prices reflects demand from biofuels and feed sectors, both of which are growing, albeit at a slower pace than in the previous decade.

The next decade will witness relatively strong growth in world production of major grains. Compared to the base period of 2007-9, world production of wheat and coarse grains are projected to increase by 14% and 19% respectively, to reach 746 Mt and 1 311 Mt, over the next decade. These projected production levels are likely to match or outstrip world consumption of these grains for food, feed and industrial use.

Rice markets in closer balance

Rice markets are projected to remain substantially in balance over the coming decade, at prices inferior to the relatively high levels prevailing in 2007/08. World rice prices continued to be high in 2010, averaging USD 570 per tonne in the first three months of the year, which compares with USD 335 per tonne in 2007, prior to the price surge. With weaker import demand, the market strength largely reflects policies in the major exporting countries, tending to reduce export supplies, for instance, through export restrictions and the retention of large public stocks. Global rice inventories are projected to rebuild over the *Outlook* by 18% by 2019 and this should increase the stocks-to-use ratio. World rice prices are expected to weaken in the coming years, ending in 2019 at USD 422 per tonne. At that level, rice would still be almost 1.9 times the price of wheat, which compares with a ratio of 2.7 in 2009.

A continuation of policies in support of production together with renewed interest by private investors in large scale production in land and water-rich countries are expected to be important drivers of the rice sector in the coming decade. For instance, the large production gains anticipated in Myanmar, Cambodia and Laos are likely to allow these countries to emerge as important players in the export market, which would widen the choice of origins for rice trade and reduce the dependence on traditional suppliers such as Thailand and Vietnam. Because important Asian countries are expected to engage in the commercial production of genetically modified rice by 2015, the questions of product segregation and labelling may also acquire increased prominence in the commercialisation of rice both in domestic and export markets. Compared to the base period 2007-09, world production of rice is projected to increase by nearly 15%, or 67 Mt, to reach 522 Mt by 2019. World consumption is projected to grow by 1.1% *per annum* to reach 521 Mt by 2019. Particularly fast growth in consumption is foreseen in Africa amid relatively strong expansion of population and growing preference for rice in diets. In China, the largest consuming country, consumption should continue to decline as consumers become more affluent and shift to higher protein-based diets.

Figure 1.11. The outlook for world crop prices to 2019

Index of nominal and real prices, 2005=1
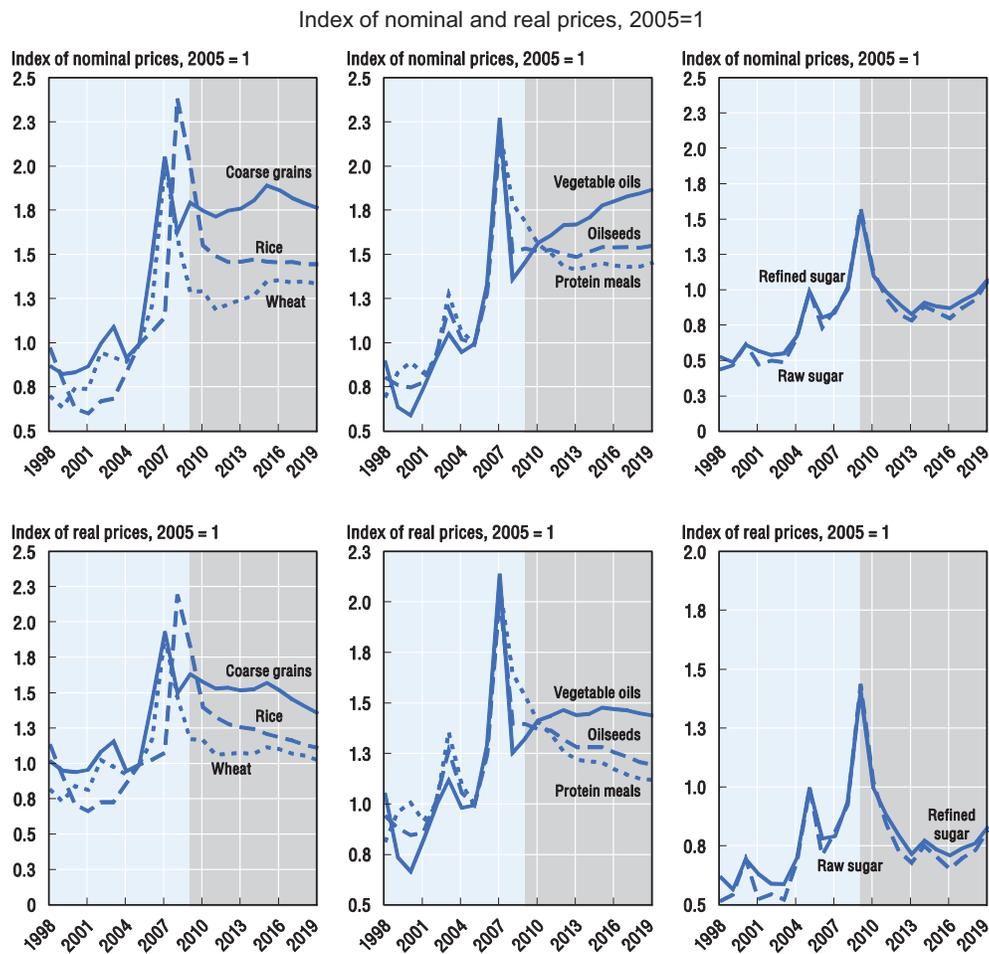
Source: OECD and FAO Secretariats.

High vegetable oil demand and prices drive the world oilseed economy

Following the sharp fall in prices towards the end of 2008, values for oilseeds and derived products have since moved at levels above those prevailing prior to the recent price spike. With sustained food vegetable oil demand in developing countries, robust mandates for biodiesel consumption and strong use of protein meal by the expanding livestock sector, oilseeds and oilseed products markets are expected to continue to undergo further expansion over the projection period. Compared to the levels prior to the food crisis, oilseeds and protein meal prices are projected to remain firm over the projection period as global stock-to-use ratios are expected to stay at low levels. With sustained crush demand and increasing production, oilseeds prices are expected to increase in nominal terms to USD 419/t in 2019 but to decrease in real terms (when adjusted for inflation) over the entire projection period. In line with other feed commodities, protein meal prices are expected to decrease in the early years of the outlook period before marginally increasing over the rest of the projection period to reach USD 288/t in 2019, about on par prices at the start of the *Outlook*. In a context of rising food and biodiesel use, demand for vegetable oils rises faster than for oilseeds and protein meals. The renewed firmness in crude oil prices over the projection period also contribute to a gradual strengthening in oils and fats values. Vegetable oil prices are projected in nominal terms to reach USD 1043/t in 2019, well above the base period 2007-09, and levels in nominal and real terms for the decade prior to the price surge.

While still high relative to other crops, the rate of growth in oilseed production over the next ten years will not match that observed during the previous decade. Much of the foreseen expansion will be concentrated in Brazil, the EU and Argentina, supported by land reallocation from other uses and new land entering production. The US should remain the major oilseed producer over the projection period. When compared to the 2007-09 average, world oilseed oil production should increase by 30% over the projection period. However, higher marginal costs of area expansion and growing environmental concerns in many key producing regions means that global production growth rates will be lower than over the previous decade.

At the world level, vegetable oil production should increase by almost 40% over the outlook period. Global production of palm oil remains very concentrated, with Malaysia and Indonesia producing over 85%. Combined they are expected to reach 70 Mt in 2019. Because of environmental concerns and area restrictions the growth rates are projected below recent trends, especially in Indonesia. The share of vegetable oil consumption used for biodiesel production is estimated to increase from 9% during the base to 15% in 2019, driven by binding mandates in many countries. During the outlook period, annual growth in protein meal consumption is projected at 1% in OECD economies, compared with 3.1% in non-OECD economies.

Despite increased production, steady demand growth underpins sugar prices

World prices of sugar, historically one of the more volatile of agricultural commodities, have been following a different rhythm of late than those of the major temperate zone crops. World sugar prices were relatively low in 2007/08 when other commodity prices surged and then reached 29 year highs in February 2010, while the others declined. The price surge was partly due to bad weather in key producing countries, such as Brazil and India. These production shortfalls lead to sharply higher imports by India and reduce export availabilities for Brazil. After spiking in early 2010, world raw and white sugar prices have since fallen back to pre-peak levels on

expectations of increasing supplies particularly in Brazil. A broader supply response is expected by 2010/11 as many countries boost their production in response to the recent high prices. Once production has time to adjust, the world sugar market is likely to switch from a deficit to an overall surplus situation, increasing export availabilities and leading to sharply lower prices as current price pressures are released.

Beyond this period, steady growth in global sugar consumption along with expanding demand over time for alternative products of sugar crops such as biofuels and particularly bio-ethanol, along with rising production costs in major supplying countries, are expected to lift raw sugar prices to USD 372 per tonne and white sugar to USD 439 per tonne in 2019 and to maintain them at elevated levels in nominal terms relative to prices at the turn of this century. World sugar prices by 2019, however, remain below the peaks reached at the start of the *Outlook*. When adjusted for inflation, sugar prices are expected to fall less rapidly than in the past. Both raw and white sugar prices are expected to continue to be variable over the projection period, particularly in response to the Indian production cycle, and this situation will also be reflected in the white sugar premium.

World sugar production is projected to increase to just over 200 Mt in 2019-20, some 39 Mt or 24% above the average level for the 2007-09 period. The longstanding production cycle in some countries of Asia, an important dynamic in the world market, will influence the growth in, and pattern of, global production in particular years. With low production costs and the potential to bring substantial additional land into production, Brazilian sugar production is expected to grow by some 11 Mt or 31% to reach 47 Mt in 2019, and this will propel exports to new heights. The growth underway in Brazil implies further concentration in sugar production and trade that is not without risks to sugar users and a potential source of additional price instability. World sugar consumption has slowed in the beginning of the *Outlook* in response to high prices and the lingering effects of the recession, but is expected to return to growth of an average of 1.8% *per annum* in following years to reach nearly 198 Mt in 2019-20. Global sugar stocks which are rundown at the start of the *Outlook*, rebuild in the near term as production outpaces consumption in response to the high prices and then gradually fall by 2019 with further strengthening of demand. The stronger demand and lower stocks-to-use, help to lift prices by the end of the projection period.

Biofuel prices set to rise as policy mandates drive demand

Weaker energy prices and lower profit margins and reduced investment following the economic crisis, slowed the expansion of the biofuel sector in 2009. As a result, when compared to their peak 2008 levels, ethanol and biodiesel prices decreased, respectively, by 6% and 26% in 2009. For the projection period, biofuel markets are projected to be highly influenced by mandates and other incentives in countries all over the world, with the US, Brazil and the EU playing major roles, respectively, on ethanol and biodiesel markets. Based on sustained political support for biofuels, the *Outlook* projects increasing world biofuel prices and these will also be underpinned by rising crude oil and energy prices. The world ethanol price[2] should follow an increasing trend to reach USD 54.4 per hl in 2019 supported by demand conditions in the US market where the Conventional Renewable Fuels mandate is assumed to be binding over the entire projection period. Demand should also be strong in Brazil due to the continuation of the government's blending regulation. The world biodiesel price[3] is projected to increase up to 2015 and then to remain at a plateau of almost USD 144 per hl as second generation biofuel will increasingly become available in the EU in the latter years of the outlook period and thus will diminish the pressure on supply globally.

With mandates calling for growing ethanol use along with higher crude oil prices mean that global biofuel production should increase and is projected to reach 200 bnl in 2019, and comprising 159 bnl of ethanol and almost 41 bnl of biodiesel. These quantities are far above the average 2007-09 base levels. In the context of the new Renewable Fuels Standard (RFS2) in the United States, ethanol use for fuel is projected to increase continuously over the projection period to reach 77 bnl by 2019, but to remain below the 2019 mandate of 102 bnl. Cellulosic ethanol production is indeed only projected to expand significantly in the latter years of the projection period to reach 9 bnl in 2019 and to remain far from meeting the RFS2 32.2 bnl mandate. Ethanol use for fuel should represent an average share of 8.8% in gasoline types for transport fuel by 2019.[4]

In the case of the European Union ethanol production is mainly from wheat, coarse grains and sugar beets. It should increase to 18 bnl by 2019. Under the Renewable Energy Directive (RED) fuel ethanol use is projected to increase to reach 21.2 bnl in 2019 representing an average share of almost 8.5% in gasoline types for transport fuels by 2019. With rising domestic demand for domestic use, by a growing fleet of flexi-fuel vehicles, and for exports, ethanol production in Brazil is projected to grow by almost 7.5% per annum, on average, to reach 55 bnl in 2019, while ethanol exports expand to reach 13.3 bnl by the close of the projection period. As biomass based 2nd generation ethanol and biodiesel are only expected to take-off in the latter years of the *Outlook*, reaching respectively 7% and 6% of global production, most of biofuels are expected produced from agricultural commodities. On the trade side, Brazil will be the major international ethanol supplier. Trade of biodiesel should remain marginal; Argentina is expected to be the main supplier on international markets.

On the biodiesel market, the major player should be the EU where total biodiesel use is expected to reach almost 24.4 bnl by 2019 given mandates and tax reductions by member states and the RED. The share of biodiesel in diesel type fuels is projected to grow to 8% (almost 10% in volume terms) on average[5] by 2019. In the US, the mandate defined in the RFS2 calls for 3.8 bnl of biodiesel to be used by 2012, driving the initial growth in US biodiesel use. The *Outlook* assumes biodiesel use to be held constant over the remaining years although no explicit mandate for biodiesel is legislated thereafter, the subsequent mandates referring only to advanced biofuel. Trade of biodiesel should remain low; Argentina is expected to be the main supplier on international markets. While many developing countries, especially in Sub-Saharan Africa and in South East Asia, have initiated ambitious renewable energy programmes, many have been put on hold during the economic crisis, credit constraints and with the more uncertain market prospects. The *OECD-FAO Agricultural Outlook,* therefore, presents a conservative view on biofuel prospects in many of the developing countries over the projection period.

Meat markets and prices trends are driven by developments in non-OECD countries

Although there was no run-up in meat prices similar to the experience of many crop products, these prices were adversely affected by increasing meat supplies with herd liquidation due to the rapid rise in feed costs and lower demand with the onset of recession. With renewed economic growth now underway, all meat markets are set to recover quickly in the near term of the projection period. Nominal prices for beef and pork increase by 21% and 17%, respectively, to reach USD 3562/t d.w and USD 1681/t d.w, respectively, by 2019, relative to the base period 2007-09. Poultry prices are expected to be on average 32% higher reaching USD 1 638/t p.w by 2019. When expressed in real terms (*i.e.* adjusted for inflation) prices are expected to trend higher than

those observed during the decade of the 1990s, as high feed costs will somewhat constrain the expansion of output. Beef prices are anticipated to be firm for the first half of the projection period, mainly due to a tight meat supply with the start of a herd rebuilding phase. However, expansion of meat output in following years, coupled with a reduction of imports by the Russian Federation, are anticipated to exert downward pressure on prices. Pigmeat prices in both the Atlantic and Pacific markets which can be substitutes in certain markets are not anticipated to be sustained beyond 2015 due to an increase in supply from Brazil and China, both of which are experiencing high productivity gains. Sheepmeat prices are anticipated to be weak during the early years, but with an anticipated reduction of sheep flocks in New Zealand, the tighter supplies exerts upward pressure on world sheep meat/ lamb prices in later years of the projection period to reach USD 2 830/t d.w by 2019. Poultry prices expressed in nominal terms are to remain relatively firm throughout the *Outlook* as demand continues to favour white meats.

The economic downturn triggered by the financial crisis in mid 2008 impacted severely the meat sector in 2009. Falling consumer demand and difficult access to credit affected both demand and supply. All meats were affected, although beef suffered the most compared to others, as consumers preferred cheap beef cuts and cheaper alternative sources of animal proteins. A renewed expansion of the meat sector is expected by and large for non-OECD countries from the start of the *Outlook*, and these will be responsible for much of the growth in the sector. Improved producer returns are anticipated to boost global meat output, with the shorter cycle of the pig and poultry sectors likely to respond rapidly to renewed demand. However, reduced cattle inventories may constrain beef production in the short term. World meat production growth is projected to increase by 1.8% per annum during the outlook period, somewhat slower than in the past decade as the sector is increasingly constrained by the availability of natural resources. Meat production in the OECD area is anticipated to expand just short of 1% per annum, as most farmers already benefit from technological advances, and face increasingly stringent animal welfare and food safety regulations.

World meat consumption continues to experience one of the highest rates of growth among the major agricultural commodities. Much of the increase in demand is accounted for by the large non-OECD countries with their growing wealth and affluence. Poultry meat consumption in this area is projected to grow by 38%, pigmeat by 33%, beef by 23% and sheepmeat by 31% by 2019, when compared to the 2007-09 base period. Measured on per capita basis, meat consumption in the OECD area rises by 4% in the same period, the equivalent of one-fourth of the non-OECD countries rate of growth. World meat exports, driven mainly by increased shipments of poultry and beef, are projected to expand by 22% by 2019 relative to the base period. OECD country exports are projected to increase by slightly more than 7%, while those of non-OECD countries increase by 29% to 2019. The bulk of growth in meat traded is expected to originate largely from outside the OECD area, in particular from Brazil which will single-handedly account for nearly 60% of all the meat exported from non-OECD countries in 2019.

Figure 1.12. The outlook for world livestock prices to 2019

Index of nominal and real prices, 2005 = 1
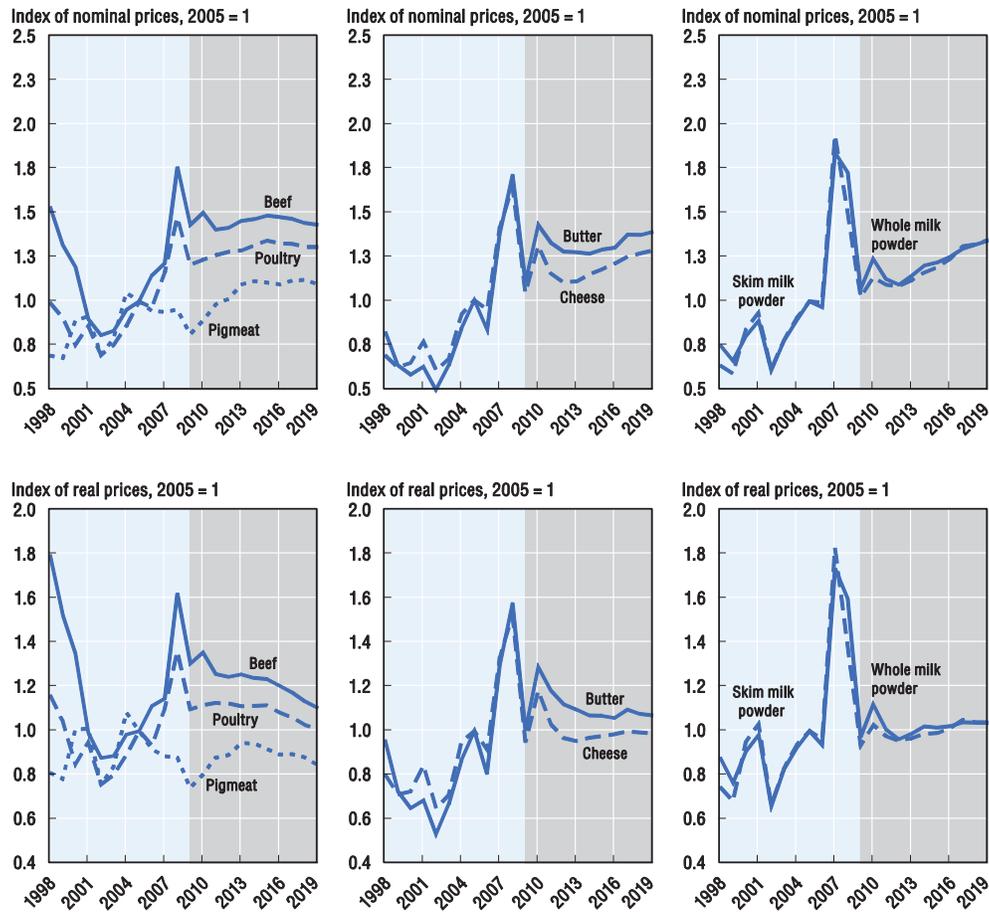
Source: OECD and FAO Secretariats.

Dairy prices driven by stronger demand and rising supply costs

International dairy markets have experienced a dramatic boom and bust cycle in recent years. The dairy outlook, like that for meats, is more optimistic than last year. In the course of 2009, international prices started to strengthen, rebounding rapidly at the end of the year. The strong recovery in prices was triggered by increased demand mainly from oil exporting countries but also by China and by lower supplies that contracted in some regions in response to low profitability in the previous year and weather impacts on production in the Southern hemisphere producing countries. The European Union also has been restrained in the export of dairy products from higher intervention stocks. In 2010, fundamentals indicate a recovery in demand with improved economic prospects and market confidence.

The dairy sector is expected to remain one of the fastest growing sectors covered in the *Outlook* with strong potential as the popularity of dairy products rise mainly among developing country consumers and as demand expands with increasing affluence. The

return to global economic growth and increasing population are expected to underpin international dairy markets and prices over the outlook period.

In the near term, dairy product prices are expected to be dampened by stock reduction mainly in the US and the EU. Nominal dairy prices are expected to rise steadily by 2-3% per annum on average, from 2012, driven by rising demand but also increasing production costs. In real terms, the longer term downward trend in prices is expected to abate, with world prices remaining relatively flat over the projection period. On average, world market prices in real terms are expected to stay 15-40% higher when compared to the decade preceding the 2007/08 peak. Butter prices in real terms are expected to register the highest gains. These are linked to continuing high energy and vegetable oil prices and to the fact that considerably less butter will be exported from countries such as the European Union or the United States. The new emerging exporters of dairy products are expected to concentrate their efforts on milk powder rather than butter which entail less sophisticated logistic requirements than butter exports.

World milk production is expected to increase by 2.1% per annum to reach 170 Mt by 2019 relative to the 2007-09 base period. The vast majority of the additional milk is projected to be produced outside the OECD area. World production of WMP, butter, cheese and SMP is expected to grow from the base period by 31%, 28%, 20% and 9% respectively, by 2019. The OECD area continues to dominate global cheese consumption, accounting for nearly three-quarters of the total consumption which is expected to increase by 20% over the outlook period. In non-OECD countries demand growth is expected for all dairy products with WMP and butter consumption growing the strongest (both by 38%), followed by cheese (33%) to 2019. World exports of dairy products are anticipated to recover and grow mainly for cheese and WMP (both at 14%).

Structural change in the dairy sector is expected to intensify over the outlook period. Milk producers and the dairy industry will increasingly need to take a more proactive role to adapt to changing input markets, demand conditions, price fluctuations and increased pressure to assure quality, safety and traceability of their products. Environmental constraints and climate change related issues, and policy, will pose further challenges for the sector in the future.

Main developments in food prices

Growth in consumer food prices slows

Rising commodity prices, particularly for cereals in 2007/08 contributed to sharply increasing food prices, especially in the developing countries for less processed foods that make up a larger part of diets. While world prices have since fallen, agricultural prices and food prices inside many countries did not reflect this change with the same cadence or rhythm having remained "sticky" at high levels for an extended period of time. While the *Outlook* does not project food prices, there remains considerable interest in how fluctuations in commodity prices translate into changes in the cost of food. For this reason the following section discusses how food prices around the world have changed between the period of peak prices and 2009 as commodity prices have declined.

Food price inflation

Food price increases as measured by the food component of the consumer price index (CPI) slowed markedly over 2009 in most countries, though they continued in general to outpace overall inflation. In OECD countries, food prices increased by 1.6%, a significant reduction from the 6% plus increase registered in 2008. There were, however, significant differences in food price inflation among OECD as well as non-OECD countries. For most countries, food price increases slowed significantly in 2009 compared to 2008 yet for others double digit increases continued.

The food price movements discussed here refer to the food component of the CPI which measures the cost of a fixed basket of foods at the retail level. The basket reflects actual consumption patterns, thus it provides a good indication of overall change in the cost facing consumers when making food purchases. This means that food prices and commodity prices will differ substantially because retail food prices include additional costs such as processing, transportation and distribution. The share of commodities in the cost of the food basket varies across countries, for instance in the United States the account for only 20-25% of the total, with the remainder attributed to labour, energy and distribution costs.[6] In low income countries the commodity share in food prices is likely to be larger since the share attributed to energy, distribution and processing is often smaller.

In most OECD countries food prices increased by less than 5%, while in eight countries they decreased. This is in stark contrast to 2008 when two-thirds of the OECD countries experienced increases of between 5% and 10%. See Figure 1.13 for an overview of food price increases over the 2006-09 period for selected OECD countries. In the non-OECD countries, food price increases were larger than in the OECD with many between 5% and 10%, but less than in 2008. For instance, in Brazil food prices increased by 5.8% in 2009 compared to 13.1% in 2008 and in Indonesia they rose 7% compared to 17% in 2008. India also had double digit food price inflation in 2009. An equally remarkable slowing of food price increases was experienced by China, where they rose by less than 1% compared to 14.4% in 2008 and 12% in 2007. A number of countries, such as Pakistan, Bangladesh and the Russian Federation as well as a Rwanda and Ghana, however did continue to experience double digit increases. Other countries such as Sri Lanka, Guatemala and China had relatively small price increases, that is less than 3%, while countries such as Senegal and Estonia, experienced net declines after increases of 9% and 14% respectively in 2008. See Figures 1.14 and 1.15 for changes in food price

indices for the years 2006-2009 in selected non-OECD and African countries, respectively.

Figure 1.13. Percentage change in the food prices: selected OECD countries, 2006-09
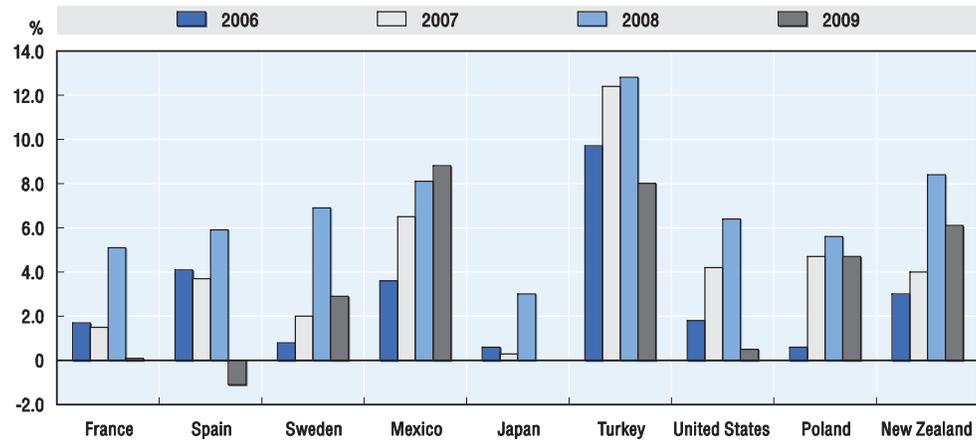
Source: *Main Economic Indicators*, OECD.

Figure 1.14. Percentage change in the food prices: selected non-OECD countries, 2006-09
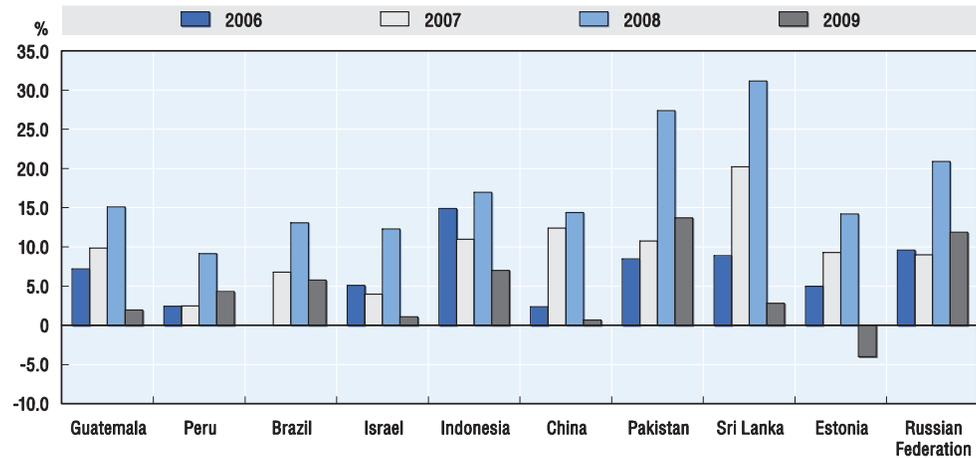
Source: National Statistical Institutes.

Figure 1.15. Percentage change in the food prices: selected African countries, 2006-09
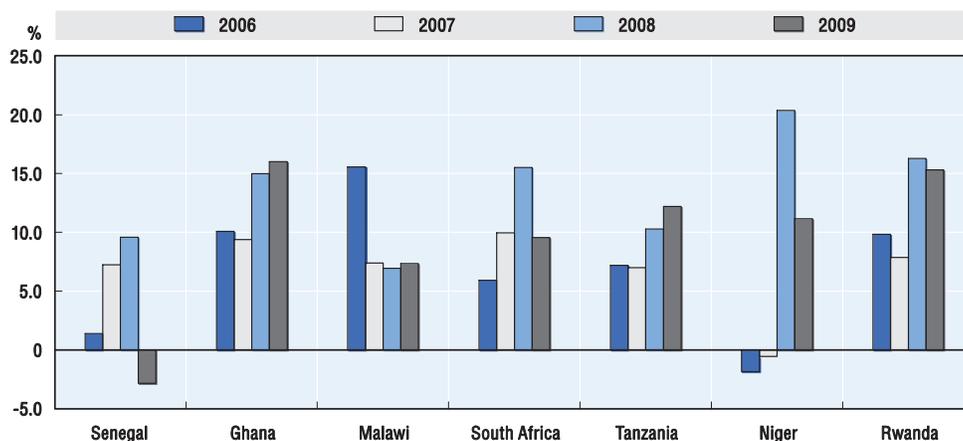
Source: National Statistics Institutes.

What has been the contribution of food prices to inflation?

The weight of the food component in the CPI varies widely across countries reflecting the structure of household expenditures. In high income countries, the share of food in the CPI ranges from less than 10-20% but in the middle and low income countries it is substantially higher, generally in the 30-60% range. For example, the food component accounted for 47% of the CPI in Sri Lanka, 58% in Malawi, 55% in Tanzania, 38% in Peru and 28% in Brazil. In contrast, in the United States it is but 8.2%, 10.4% in Switzerland and Germany and 11.8% in the United Kingdom.

For OECD countries the contribution of food price increases to inflation, measured by the percentage change in the CPI, has been very small this past year (2009), with contributions being generally between less than half of one percentage point and many were negative. There are exceptions, such as in Ireland, at 2.5 percentage points and Poland at 1.6 percentage points. This is not only because food price increases were relatively moderate but also because the share of food in total household expenditure is small (Figure 1.16)**.**

For many middle and low income countries, where food expenditures account for a substantial share of household expenditures their impact on inflation can still be significant even when food prices rise only moderately. Though food price increases did indeed slow in 2009, their increase still contributed 4 percentage points to inflation in the Russian Federation and 5.5 points in Pakistan. However, it only contributed less than 2 percentage points in Brazil, Peru, Guatemala, Indonesia, China, Sri Lanka and Israel. The contribution of food price increases to inflation has come down significantly from 2008 as can be seen in Figure 1.17.

Figure 1.16. Contribution of food price changes to inflation: selected OECD countries
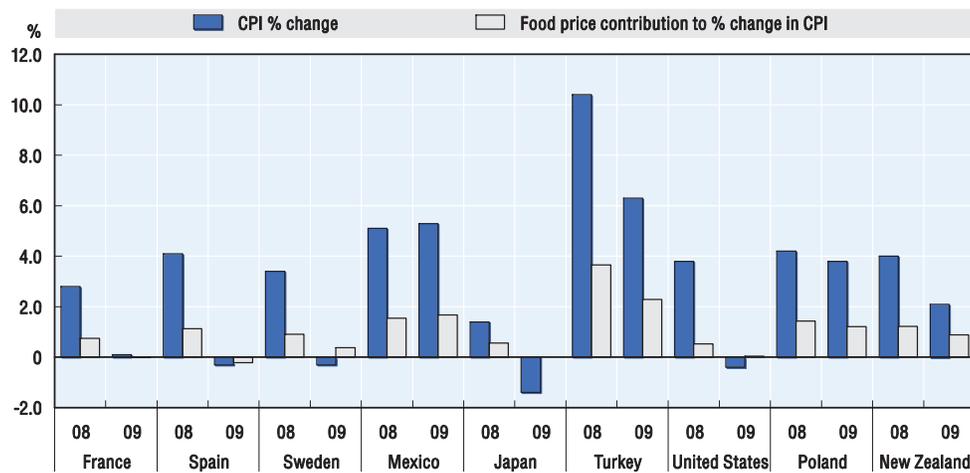
Source: MEI and OECD Secretariat.

Figure 1.17. Contribution of the food price changes to inflation: selected non-OECD countries
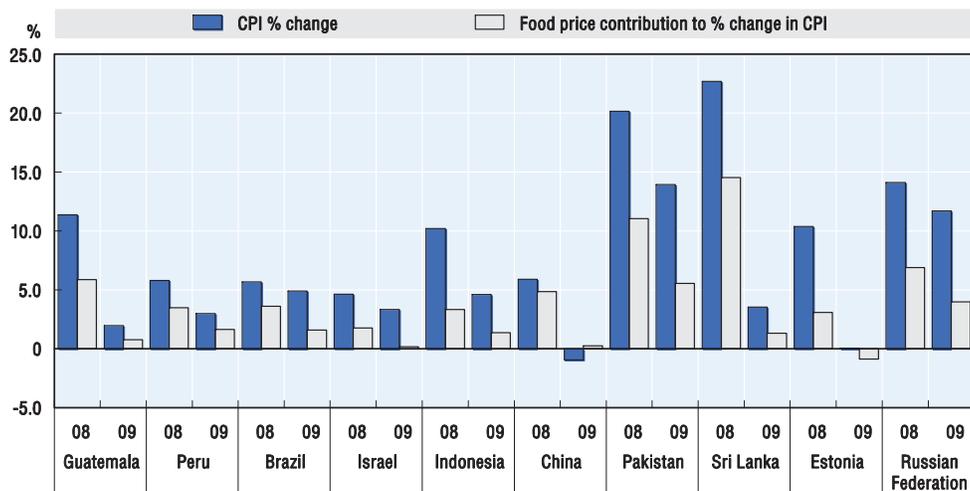
Source: OECD Secretariat.

For the set of Sub-Saharan African countries examined, the contribution of food price increases to overall inflation remains significant as seen in Figure 1.18 even if it has come down from 2008 levels. For example, in 2009 it contributed over 9 percentage points in Tanzania and 7 percentage points in Ghana and over 4 percentage points in Rwanda, Malawi and Niger, although it was negative in Senegal.

Figure 1.18. Contribution of the food price changes to inflation: selected African countries
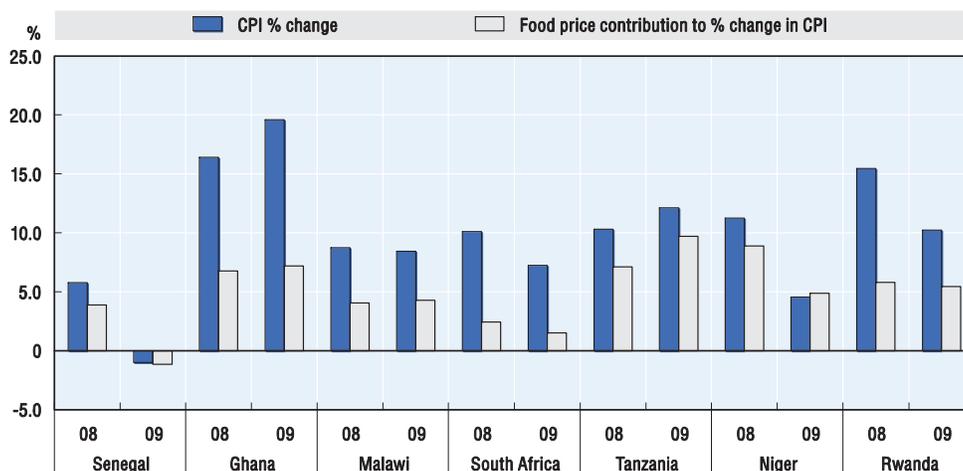
Source: OECD Secretariat based on national statistics.

In countries where a large share of household expenditures are devoted to food, rising food prices mean that there is less money available for non-food items, such as housing, transportation, health and educational services particularly in developing countries. Because of its importance and high visibility, food price inflation continues to be a closely watched economic indicator, particularly in low income countries.

This brief overview of food price developments in OECD and selected non-OECD countries indicates that food price inflation continued to slow over 2009 and in a number of countries it declined in absolute terms. However, this should not be misconstrued to imply that food prices have fallen significantly in absolute terms.

Fisheries: another dimension of the Outlook

While not usually associated with the *Outlook* report, fisheries represent an important dimension as a provider of a significant share of animal proteins in human diets and, through fishmeal, of a substantial share in animal feed rations. The increasing aquaculture industry also produces a growing and competitive demand for cereals and protein meals for use in fish feed. Fish proteins accounted for about 16% of total world animal protein supplies in 2008. Global fish production has increased about eight times in volume since 1950 to reach some 142 Mt in 2008. Capture fisheries production has stabilized at 88-94 Mt over the past decade while aquaculture production has increased significantly and now contributes 37% of the total fish production and 46% of the total fish destined to human consumption. FAO and other organisations have projected total fish production to increase by 10-15% over the next ten years (Box 1.2).

The future potential of the industry is linked to the ability of policy makers to provide a conducive policy landscape for sustainable and profitable operations. In recent years, national and international policy debates have focused on sustainable and responsible fisheries and stock rebuilding, recognising that major fish stocks are either overexploited or at very high levels of exploitation.

Box 1.2. The importance of the fisheries sector and its links with agriculture*

The fisheries sector plays a significant role in global food security providing a valuable dietary source of proteins, minerals, micronutrients and essential fatty acids. In addition, the sector contributes to economic activity, employment and in generating foreign exchange. World per capita fish consumption is estimated at about 17.1 kg, with fish providing about 3 billion people with 15% of their average per capita intake of animal protein.

Fish is widely traded, with about 38% of production entering international trade as various food and feed products. Trade of fish and fishery products has significantly increased in the last decades, reaching a record USD 102 billion in 2008. In 2009, following the global economic recession, there was a contraction in demand, with a slight decline of fishery trade in both value and volume terms. However, trade is again expanding and the outlook for 2010 is generally positive as is the longer term trend for fishery trade. Developed countries absorb about 80% of world fishery imports in value. Developing countries play a crucial role in fishery exports with a share of about 50% by value and 60% by quantity (live weight equivalent) of the total. The fishery net exports of developing countries (*i.e.* the total value of their exports less the total value of their imports) has shown a continuing rising trend in the last decades, growing from USD 9 billion in 1986 to USD 27 billion in 2008. These figures were significantly higher than those for agricultural commodities such as rice, sugar, coffee and tea.

At present, about 80% of total fishery production is used for direct human consumption. The remaining 20%, entirely from capture fisheries, is destined for non-food products, mainly for production of fishmeal and fish oil, as well as direct feed in aquaculture and livestock. In 2008, total world fish production (capture and aquaculture), excluding aquatic plants, reached 142 Mt. It should be mentioned that this figure might underestimate the effective amount due to the incomplete recording of subsistence fisheries as well as of illegal, unreported and unregulated catches. Estimates for 2009 show a slight increase from the previous year. Compared with production figures a decade ago, the current amount represents a growth of more than 28 Mt. This additional supply is mainly due to increases in aquaculture production. Capture fisheries production, which reached its peak in 1996 with 93.8 Mt, has stabilised within a range of 85 and 94 Mt, with variations mainly caused by the El Niño climate pattern phenomenon. In the last three years, capture fisheries production remained close to 90 Mt. Forecasts indicate that any major increase in future supply will come from aquaculture. Aquaculture production is already playing a substantial role in supplying fish for human consumption, growing from a share of 17% of per capita fish consumption in late 1980s to an estimated 46% currently. It is estimated to reach 50% within the next decade.

With an annual average rate growth of about 9% in the last two decades, aquaculture is currently growing faster than all other food-producing sectors. Aquaculture is expanding in all continents, in new areas and species, intensifying and diversifying the product range. Although the rate of increase in aquaculture production has slowed to about 6% per year in the 2000s, growth prospects for the sector are still good. Several more species and new product forms will be commercially produced in the near future and further technological development will contribute significantly to improve productivity, yield, quality and consumer acceptability. However, it is also evident that, in many countries, significant challenges remain in order for the aquaculture sector to reach its full potential and become economically, environmentally and socially sustainable. Important factors which will have a future impact on the aquaculture industry include climatic changes, environmental issues, access to sites and water, raw material supply for feed, pandemics and fish health management, integration and ownership structures, governance, food safety and traceability. The OECD Workshop on Advancing the Aquaculture Agenda, held in April 2010, underscored the importance of ensuring a solid governance system for the sector with a view to ensuring future growth.

Fisheries, and in particular aquaculture, interact in several ways with agriculture. One evident example is in integrated farming[1], but more important is their impact on ecosystems, markets, products and prices, as well as on innovations and technology. Competition between the fishery and agriculture sector may arise for water and land resources, especially for irrigated agriculture, as well as on the availability and relative efficiency on the use of feeds between terrestrial animals and farmed fish. Fishmeal and fish oil obtained from capture fisheries and from fisheries by-products are used as feed in aquaculture as well as in the feed rations of pigs, poultry, ruminants and pets. With the expansion of aquaculture, supplies of fishmeal have been largely directed to this sector, as major constituents of aquatic carnivorous/omnivorous species feeds, diverting away from livestock, which now mainly use fish meal in starter and breeder diets for poultry and pigs. It is estimated that in 2007 aquaculture consumed about 68% of world fishmeal and 81% of world fish oil supplies. The growth of the aquaculture industry and the increasing competition with the livestock sector generated upward pressures on prices of fishmeal and fish oil and has also led to an increasing demand for additional or substitutive sources of feed. Livestock and agriculture by-products, used traditionally to feed terrestrial animals, are now increasingly employed by the aquaculture sector, especially for the farming of non-carnivorous aquatic species. Continued growth in demand for livestock and fish products, as well as for biofuels obtained from agriculture by-products, has raised concerns over the competition for feed supplies, in particular for the finite fishmeal and fish oil resources, and the impacts of such growth on the environment and on the aquaculture and livestock developments.

World fish utilization and supply

Food fish supply from capture
Non-food uses from capture
Food fish supply from aquaculture
Per capita food fish supply

Fish utilisation (million tonnes)
Food fish supply (kg/capita)

World production (quantity)

1961-70   1971-80   1981-90   1991-2000   2001-07

Percentage

Aquaculture   Fruit   Vegetables   Milk   Meat   Eggs   Cereals   Roots and tubers   Pulses

* All statistics quoted in this box are from FAO, Fisheries and Aquaculture Department.
1. The term "integrated farming" refers to integrated resource management of different activities, such as crop, livestock and fish subsystems. When involving aquaculture, it is the concurrent or sequential linkage between two or more activities, of which at least one is aquaculture.

Issues and uncertainties

The agricultural market projections through to 2019 discussed in this chapter are a representative scenario based on a consensus view of what may happen in the future given a number of key assumptions regarding the evolution of the macroeconomic environment and exchange rates, oil and energy price levels, a continuation of existing agricultural policies, average weather conditions, longer term productivity trends and the absence of market shocks. Should any of these assumptions change, the resulting set of agricultural commodity projections would also be different. The sensitivity of the projections to crude oil price assumptions was demonstrated in a scenario in the last year's edition of the *OECD-FAO Agricultural Outlook*. The results indicated that the assumption of higher crude oil prices would push agricultural commodity prices upward,

with crop prices showing a significantly higher sensitivity to oil price changes compared to livestock products. This stems from the high energy share in total crop production costs through fertiliser, chemicals and fuel prices. Moreover, the emergence of the biofuel sectors has now forged a closer link to crude oil markets particularly for grains, oilseeds and sugar. The impact of crude oil prices on the livestock sector is smaller as the higher cost of energy and feedstuffs is to a certain extent mitigated by increased availability of distilled dry grains (DDGs), a by-product of bioethanol production, which can be used in animal feed.

A number of major uncertainties remain. At the beginning of the *Outlook*, the lingering effects of the global financial market turmoil and the deep economic recession are intermingled with the onset of a strong recovery in the large developing countries and a more fragile turnaround in much of the OECD area. This has been made more fragile by the unfolding Greek crisis and fears of contagion to other countries with large budget deficits in Europe that now threaten to slow the global recovery. Many OECD countries are starting to address excessive budget deficits to restore fiscal balance and to soak up excess liquidity in their economies in order to prevent asset bubbles and inflation. The issue for governments for 2010 and beyond is to devise exit strategies as to when and how to reduce the liquidity and fiscal stimulus without reversing the nascent recovery. With globalisation and closer economic and financial integration between nation states, many external factors such as variable oil and energy prices, freight rates, inflation, interest rates, credit availability and exchange rate changes can have profound impacts on the competitive positions of national agricultural industries and their trade performance. Among other developments are the continuing migration of production to areas of the world which suffer higher yield variability together with more frequent weather disturbances associated with climate change may render global yields much more variable, leading to greater instability in production and trade flows. Finally, future changes in agricultural and trade policies and the eventual outcome of the current Doha Round of international trade negotiations and bilateral agreements that may be under consideration can be expected to have an important influence on agricultural markets. All of these factors play an ever increasing role in commodity price formation suggesting a continuation of volatile and uncertain agricultural commodity markets.

The past decade has been one of constant change, altering the environment in which the sector operates. The most recent years have been characterised by significant price volatility and a sharp rise in the numbers of malnourished people. Coming years will also be characterised by continuing economic, demographic, market and environmental pressures that will bring both opportunities and challenges to farmers, food businesses, consumers and governments. Some of the issues that were identified as major challenges are as follows.

Food security: Hundreds of millions of people remain food insecure. Although the world now produces enough to feed its population, the number of undernourished has increased since the mid 1990s, reaching more than one billion persons in 2009, in part as a result of recent price spikes and the global economic recession. Paradoxically, many of the world's food insecure people are themselves farmers. The population and income dynamics in emerging economies will continue to increasing demand for food in the decades to come, while the growing biofuels market is a new source of demand impacting on food markets through related land use changes. Production and productivity will need to be increased while a well functioning, rules-based multilateral trading system will be crucial in ensuring food can move from where it can be abundantly produced to where it cannot. These issues are further discussed in Box 1.3.

Box 1.3. Food security remains high on the international policy agenda

The World Food Summit on Food Security, held in Rome on 16-18 November 2009, called for action to reduce hunger and malnutrition. Objectives, cited in the Summit's Declaration included better coordination at the global, regional and national levels, a reversal of the decline in domestic and international funding for agriculture and a proactive approach to the challenges of climate change. As background to the Summit, the FAO released a number of background studies and held a high-level expert forum in October 2009 on How to Feed the World in 2050.

The challenge is to feed a growing, more urban and, on average, richer population while adopting more efficient and sustainable production methods and adapting to climate change. World population is expected to grow by 2.3 billion people between 2009 and 2050 with nearly all this growth from developing countries. The population in sub-Saharan Africa is expected to grow the fastest, by some 114%. It is estimated that feeding a population of 9 billion would require a 70% increase in global food production between 2005-07 and 2050. Production in the developing countries would need to almost double. Of course, the need to increase output would decline significantly if progress could be made in reducing production losses (*e.g.* from disease, pests, storage) and food waste (*e.g.* during processing, transportation and consumption). The projections of this *Outlook* indicate global production growth which is on track with estimated longer term food requirements.

Demand for cereals for food and feed is projected to rise by one-third to 3 Bt by 2050, and possibly higher due to a growing liquid biofuel market. Net cereal imports into the developing countries would increase almost three-fold to nearly 300 Mt by 2050, some 14% of their total cereal consumption. Demand for more income-responsive vegetable oils, meats and dairy products are expected to rise even faster. Livestock is one of the fastest growing sub-sectors in agriculture with over 80% of the projected growth in the next decade taking place in developing countries, particularly in Asia and the Pacific (especially China) and Latin America, outpacing growth in the OECD area by a factor of 2:1 over the next decade.

To support the necessary expansion in output in developing countries, FAO estimates the required average annual investment in primary agriculture and necessary downstream services (*e.g.* storage, processing) at USD 209 billion in 2009 prices (or USD 83 billion net of depreciation), much of which would come from private sources. This amount represents a 50% increase from current levels and does not include the public investments required in such areas as roads, irrigation, electricity and education. In general since the 1970s, those countries with higher net investment per agricultural worker have been more successful at reducing hunger.

As suggested in the 2009 *Outlook* report and supported by the FAO Food Summit background studies, the technical ability to produce enough food can be achieved, given sufficient investment and sustainable resource management. However, this alone will not alleviate hunger which is primarily a question of poverty. It is more a problem of food accessibility than of food availability. A comprehensive approach to food security needs to include investments to promote income generating activities for the poor and thus improve their ability to purchase food. Importantly, the payoff from hunger reduction in terms of economic growth can be substantial. Throughout the 1990s, the value-added per worker, in countries where 2.5% of the population was undernourished, was 20 times higher than in countries where more than 35% of the population was undernourished.

Sources: http://www.fao.org/wsfs; http://www.fao.org/wsfs/forum2050/wsfs-forum and www.oecd.org/agriculture

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Climate change: There is a broad scientific consensus that less-resilient agricultural production areas will suffer the most, as temperatures rise further, for example in semi-tropical and tropical latitudes, and as already dry regions face even drier conditions. Climate change may also increase food safety risks that might result from heat-related and water borne diseases with temperatures rising and more flooding. Production variability and uncertainty of supplies are expected to rise as a result of likely increases in the frequency of extreme events such as droughts and floods. In more extreme cases, production zones might shift. It was also recognised that agriculture will be required to make an important contribution to reducing greenhouse gas emissions (Box 1.4).

Box 1.4. To what extent is climate change included in the *Agriculture Outlook*

Climate change refers to a change in weather patterns over relatively long periods of time, usually at least a decade. While recent climate change concerns are mainly related to increasing global mean temperature (global warming), in the broader sense it encompasses changes and variability in temperature, precipitation, atmospheric pressure, humidity and wind. Climate change also affects the frequency of storms, floods, droughts and other extreme weather events.

The global warming hypothesis is supported by a statistically significant increase in average global temperatures over several decades, as measured by a variety of sensors based on land, sea and satellites.[1] According to the Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report, "Warming of the climate system is unequivocal".[2] Climate change is expected to impact significantly on agriculture as weather evolves in the future. While science is not yet capable of providing precise predictions, there is wide agreement in the scientific community on some climate change trends.

Average temperature increases will be unevenly distributed around the globe. The IPCC projects that warming will be greater at the equator and the poles than at the mid-latitudes.[2] In very general terms, this may translate into more favourable agricultural conditions for temperate regions (*e.g.* warmer, longer growing season), but less favourable conditions (*e.g.* heat stress) in the already hot tropics.

Rising temperatures will accelerate the hydrological cycle,[3] changing the temporal and spatial distribution of fresh water. Global water availability is likely to remain constant. While in the short-term the accelerated melting of glaciers may result in increased risk of floods, over the longer term it implies reduced flows to areas which rely on such water supplies. It is also conceivable that even if annual precipitation remains unchanged, rainfall may occur more frequently when it is not needed (*e.g.* during the summer harvest rather than in winter and spring).

Higher CO_2 concentrations are expected to have a positive "fertiliser effect" on plant yields, especially rice, wheat and soybeans. However, this hypothesis is largely based on laboratory experiments and may be less in reality. Moreover, a number of important crops like maize and sugar cane belong to a plant family where this fertilisation effect is smaller, even in the laboratory.

All these factors will have both positive and negative consequences for crop and livestock production, depending on many environmental conditions prevailing in a particular geographical location, production management systems, and the impact of mitigation and adaptation policies and practices. However, most analysis of climate change focuses on 25-50-year time horizons so it is difficult to incorporate such analysis into a medium-term agricultural outlook. There are no climate change variables or equations in the Aglink-Cosimo model used to generate projections for the OECD-FAO medium term agricultural outlook. To date, there are no explicit links between the physical models used to access climate change and the economic models used for market analysis, although this is an area likely to be addressed in the near future.

While the OECD-FAO medium-term projections may implicitly incorporate certain elements of climate change for some regions, this impact cannot be separated out or quantified. One of the assumptions underlying the projections is "average" weather or growing conditions in the different countries and regions. Climate change impacts, through changed average weather conditions, would be expected to appear through yield performance/variation and average pasture conditions. The initial phase of the *Outlook* process involves commodity experts adjusting projected crop yields and output, based on a number of factors such as input use, innovation, technology. National experts from all major producing regions respond to a detailed, commodity-specific questionnaire so that global projections are built up from country level analysis.

While it may not be possible at this stage to provide quantitative estimates of the medium-term impact of climate change on agriculture, this will be a topic of increased analysis over the next few years. Agriculture Ministers, at the February 2010 meeting in Paris noted that climate change presents challenges and opportunities for the agricultural sector in reducing green house gas emissions, in carbon sequestration, and the need for adaptation. They asked for further analysis of the likely impact of climate change on agriculture and on agro-forestry, the role of the sector in mitigation and adaptation, and the appropriate policy responses.[4]

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1. NASA Goddard Institute for Space Studies, http://data.giss.nasa.vog/gistemp .

2. IPCC Fourth Assessment Report: Working Group I: The Physical Science Basis.

3. World Meteorological Organization, http://www.wmo.int.

4. The Ministerial Communiqué is available at: www.oecd.org/agriculture/ministerial.

Global food chains: The food industry is becoming more vertically integrated, globalised and concentrated. These developments have enabled the industry to respond well to a wide range of changing consumer preferences, while maintaining relatively low prices. However, there are also concerns about their growing market power, about price transmission, transparency and what is a "fair" distribution of profits across the food chain. Both public food safety standards and private quality standards have been raised in response to consumer demands, but these imply higher compliance costs and some farmers, particularly in developing countries, may have difficulty in meeting the more stringent standards.

Innovation: The capacity of the global food and agriculture system to continue to provide adequate supplies for food, feed, and non-food uses depends in large part on technology and innovation. In some cases there remains considerable scope for improving productivity through more widespread adoption of available technologies. Progress can also be made to make better use of what is produced - as much as one-third of food "disappearance" has been estimated as "waste". Waste occurs at the farm level, in the storage and distribution system, in food service, and at home. Governments, in partnership with the private sector, need to increase investment in research and development, while keeping markets open to allow the free flow of innovation and technology. A major challenge remains in the development and approval of genetically modified crops, and the extent to which asynchronous action by Governments results in trade diversions among countries and regions.

The OECD Committee of Agriculture met at Ministerial level on the 25-26 February 2010 and discussed many of these same issues. What Ministers' had to say on these different issues is covered in the Ministerial Communiqué from the meeting, an extract of which is shown in Box 1.5.

Box 1.5. 2010 OECD Agriculture Ministerial Meeting

Ministers' discussions were wide-ranging and forward looking. A focus of discussion was the question of food security. Will the food and agriculture system be able to respond as population growth causes demand for food to increase, in a world where pressure on land, water and other natural resource is already evident and where climate change will bring additional challenges? The task for governments is to make sure that the right policies and institutions are in place.

Ministers agreed to build on and complement the policy principles agreed in 1998 acknowledging that the main priority is the need to provide an adequate supply of safe and nutritious food, on a sustainable basis, for the world's growing population. Specifically, *Ministers recognised*:

a) that an ***integrated approach to food security*** is needed involving a mix of domestic production, international trade, stocks, safety nets for the poor, and other measures reflecting levels of development and resource endowment, while, poverty alleviation and economic development are essential to achieve a sustainable solution to global food insecurity and hunger in the longer term;

b) that ***"green growth" offers opportunities*** to contribute to sustainable economic, social and environmental development, that agriculture has an important role to play in the process, as do open markets that facilitate the sharing of technologies and innovations supportive of green growth, and that, in this context, care needs to be taken to avoid all forms of protectionism;

c) that ***climate change presents challenges and opportunities*** for the agricultural sector in reducing green house gas emissions, in carbon sequestration, and the need for adaptation;

and Governments should ensure that

d) farmers and food suppliers, in developed and developing countries, are able to respond effectively to changing consumer and societal demand, and that the transmission of price signals along the food chain is improved locally, regionally and internationally;

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e) the necessary institutional, regulatory and policy frameworks are in place to enable markets for food and agricultural products to function efficiently, effectively transparently and fairly;

f) appropriate policies are developed to facilitate the management of risk at the farm and farm household levels and throughout the agro-food sector, including, where appropriate, in response to the impacts of extreme price volatility on farmers, while maintaining an efficient distribution of responsibilities between private and public actors;

g) policies for the food and agriculture sector are coherent with general macroeconomic, trade, industrial, environmental, energy, consumer and social policies (including health and nutrition), and that there is coherence between country policies and efforts to assist developing countries;

h) trade play a role in matching global supply and demand, as a reliable source of supply for countries dependent on imports and a reliable outlet for competitive suppliers, through an efficient well-functioning rules-based multilateral trading system, to which an ambitious, balanced and comprehensive conclusion of the Doha Development Agenda would be an important contribution;

i) policies are supportive of the efforts of farmers and other participants in the supply chain to effectively manage natural resources to supply sustainably produced commodities;

j) incentives and disincentives can be effectively and transparently designed to reflect the total costs and benefits to society, with a view to improving environmental performance, in consistency with multilateral trade rules and commitments; facilitating adaptation to and mitigation of climate change; allowing the food and agriculture system to respond to resource pressures particularly those affecting land and water; reducing losses and waste in the food supply chain; ensuring the provision of public goods and services such as rural amenities, biodiversity, maintenance of landscape and land eco-system functions and contributing to the development of rural areas;

k) there is a supportive investment climate in particular with respect to foreign direct investment in emerging and developing countries, in line with internationally agreed guidelines;

l) innovation, including transfer of technologies, is fostered in order to increase productivity, enhance efficiency, improve sustainable resource use, respond to climate change and reduce waste including through balanced protection of intellectual property rights, and a regulatory environment conducive to innovation and new technology, and to public-private partnerships;

m) consumer protection is enhanced through further development and implementation of efficient, science-based food and feed safety standards, consistent with international agreements;

n) policies are explicitly connected to specific objectives or intended beneficiaries, while also limiting the administrative burden on the sector so that total costs to the public are minimised, and that policies are monitored and evaluated regularly for continued relevance, cost-effectiveness and efficiency."

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Note: The text in italics is extracted from the communiqué from the Ministerial of Agricultural Ministers held at OECD in February 2010, the complete text of which can be consulted at www.oecd.org/agriculture/ministerial.

Notes

1. One aggregate measure is the net production index, which is a summary measure of the growth in gross value of production of all commodities included in the Outlook, net of seed and feed costs which are internal to the sector, all measured at constant international reference prices of 2004-06.

2. Brazil, Sao Paolo (ex-distillery).

3. Producer price Germany net of biodiesel tariff.

4. All biofuels use are expressed on the basis of energy contained unless otherwise specified.

5. All biofuel use shares are expressed on the basis of energy contained unless otherwise specified.

6. With the decline in commodity and oil prices, food price increases across the globe subsided in 2009 compared to 2008.

Chapter 2

Price Volatility and Price Transmission

Increased interest in price volatility has been aroused by the rapid rise in food commodity prices in 2007/08, and their subsequent fall. As in former periods of rapid price change, there are different implications for various agents across the food chain. Producers (sellers) clearly benefit and consumers (buyers – food or feed) lose from a rise in prices; the benefits are reversed for a fall in prices. These variations also have different implications for producers and consumers in developed versus developing countries.

When prices spike, consumers in developing countries who spend a high share of their incomes on food are most seriously affected; they may also have less options in their food choices. When prices fall, producers in developed countries often have access to various support schemes and credit markets, while producers in developing countries may face large income fluctuations, often for commodities for which they are highly dependent for their incomes. Moreover, high volatility - an unexpected large rise and fall in prices - imposes large costs throughout the food chain, as uncertainty hinders investments and sectoral development. Governments, who are concerned that price volatility may be increasing, or if not increasing, remaining at unacceptably high levels, are looking for the means to prevent or minimise high price volatility and its harmful effects on their populations.

This chapter examines two dimensions of the question as to whether agricultural commodity prices are becoming more volatile. The first is volatility at the global level. Are the fluctuations in world commodity prices greater now than in the past? The second is market integration and the transmission of international prices to domestic markets. How are shocks in international markets absorbed and by whom? These complex issues are not evident in a projection of the nature provided in this *Outlook*, which assumes an inherently stable trajectory for key driving forces such as crop yields, input prices, energy prices and policy environment. The price spike of 2007/08 is revisited and measures of price volatility are presented. The focus then shifts to a discussion of market integration and price transmission to domestic markets, again looking at the implications for price volatility. Finally, some policy options and a research agenda are discussed.

The global price spike of 2007/08

The agricultural commodity price spike of 2007/08 has been widely examined.[1] In this period international food commodity prices rose to unprecedented levels in nominal terms, as witnessed by the FAO food commodity price index which reached a peak in June 2008, before retreating back to 2006 levels by early 2009. As shown in Figure 2.1, this price surge in primary food commodity prices followed what has been described as the longest and largest surge in global commodity prices in over a century.[2] The factors

underlying this broad surge appear largely global and macroeconomic in nature, including the rapid economic growth of developing countries during the period, particularly in Asia, but also monetary factors including money supply growth, financial laxity and exchange rate movements (particularly depreciation of the US dollar). Given a substantial co-movement among primary commodity prices during the period, food commodity prices, despite their huge implication for food security, were relatively more restrained than many other commodity prices.

Figure 2.1. Co-movements of commodity prices, 2000-10
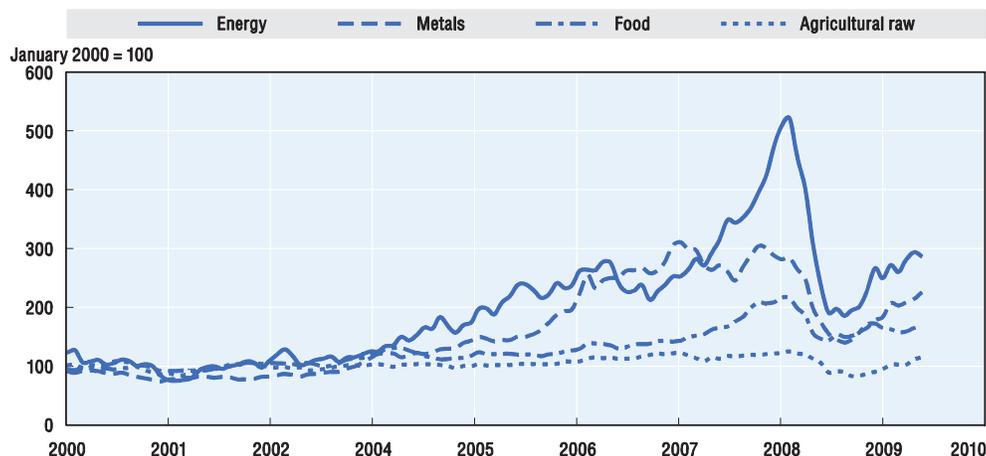
Source: IMF International Financial Statistics (2010).

In the context of the broader commodity price surge, the food price hike was affected by a series of drought-induced crop shortfalls at a time of low stocks. It was also influenced by the increasing integration of agricultural markets to energy markets, and the important impact, both intended and unintended, of government policies. Importantly, energy prices, which experienced the largest price spike, underpinned production costs of agricultural products relying on energy and fertilisers. Coupled to this impact was the emerging demand for feedstocks to support production of biofuels. This impact was largely crop-specific and included maize in the United States, vegetable oils in the EU, and to a lesser extent, sugar in Brazil. Mandated consumption targets for biofuels, and other support policies further re-enforced the links between energy and feedstock prices. Additionally, increased production of feedstocks was to the detriment of other crops whose cultivated areas decreased (*e.g.* wheat and soybeans). Fears about food price inflation incited further policy reaction by food commodity (including rice) exporters and importers alike who were keen to assure food supplies, and in combination put additional upward pressures on prices (Figure 2.2).

Figure 2.2. Co-movements of agricultural food crop prices
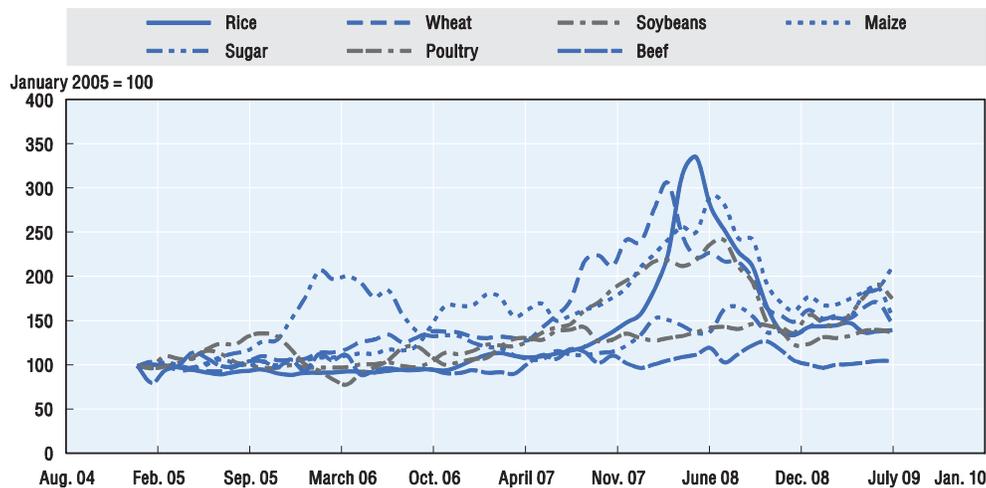
While the energy factor explains an important and controversial part of the increase in agricultural commodity prices, other factors were at play too. Agricultural supply initially exhibited sluggish responsiveness to the increase in demand, not only due weather related production shortfalls and its inherent production lags, but also after having undergone a long period of low investment given the low real prices in the previous decade. Commodity stock levels fell to critically low levels in 2006 and 2007. Macroeconomic factors such as the depreciation of the US dollar and monetary expansion also influenced the crisis, including agriculture. The depreciation of the US dollar improved the purchasing power of many importing countries, causing an increase in prices of commodities which are denominated in dollar terms.

The role of speculation in financial markets encounters vigorous debate. Some analysts argue that low interest rates and low returns in other markets attracted noncommercial investors into agricultural and other commodity markets, fueling higher prices. Of course the causality is debatable - higher prices more likely attracted speculators, rather than the other way round. Anecdotal evidence suggests the number of traders in futures markets increased as prices increased. For example, institutional investment funds, which trade on large, long-term commodity-indices rather than specific markets, may have had a role in rising futures prices. Various studies, such as by Irwin and Saunders (2010) and Gilbert (2009), provide differing conclusions as to whether index funds have caused the 2006-2008 bubble in commodity prices.

Volatility and uncertainty in agricultural markets

The nature and causes of commodity price volatility is complex, and many contributing factors can be identified. Price volatility refers to unpredictable price movement. The nature of volatility, in terms of periodicity of movements, either daily, monthly, yearly, or season of a year may have differing implications for producers or consumers depending on the commodity.[3] Agricultural prices have followed a long run stagnant trend, punctuated by high spikes; at least one study has identified three major

spikes over the period 1970 to 2008.[4] In terms of causes, volatility fundamentally follows from the dependence of agricultural production on weather conditions, which can have direct impacts on the variability of yields. It is also compounded by low short run supply responses to price changes (*i.e.* low supply elasticity), when production decisions have already been taken. Demand responses for food are often also typically low given that food itself is an essential product. Under these basic circumstances, prices often react strongly under seemingly small shocks to demand and supply. The low elasticity of supply can be compensated partly by stock holding, which enables continued supply to meet demand. Hence, stocks play a critical role, unless they are reduced to low levels which limit their cushioning effect. Low levels are associated with periods of higher price volatility (see Deaton and Laroque, 1992; Balcombe, 2008; and Chavas and Kim,2006).

Shocks can be transmitted from other markets. They can originate from the demand side such as economic expansions or recessions; or from the supply side through reduced supply of inputs, availability of substitutable/complementary products or, typically, energy markets. Finally, shocks can be transmitted through macro economic variables such as exchange rates and terms of trade. Balcombe (2008) finds that the volatility of most individual food commodities is positively related to the general volatility of other agricultural commodities.

One common measure used to gauge price volatility is the coefficient of variation (CoV) of a given price series, which expresses an estimation of the variability of the series as a ratio to its average value. This permits comparison across commodities with different average prices. A traditional measure of variability used in this calculation is the standard deviation of observed prices. This measure refers to *ex post* observations of actual prices, but it implicitly considers all price variability to be unexpected. Clearly, some variability can be predicted (*e.g.* seasonal variation, business cycles, or other trending behaviour) such that results from using the simple standard deviation may overstate the degree of volatility or uncertainty (for more discussion, see Moledina *et al.,* 2004). Therefore, in order to have a better measure of the unpredictability or uncertainty faced by the market, it is common to take into account only movements of the series that cannot be predicted on the basis of its previous values. Table 2.1 presents the CoV of prices for a selection of commodities, after the predictable component has been removed from the observed values.[5] Values close to 0 indicate small volatility, and higher values denote greater volatility.

The results indicate a wide diversity of experience in price volatility. International price volatility is indeed large. For the selected countries and commodities displayed below, domestic price volatility is generally lower than for international markets. Important exceptions include some developing countries such as maize in Uganda, or wheat in Sudan, for which prices have been more volatile. For markets more open to trade, volatility in prices converges to values close to those in international markets. For countries which use price stabilising policies extensively, such as India, China and Japan, price volatility is substantially less than international markets. It should be noted, however, that comparison across countries is complicated by many factors, including product quality or attribute differences which may affect the diversity of movement in market prices.

Table 2.1. Coefficients of variation of commodity prices in selected countries: 2006-10

	Maize	Rice	Wheat
International	0,110	0,117	0,080
Argentina	0,084		
Australia			0,080
Bangladesh		0,055	0,056
Brazil	0,103	0,085	0,118
Burkina Faso		0,102	
Cambodia		0,107	
China		0,012	
Ecuador	0,046		
Egypt			0,081
EU	0,061		0,096
India		0,034	0,043
Israel			0,061
Japan		0,027	
Kenya	0,093		
Mexico	0,042		
Peru			0,026
Philippines		0,046	
South Africa	0,078		
Sudan			0,128
Thailand		0,117	
Uganda	0,157		
United States	0,110	0,110	0,080

Source: FAO (2010). Prices are wholesale monthly prices per tonne, converted in USD, for the period January 2006-January 2010. International reference prices are US for maize, wheat; Thailand for rice.

Due to recent price fluctuations, the question of whether price volatility has increased is being debated. Figure 2.3 plots the nominal annualised historic volatility for the same three crops over 1957-2009. While one can distinguish spikes in the volatility due to the 1971-73 and the 2007/08 price hikes, there is no apparent trend in the series, suggesting that volatility of observed prices may increase for certain periods, but then return to normal levels. Table 2.2 documents the estimated CoVs for these crops over the period 1967-2009 using monthly data. Similarly, no clear pattern emerges when making comparisons across decades. In the past twenty years, historic price volatility of wheat and maize has increased, but over a longer time span there is little discernable evidence of such a trend. In fact, prices appear to have been less volatile in the most recent decade than throughout the 1970-80s. Note also that for rice, Table 2.2 shows declining price

volatility in decade averages over the past thirty years. Using more formal time series analysis methods Balcombe (2008) also investigates the dynamics of international commodity prices over a long period. Using monthly and yearly observations, the author does not find evidence of a trending behaviour in price volatility. A recent study by Gilbert and Morgan (2010) also confirms this general result. However it finds an important exception in the case of rice prices, for which price volatility may be increasing. Other evidence, however, based on analysis of implied volatility inferred from options market prices, which offer an indicator of market uncertainty about the subsequent futures and cash prices, for maize and wheat, suggests that market uncertainty and unpredictability for these commodities has risen over the past twenty years.[6] Given this mixture of results, based on differing methods and time spans, the evidence is inconclusive as to whether and how price volatility has changed. More research is required.

Figure 2.3. Nominal annualised historic volatility: cereal commodities
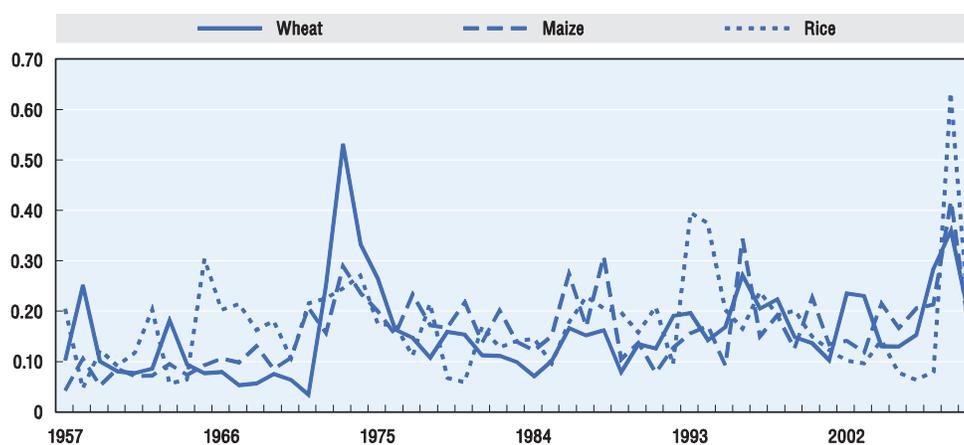
Table 2.2. Historic annualised volatility of international grain prices

	Maize	Rice	Wheat
Average 1967-69	0,088	0,154	0,104
Average 1970-79	0,194	0,183	0,208
Average 1980-89	0,185	0,157	0,123
Average 1990-99	0,089	0,121	0,096
Average 2000-09	0,135	0,116	0,112

Source: FAO (2009).

Even if the assessments are mixed, high price volatility is an on-going characteristic of agricultural markets. The current debate centres on whether there are now new factors which may cause higher price volatility in the future. First is the increased linkage between energy and commodity markets. As agricultural production increasingly relies on energy inputs on the supply side, and is increasingly used as feedstock for energy production, commodity prices will tend to be increasingly linked with oil prices and the

volatility of energy prices will be transmitted to them. Uncertain energy futures in the context of a recovering and expanding global economy, and apparently fixed supplies of conventional fuel sources, raises fears of "food versus fuel" in times of shortages. It is expected that if energy prices rise further, the link with food prices will be stronger.

Another new element is the presence of large institutional investors in futures markets, and concerns over the potential for speculation to influence food commodity prices in the short term. In terms of policy, according to Chavas and Kim (2006) the removal of stabilisation policies and the reduced public stocks of food grains have created conditions favourable to greater price volatility. This last point is particularly important with respect to China, which has greatly reduced its stocks over the last 10 years. The common view is that low world stock/use ratios translate into an inability of world markets to help stabilise prices when there are adverse shocks to short-term supplies. Finally, there is concern that extreme weather events, associated with climate change, are increasing in frequency and impact. High production variation, particularly by major suppliers/exporters, would induce higher price volatility in the future.

The transmission of international prices to domestic markets

Movements of prices in global markets are arguably less important than what happens inside domestic markets, as trade is a low percentage of global transactions.[7] The issue is how global price movements affect domestic prices and markets for agricultural products inside countries (and, potentially, *vice versa*). This is the concept of "spatial price transmission", which is an economic process by which prices in spatially separate jurisdictions may be influenced by arbitrage/trade between them. In terms of global to domestic markets, it is a measure of the extent to which domestic markets are integrated with global markets; a high degree of price transmission is indicated by co-movement in prices, and a low degree of price transmission is indicated by prices which move independently of each other. Price transmission may also be assessed within domestic markets, measuring the impacts of price movements vertically in the food chain, and this also impacts how international prices may be transmitted differentially to producers and consumers. Assessment of vertical price transmission involves a host of important domestic issues which are beyond the scope of the current discussion and is omitted from the analysis presented.

Price transmission is affected by the movement, or the potential movement, of imports or exports to take advantage of price differentials in spatially separated markets. Hence price transmission must take account of transaction, transport and informational costs between markets, as well as differences in product attributes. Importantly, domestic policies often play the critical role in price transmission, as import or export restrictions, variable tariffs or export taxes, and import risks due to sanitary or phyto-sanitary inspection affect the movement of goods. International pricing schemes, such as minimum support prices or intervention policies affect price transmission among markets. Market structures also may play an important role if importing or exporting agencies exercise market power in conducting their operations.

Figures 2.4, 2.5, and 2.6 provide evidence of price movements experienced for the major traded food grains in selected developing and developed countries relative to those of international reference prices during the price hikes of 2007/08, and the consequent recession of 2009.[8] The evidence of these figures confirms the results of a large number

of studies which indicate that the impact of higher global prices varied substantially across countries.

Figure 2.4. International and wholesale prices of rice
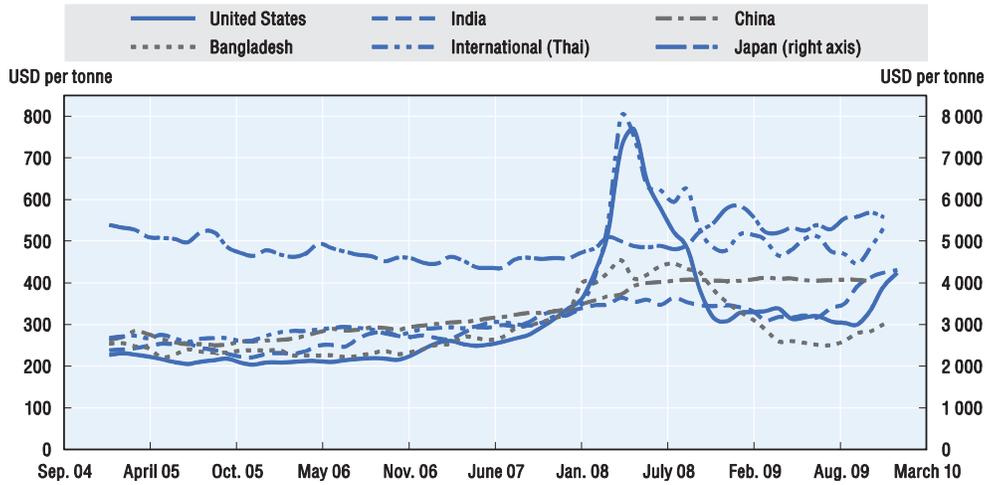
Source: FAO : see http://www.fao.org/giews/pricetool/; Ministry of Agriculture Fisheries and Forestry : http://www.maff.go.jp/e/tokei/kikaku/monthly_e/index.html

Figure 2.5. International and wholesale prices of wheat

Source: http://www.fao.org/giews/pricetool/
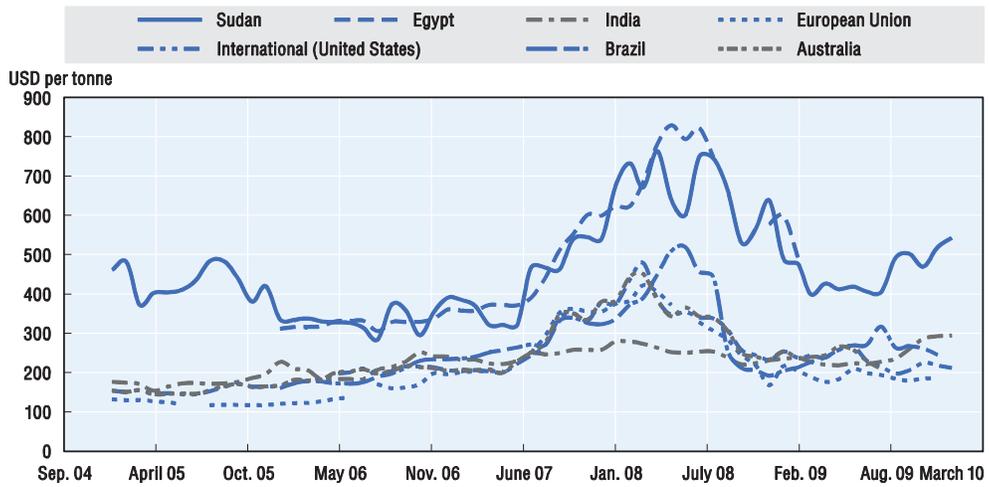
Figure 2.6. International and wholesale prices of maize
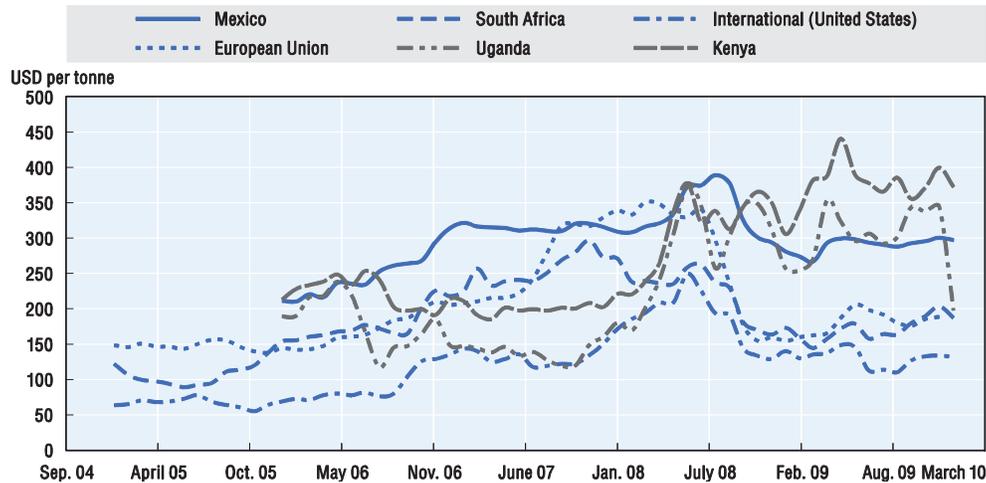
For rice, markets of key exporters, such as Thailand (the international reference point for rice) and the United States, face, by the fact of their high export exposure the full brunt of international price fluctuations. The level of trade can affect price transmission. Market prices for certain importers, such as Bangladesh, reacted less than international prices, showing similar movements in terms of timing but with considerably less amplitude. Prices in some large markets such as Japan, India and China barely reacted at all to international price movements. In fact, prices in these markets appear largely independent of international markets, and often evolved in opposite directions over the period. The presence of support price systems, and managed trade environments where varying import tariffs, tariff quotas, export bans, or export taxes were imposed played a key role in reducing the transmission of high international prices for rice to domestic markets.[9] At the same time, analysis suggests that imposition of export bans or tariffs by key exporters also played an important role in exerting upward pressure on international prices by restricting supplies. In fact, most major rice producing and consuming nations have various forms of price intervention systems in place.

In wheat markets which are larger and less protected, data for selected countries appear to show stronger co-movements with international prices than for rice, although similar patterns remain for certain countries such as India which appear largely independent of other prices. While greater coherence in prices may be noticeable, some markets illustrate that their reaction takes time, such that their key turning points lagged behind those of the international reference price by several months.

For maize, similar patterns are also shown across countries except, for this important food crop in Africa, it appears that prices rose with the international price spike, but continued to rise after the downturn of late 2008. This pattern is illustrated for Kenya, and is partially due to the fact that an appreciating real exchange rate shows rising prices in US dollar terms. In addition, the diversity of movement for maize in these countries is affected by differences in products (*e.g.* white versus yellow maize), but their resilience to the deflation of commodity prices in late 2008 and 2009 is remarkable. However, in November 2009, among the 860 domestic price quotations monitored by FAO, more than

60% of them were more than 25% higher than their level two years before.[10] Some studies (Morisset, 1998) have found that world prices tend to be well transmitted when they increase but less when they decrease. On the other hand, it is often observed that when world prices do fall substantially, developing country markets can be quickly inundated with lower cost imports.[11]

It is difficult to draw firm conclusions from visual inspection of data presented in figures for selected countries and commodities. Preliminary tests (not reported) on these series suggest low levels of co-movement between domestic and world prices.[12] More rigorous research is becoming available which uses sophisticated time series analysis methods to analyze price transmission. For example, recent work at FAO has examined price transmission for several commodities in several African countries.[13] This work found strong statistical evidence for co-movement of white maize prices in South Africa with world yellow maize prices (US), and similarly for some other southern African countries such as Malawi. However, results for other countries, particularly for eastern African markets such as Kenya reveal weaker integration with external markets, and many other markets with little or no co-movement. Where some co-movement of prices was found, transmission was estimated to be complete after 4-9 months.

Other FAO work has examined rice price transmission in Asian markets.[14] This work concluded that price transmission was weak in Bangladesh, India, Philippines and Vietnam during the 2006-08 price spike, due largely to exchange rate movements and government policies implemented expressly to stabilise domestic markets. The study found that prices in Indonesia have actually been destabilised by domestic policies. China, which normally does not allow private trading, allowed international price signals to be reflected in domestic consumer prices. The study further indicated that as international rice prices soared in 2008, domestic prices in most Asian countries also increased despite stabilisation programmes.

There is a substantial literature on price transmission in agricultural markets, most of which has been undertaken before the price spike of 2007-2008. For example, Rapsomanikis (2009), Rapsomanikis, Hallam and Conforti (2003, 2004), and Conforti (2004) shed light on the degree of integration for developing countries. The findings emerging from this work also assess the various conditioning factors in price transmission, in particular the fact that non-tariff trade barriers, domestic policy and lack of domestic infrastructure can significantly obstruct the transmission of international price fluctuations.

Other studies trying to test more formally the link between policy and price transmission identify key policy shifts undertaken during structural adjustment reforms (Conforti, Baffes and Gardner). By testing for structural breaks in the data, it is possible to evaluate whether price transmission improved as a result of policy reforms. One often cited example is that of maize in Egypt, a country that underwent significant agricultural liberalisation measures in the late 1980s.[15] There, the transmission of world to domestic prices went from being non-existent to near 100% in years following structural adjustment reforms (Baffes and Gardner). But such clear cut examples are the exception. In that same study, only 11 instances of structural breaks due to reform were identified. Of those, the transmission of world prices to domestic markets increased significantly in six cases (Ghana's rice, Madagascar's wheat and rice, Egypt's maize, Colombia's maize, and Argentina's wheat). The majority of the country-commodity cases did not detect a significant effect of reform on either short-run transmission or longer-term adjustment of domestic to world prices.

The relationship between market integration and volatility is a complicated one, and largely dependent on the causes and sources of a given shock. On the one hand, the more fluid the flow of trade, the greater the capacity of markets to dissipate a shock. For a drought in a country, for example, imports can limit domestic price increases, and for a bumper crop, exports can limit price declines. If such events occur in a very large country, stronger integration can transmit domestic shocks to international markets, affecting volatility in all countries. However, by the same token, domestic stabilisation policies may destabilise world markets, as was seen when export bans in major rice exporting countries were put into effect in 2007/08.

If the study of price transmission points to the role of domestic policies in affecting the integration of world and domestic markets, many of those policies have been put in place because global prices are considered to be too volatile. Volatility is an important concern both at the macro level for the government and at the micro level for both consumers and for producers. Indeed, the delay between production decisions and actual production creates risks for the producers, who often must establish decisions based only on an estimation of future prices. On the demand side, high prices affect consumers whose food expenditures may constitute a high percentage (in some countries, as much as 70%) of household income. As a result of these concerns government policies attempt to stabilise international price fluctuations by border policies, stock holding policies and price intervention schemes. In some cases consumer prices are mandated in the effort to contain price volatility.

Private measures, such as futures markets, exist in most developed countries offering the possibility to mitigate risk, but such institutional structures are not easily implemented in developing countries. For producers, a normal strategy to circumvent uncertainty is to diversify production to encompass different commodities whose prices are not correlated. While diversification can help reduce risk, it can also reduce advantages related to increasing returns, and might lead to investment in less risky but less profitable crops. But in general, risk averse producers are likely to produce less than under more certain situations (Holt and Aradhyula, 1990). This may be particularly true if the costs of investments required for production are high. The use of production contracts, as a means to spread risk within the food chain has increased markedly over time in certain markets, particularly but not exclusively in developed countries. For consumers, strategies to avoid large variations in food costs are difficult. Diversification of diets may be possible, but with low incomes, and the lack of means to undertake precautionary savings, low income consumers face difficult circumstances under a price surge, and often must reduce consumption.

On the macro scale, price volatility plays an important role especially for developing countries that have a less diversified production base, and where import or export of a commodity represents a large share of the trade balance. Indeed, in these situations, large changes can induce considerable disequilibria on trade balances, including export revenues or, importantly the food import bill, both of which may threaten food security.

Price volatility: what are the policy options?

Governments and policy-makers remain concerned about future price fluctuations, and in particular, about the impact of such shocks on their domestic economies. Price fluctuations have important implications for resource allocation in agriculture and the food security of the world's poor who typically spend an important share of their income on food. The degree of market integration has important implications for the transmission of these shocks to domestic markets, but also for the magnitude of the fluctuations themselves. Terms-of-trade effects of higher food commodity prices have also important implications especially for resource-poor countries; and even in cases where price fluctuations do not affect a country's balance of payments, adverse effects on the poor and food insecure have been observed following the 2007/08 price increases. High food prices clearly place a burden on poor net food importers; however, they also present an opportunity to encourage food production and enhance the contribution of agriculture to poverty reduction and economic growth.

Recent policy responses to higher food prices

A large number of emerging and developing countries, including those covered in the OECD policy monitoring report on emerging economies, made various policy interventions in response to the higher food prices in 2007/08.[16] The most common policy response was to reduce or suspend taxes and import tariffs on food products (albeit in some cases at a fiscal cost), followed by the imposition of export barriers. The wide range of interventions also included the release of government held stocks, measures to stimulate domestic production, retail price controls, consumer subsidies for staples specifically targeted at the poor, changes to biofuel policies and direct income transfers.

Most short-term policy responses in key emerging economies to international agricultural price surges in 2007/08 were dismantled in the second half of 2008 and in 2009. But food security considerations frequently associated with objectives of high levels of self-sufficiency in production of selected commodities, further enhanced by the price surge, remained an important driver for agricultural policy measures applied by emerging economies' governments in 2009. For example, while China eliminated export taxes on grains in mid-2009, VAT rebates on grain and soybean exports had not been reintroduced by the end of 2009 and the objective of 95% self-sufficiency in grain production led the government to increase minimum prices for grains and to add to already high input subsidies in 2009.

A large part of India's policy responses remained in place. While some export restrictions on selected grains and pulses were lifted in 2009, the export ban on rice, reduced tariffs on imports of selected grains, pulses and oils, limitations on private stockholding, de-listings from futures trading on rice continued to be implemented in 2009. Moreover, to stimulate production, minimum support prices for over 20 commodities listed were increased significantly in the season 2008/09, but then left mostly unchanged for the 2009/10 season. While fertiliser subsidies reached record high levels in 2008/09, they were budgeted to decline by one-third in 2009/10 due to the decline in the prices of imported fertilisers.

Some other Asian countries, such as Indonesia and Vietnam, lifted all short-term export restrictions, but continued to apply reduced tariffs on imports of a wide range of food products (Vietnam) and continued to provide yield-enhancing input subsidies in

particular for rice producers (Indonesia). Russia and Ukraine lifted short term policy responses limiting grain exports, but Russia's drive to increase self-sufficiency in livestock production led the government to impose further limitations on meat imports and to stronger budgetary support for livestock producers in 2009 and early 2010. Argentina lifted some export restrictions such as maximum export prices for dairy products and lowered its export taxes on cereals and soybeans. Chile and South Africa are among very few emerging economies that focused on one-off direct support to consumers and did not apply any policy responses directly affecting the price or increasing the supply of agricultural commodities on domestic markets. In Brazil, all trade-related measures were lifted in 2008 while cash transfers to the poor population and concessional credits for agricultural producers gained importance in 2009. Analysis is underway at both the OECD and FAO into the efficiency and effectiveness of these policy responses.

In most OECD countries, poverty rates are below those in the emerging economies and the impact of price fluctuations on producers, rather than consumers, dominate governments' concerns. Many OECD countries maintain policies to protect farmers from low prices: the marketing loan assistance and countercyclical programs in the United States, the intervention price mechanisms in the European Union, the rice diversion programme in Japan and the supply management and agri-stability programmes in Canada. Those are also part of the policy response to price fluctuations and of the price transmission between global and domestic markets.

Policy alternatives toward a holistic risk management

Governments are concerned about the impacts on consumers and food security (particularly poor consumers when prices are high) and impacts on producers (particularly when price are low). Fluctuations in prices and production are common in agriculture and traditionally part of a farmer's risk management strategy. The broader policy question is how can policy underpin farmers' and consumers' risk management strategies?

Governments have a role to play in facilitating access to market and non-market strategies, while empowering farmers to take responsibility for managing their own business risk[17] (as well as assisting poor consumers with food expenditures). Good risk management practices require a diversified government strategy to facilitate the management of the impacts of different agricultural risks on targeted populations. The distinction needs to be made between normal risks that are frequent but generate limited damage and catastrophic risks that are rare but have large consequences for individuals or regions. These latter risks should be the main focus of policy actions, keeping in mind the pre-existing policy environment and the whole set of risks affecting the targeted population.

From the point of view of farming risk management, most OECD countries offer market price support and technical and investment support, such as water management and inspection services. *Ex ante* measures for risk mitigation, in particular income tax smoothing systems for agriculture are also used. Some countries go further by providing payments that are countercyclical with respect to prices or revenue, and provide subsidies for insurance policies or futures contracts. Support for income diversification strategies is rare, but in some countries rural development and social policies may provide alternative sources of incomes. *Ex post* risk-related measures, such as disaster relief, social policy, and other *ad hoc* assistance like debt relief and labour replacement are also available in

most countries. Typically countries with lower levels of price support have larger shares of risk-related payments.

A great diversity of sectoral and non sectoral policies, sometimes addressing part of the risk, affects agricultural risk management. This may have unintended effects due to important correlations between different sources of risk, policy instruments and risk management strategies. Countercyclical payments may discourage farmers from taking advantage of natural hedging due to negative production/price correlations; make market instruments less attractive; and contribute to the incompleteness of markets. Insurance subsidies may discourage farmers' diversification strategies. Generous disaster assistance may displace other risk management strategies. Good risk management policies for the agricultural sector need good risk governance through: creation of markets by addressing market failures such as missing asymmetric information; avoidance of rent seeking incentives in support and disaster assistance; accounting for trade-offs between different government objectives that most reduce risk may not have the largest positive impact on farmers' welfare.

Tools for increased market information should be enhanced. At national levels, governments should promote mechanisms to encourage price discovery and tools for hedging of market risks by local agents. Organised commodity exchanges are useful and time tested price discovery and hedging institutions, if they are regulated properly and attract sufficient contract volume to avoid monopolistic practises. They have facilitated commodity marketing in many developed countries and their expansion in developing countries is a welcome institutional development and a sign of market deepening.

The case of price support

Recent events have brought the discussion of the desirability of price support for agricultural commodities back to the forefront of debate on agricultural policy. Policy in OECD countries was largely dominated by price support mechanisms in the past - and price support still accounts for a significant share of total support to the sector. There is therefore a wealth of information and analysis concerning their effects.[18] One of the most notable effects is of course to mask price signals to producers. Usually governments have set prices higher than market clearing levels leading to the kinds of market and trade disruption that characterised the 1970s and 1980s when surplus production was disposed of through export subsidies and dumping. Price support has also had the effect of raising prices to consumers. This is equivalent to a regressive tax to the extent that poorer consumers tend to spend a higher share of their household budget on food.

It is also well established that price support can have perverse distributional effects on the producer side, raising prices and incomes in direct proportion to production, so that the distribution of support is heavily skewed towards the biggest producers. Clearly, this problem is most serious in countries where the distribution of production (or land) is itself heavily skewed. Price support has also encouraged intensification with sometimes adverse effects on environmental outcomes as farmers used increasing quantities of fertiliser and pesticides in pursuit of higher output and fragile lands were brought into production, also with adverse effects on environment, soil quality and biodiversity. Finally, price support is found to have an extremely poor transfer efficiency - that is a relatively small proportion of the price increase it generates is actually captured by farmers. Instead, it goes to input suppliers, is captured by processors and distributors or ends up capitalised in land values, benefitting land owners who are often not themselves farmers.

International policy considerations

While price volatility may not be increasing, it is certain that price surges will take place periodically, and given that the causes and consequences tend to be global in nature, a co-ordinated international policy response is appropriate. A major aspect of any commodity price spike is a fast and sudden erosion of confidence in the workings of the market, both national and international, with the result that uncoordinated operations, by private and public agents alike, for individual protection leaves all worse off. In this context, there is a need for enhanced rules and disciplines, particularly those which concern export bans and taxes, which enhance confidence in market access in times of crisis.[19] The most efficient way to reduce the probability of future surges in global food markets is to promote market information, transparency and competition and at the same time to create or enhance institutions to ensure confidence in the markets.

At the international level, policy options to stabilise prices are limited. The complex mechanisms by which world market price surges arise and the individual country reactions which follow render international interventions difficult. International stock management schemes, such as those characterizing the International Commodity Agreements, require continuing commitment and are vulnerable to changing market conditions. Indeed, the experience of international food reserves has not been promising. As one example, the ASEAN *Food Security Reserve*, established in 1980 with an initial stock of 50 000 tonnes of rice, has been used infrequently, if at all. Moreover, the quantities in the Reserve are very small and would only be sufficient to deal with localised shocks. Establishment of a larger scheme, by extending to more countries or holding higher levels of stocks would likely encounter even larger collective action problems.[20]

The experience with public buffer stocks suggests that, often, such interventions have been disruptive, rather than stabilising. Given the current state of knowledge about markets and previous experiences with collective action problems, it is not clear how such initiatives could present practical solutions on a multilateral basis. The same concerns arise for what has been termed "virtual stocks" which are designed to alter the fundamentals of the futures rather than the cash markets.[21] Any attempt to publicly influence the prices in futures markets might become extremely expensive and could lead to a withdrawal of the agents who use the futures markets for hedging purposes, thus rendering futures market purely speculative.

Stockholding programmes which specify rules for public stock levels and release for during emergency situations may underpin confidence necessary to prevent panic and hoarding. However, past experience suggests that a study of best practices in stockholding for emergency situations may provide useful information for capacity building in those countries most concerned about food security. One of the major international responses to commodity market volatility in the past has been compensatory financing, such as what was provided through the European Union's *Système de Stabilisation des Recettes d'Exportation* (STABEX) to ACP countries and the *Compensatory Financing Facility* of the International Monetary Fund (IMF). Both programmes aimed to provide compensatory finance to help countries avoid a negative impact on growth from sharp commodity price changes.[22] During the recent price surge, a number of countries which experienced significant increases in their food and fertiliser import bills, resorted to the *Exogenous Shock Facility* (ESF) of the IMF. ESF provides for liquidity to mitigate the negative impact of exogenous shocks on developing countries' balance of payments, international reserves position and inflation.[23]

Although compensatory financing mechanisms can be used to stabilise the economies of developing countries during price surges, they may not be appropriate for addressing short-term food financing difficulties. The need for such food financing facility to assist low income net food importing developing countries was foreseen by the Marrakesh Decision and the World Trade Organization (WTO) Ministerial Conference at Doha.[24] On the basis of analysis by FAO, it was suggested that a *Food Financing Import Facility* (FIFF) be created to enable a country to finance food imports when there was a need, rather than to compensate balance of payment losses after the fact.[25] Very little has been pursued on FIFF or similar alternatives, perhaps due to the low food price period that ensued. However, an international food import financing programme could have provided some relief to the affected countries during the recent period of soaring food prices. The rationale for this suggestion remains valid.[26] The DDA draft modalities text (WTO, 2008) has refined rules on how food aid would be governed, as between emergency and non-emergency situations, to facilitate more effective and market responsible assistance.

An international research agenda

A number of institutions or arrangements could ensure more confidence in global markets, and assure smoother flows of food supplies. The FAO has identified a number of areas for further analysis and discussion.[27]

- An enhanced system of global market information, in particular more accurate and timely information on national stocks of commodities.

- A system of timely advance notice of agricultural trade policy measures affecting the supply of agricultural exports and the demand for imports, and possible disciplines on such measures.[28]

- Multilateral or regional agreements among major exporters and major importers to assure normal flow of supplies during crises.

- A reliable system of assurance of supplies for the most vulnerable countries which could also be enhanced by guarantees of trade finance.

- A market based insurance system for imports of the most vulnerable countries which could provide fast disbursing funds in such cases.

- A linking of organised commodity exchanges across different countries to ensure that all transactions are executed and avoid the problems of counterparty risk experienced by some food importing countries during the recent crisis.

Ministers for Agriculture from the OECD countries, and from non-OECD countries that are major players in food and agricultural markets met in Paris on 25-26 February 2010. In their communiqué, Ministers[29] also expressed concern about the significant price volatility in recent years and recognised that, in this context, *an integrated approach to food security is needed* while *governments should ensure that appropriate policies are in place to facilitate the management of risk.* Among other areas identified for further analysis, *they requested that OECD:*

- *i) distinguish areas where farmers and the agro-food sector can address challenges and exploit opportunities on their own, from areas where government policy responses might be required;*

- *(ii) harness OECD's broad expertise and capacity for horizontal work to explore policy options that would contribute to growth and development, to poverty alleviation and to building global food security on a long term and sustainable basis, building also on experiences and expertise in the developing countries themselves;*

- *(vi) analyse the functioning of markets and the extent to which the changing physical and market environment is generating new or increased risk and volatility affecting the agriculture and food system, and define appropriate individual, market or public responses to manage risk; and ensure transparency and efficient functioning of markets;*

- *(viii) explore how trade policy, on both the import and export side, can contribute to building global food security and sustainable resource use, paying particular attention to policies that might be needed to facilitate adjustment and to ensure outcomes that are equitable as well as efficient.*

The policy issues related to price volatility identified above provide a useful research agenda for international organisations, national governments and academic institutions.

Notes

1.   See FAO (2009); OECD (2008, 2009); Abbott and Borot de Battisti (2009), Sarris (2009c).

2.   See World Bank (2008).

3.   For illustrative purposes, the analysis of volatility in this chapter refers to average monthly data.

4.   See FAO (2009a).

5.   We use here such a measure in Tables 2.1 and 2.2, where the decomposition between predictable and unpredictable part is done with an AR(p) process which best fits the data in each case. The volatility then refers to the standard deviation of the unpredictable part (the residuals of the AR) only, and may remove a substantial amount of the variation in the raw data. For example, this method reduces the standard coefficient of variation from 0.32 to 0.11, from 0.39 to 0.08, and from 0.41 to 0.12 for the international prices of maize, wheat and rice, respectively. Consequently, the way volatility is measured affects the results obtained and care must be used in interpretation.

6.   See FAO, (2009), "Implied Volatilities", *Food Outlook*, December, p. 98.

7.   For example, global trade (exports) as a ratio to production in 2007/08 was about 7%, 10% and 19% for rice, coarse grains and wheat respectively.

8.   Comparing in different currencies is difficult. The figures use US dollars, but it may be more appropriate to adjust for relative price inflation in the non-food sectors of each country to normalise for other factors influencing commodity prices. Data for Japan and the EU come from their respective websites. Prices were converted from local currencies to US dollars using monthly average exchange rates reported by the IMF (2010) International Financial Statistics database.

9.   See Gilbert and Morgan (2010).

10.   See FAO (2009b).

11.   See FAO Briefs on Import Surges at www.fao.org/economic/est/publications/import-surges/en/

12.   Only Australian and EU wheat prices showed evidence of co-integration with world reference prices, over 2005-2010.

13.   See Rapsomanikis (2009).

14.   See Dawe (2008).

15.   In 1986, the government of Egypt underwent structural adjustment reforms which included the liberalisation of domestic prices, exchange rates and interest rates, and removal of import and export restrictions. For additional information see Raspsomanikis *et al.* (2006).

16.   For a detailed description of the policy responses in Brazil, Chile, China, India, Russia, South Africa and Ukraine, see OECD (2009), *Agricultural Policies in Emerging Economies: Monitoring and Evaluation 2009.* For a survey of policy responses in developing countries see FAO (2009), *The State of Commodity Markets*, Part 3.

17.   For a detailed discussion see, OECD (2009), *Managing Risk in Agriculture; A Holistic Approach.*

18.   For a discussion of policy design and reform, see OECD (2002) *Agricultural Policies in OECD Countries: A Positive Reform Agenda* and OECD (2008a) *Agricultural Policy Design: A Synthesis*.

19.   Various proposals have been made in the context of current WTO negotiations to correct the current imbalance of import and export rules to imports, including the binding and elimination of export taxes, and prohibition of export restrictions.

20.   The purpose of the ASEAN Food Security Reserve, as stated in the original Agreement, is to provide for a supply of rice in emergency situations when a member country, having suffered a natural or man-induced calamity, is unable to cope with such state or condition through either its national reserve stocks or normal international trade. See also Dawe (2005).

21.   Proposals for intervention in the futures markets can be found in von Braun and Torero (2009).

22.   The IMF Compensatory Financing Facility has not been used since 2000 due to very tight conditionalities. See IMF (2004).

23.   Countries which made use of the Exogenous Shock Facility to mitigate the impact of the food and oil price surge include Ethiopia, Malawi, the Kyrgyz Republic, Senegal, Mozambique and Kenya. Other countries resorted to the Facility due to the impact of the global economic downturn.

24.   Report of the Inter-Agency Panel on Short-Term Difficulties in Financing Normal Levels of Commercial Imports of Basic Foodstuffs, Document G/AG/13, WTO Committee on Agriculture, 28 June 2002.

25.   For a recent analysis of this proposal, see Sarris (2009b).

26.   For more on trade rules that maybe required in the medium term in light of envisioned developments, see Sarris (2009a).

27.   FAO (2010), *Management of Wide International Commodity Price Movements - National and International Experiences and Policy Responses*, presented to the 68th session of the FAO Committee on Commodity problems.

28.   The current Agreement on Agriculture in the WTO does not prevent governments from reducing or banning exports.

29.   The full text of the communiqué can be found at www.oecd.org/agriculture/ministerial

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ANNEX A.

TABLES

Table A.1. Economic assumptions

Calendar year (a)		*Average 2007-09est.*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
REAL GDP (b)												
Australia	%	2,4	2,4	3,5	4,0	4,1	4,0	4,0	3,9	3,2	3,2	3,2
Canada	%	0,1	2,0	3,0	2,8	2,3	2,2	2,1	2,1	1,6	1,6	1,6
EU 15	%	-0,3	1,0	1,8	2,3	2,2	2,2	2,2	2,2	1,7	1,7	1,7
Japan	%	-1,4	1,5	2,0	1,6	1,1	1,1	1,1	1,2	1,2	1,2	1,2
Korea	%	2,5	4,4	4,2	4,8	4,7	4,6	4,5	4,3	3,8	3,8	3,8
Mexico	%	-0,6	2,7	3,9	4,0	4,0	4,0	4,1	3,9	3,0	3,0	3,0
New Zealand	%	0,4	1,5	2,7	2,7	2,3	2,3	2,2	2,3	2,0	2,0	2,0
Norway	%	1,3	1,3	3,2	3,8	3,6	3,5	3,3	3,2	3,3	3,3	3,3
Switzerland	%	1,2	0,9	1,9	2,6	2,9	3,0	3,0	2,9	2,5	2,5	2,5
Turkey	%	-0,1	3,3	4,2	4,6	4,6	4,6	4,6	4,6	4,6	4,6	4,6
United States	%	0,0	2,5	2,8	2,8	2,6	2,7	2,7	2,7	2,3	2,3	2,3
Argentina	%	4,4	2,3	2,4	4,7	4,7	4,6	4,6	4,6	4,6	4,6	4,6
Brazil	%	3,6	3,6	3,9	3,2	3,2	3,1	3,1	3,1	3,1	3,1	3,1
China	%	10,1	8,7	9,0	8,5	8,4	8,2	8,1	8,2	8,2	8,2	8,2
India	%	7,1	7,5	8,0	6,9	6,9	6,8	6,8	6,8	6,8	6,8	6,8
Russia	%	1,7	3,2	3,4	5,6	5,5	5,3	5,3	5,4	5,4	5,4	5,4
South Africa	%	2,1	2,1	3,5	4,2	4,3	4,3	4,3	4,3	4,3	4,3	4,3
OECD (c) (d)	%	-0,2	1,9	2,5	2,7	2,5	2,5	2,5	2,5	2,1	2,1	2,1
PCE Deflator (b)												
Australia	%	3,3	2,4	1,8	2,2	2,5	2,5	2,5	2,5	2,5	2,5	2,5
Canada	%	1,3	1,1	0,9	1,6	2,1	2,1	2,1	2,1	2,1	2,1	2,1
EU 15	%	1,9	0,5	0,6	1,5	2,0	2,0	2,0	2,0	2,0	2,0	2,0
Japan	%	-0,5	-1,1	-0,8	0,5	1,1	1,1	1,1	1,1	1,1	1,1	1,1
Korea	%	2,9	2,8	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
Mexico	%	6,3	4,4	4,8	3,9	3,2	3,2	3,2	3,2	3,2	3,2	3,2
New Zealand	%	2,7	1,4	1,4	1,9	2,1	2,1	2,1	2,1	2,1	2,1	2,1
Norway	%	2,5	1,7	2,2	2,2	2,1	2,1	2,1	2,1	2,1	2,1	2,1
Switzerland	%	1,2	0,7	0,4	0,8	1,1	1,1	1,1	1,1	1,1	1,1	1,1
Turkey	%	8,4	6,8	5,5	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0
United States	%	2,1	1,4	1,2	1,7	2,0	2,0	2,0	2,0	2,0	2,0	2,0
Argentina	%	8,6	11,6	14,6	5,0	5,0	5,0	5,6	5,6	5,6	5,6	5,6
Brazil	%	0,2	4,7	2,8	4,5	4,5	4,5	4,7	4,7	4,7	4,7	4,7
China	%	3,2	2,4	3,2	1,9	1,9	1,9	2,0	2,0	2,0	2,0	2,0
India	%	7,9	8,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0
Russia	%	11,0	8,8	7,5	7,7	7,2	7,5	7,7	7,7	7,7	7,7	7,7
South Africa	%	7,9	6,6	7,2	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0
OECD (c,d)	%	2,1	1,1	1,1	1,8	2,1	2,1	2,1	2,1	2,2	2,2	2,2

Table A.1. Economic assumptions *(cont.)*

Calendar year (a)		2009est	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
POPULATION												
Australia	%	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	0,9	0,9	0,9
Canada	%	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9
EU 27	%	0,3	0,3	0,2	0,2	0,2	0,2	0,2	0,1	0,1	0,1	0,1
Japan	%	-0,1	-0,1	-0,1	-0,2	-0,2	-0,2	-0,2	-0,3	-0,3	-0,3	-0,4
Korea	%	0,4	0,3	0,3	0,3	0,3	0,2	0,2	0,2	0,2	0,1	0,1
Mexico	%	1,0	0,9	0,9	0,9	0,9	0,8	0,8	0,8	0,7	0,7	0,7
New Zealand	%	0,9	0,9	0,9	0,9	0,9	0,9	0,8	0,8	0,8	0,8	0,8
Norway	%	0,9	0,9	0,8	0,8	0,7	0,7	0,7	0,7	0,7	0,6	0,6
Switzerland	%	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4
Turkey	%	1,2	1,2	1,2	1,1	1,1	1,1	1,0	1,0	1,0	1,0	0,9
United States	%	1,0	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,8	0,8	0,8
Argentina	%	1,0	1,0	0,9	0,9	0,9	0,9	0,9	0,9	0,8	0,8	0,8
Brazil	%	0,9	0,9	0,8	0,8	0,7	0,7	0,7	0,7	0,6	0,6	0,6
China	%	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,5	0,5	0,5
India	%	1,4	1,4	1,3	1,3	1,3	1,2	1,2	1,2	1,1	1,1	1,1
Russia	%	-0,4	-0,4	-0,4	-0,3	-0,3	-0,3	-0,3	-0,4	-0,4	-0,4	-0,4
South Africa	%	0,9	0,8	0,6	0,5	0,4	0,4	0,4	0,4	0,4	0,4	0,4
OECD (c)	%	0,5	0,5	0,5	0,5	0,5	0,4	0,4	0,4	0,4	0,4	0,4
World	%	1,2	1,2	1,1	1,1	1,1	1,1	1,1	1,0	1,0	1,0	1,0

Calendar year (a)		*Average* 2007-09est.	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
GDP deflator												
Australia	%	3,5	1,8	2,3	2,6	2,6	2,6	2,6	2,6	2,6	2,6	2,6
Canada	%	1,7	2,3	1,4	2,0	2,4	2,4	2,5	2,6	2,7	2,7	2,7
European Union	%	1,6	0,5	0,6	1,5	2,0	2,0	2,0	2,0	2,0	2,0	2,0
Japan	%	-0,4	-1,6	-0,7	0,1	0,9	0,8	0,8	0,8	0,8	0,8	0,8
Korea	%	2,6	0,4	2,0	2,2	1,6	1,5	1,4	1,2	0,9	0,9	0,9
Mexico	%	5,9	4,1	4,7	3,8	3,1	3,1	3,1	3,2	3,2	3,2	3,2
New Zealand	%	3,5	2,5	2,2	2,4	2,0	2,1	2,2	2,2	2,2	2,2	2,2
Norway	%	2,8	3,7	2,9	2,7	2,3	2,2	2,2	2,2	2,2	2,2	2,2
Switzerland	%	1,7	0,5	0,3	0,8	1,2	1,2	1,3	1,3	1,3	1,3	1,3
Turkey	%	8,4	6,8	5,5	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0
United States	%	2,1	0,9	1,0	1,6	1,9	1,9	1,9	1,9	1,9	1,9	1,9
Argentina	%	1,3	1,5	4,8	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0
Brazil	%	9,4	5,5	6,2	4,7	4,7	4,7	4,7	4,7	4,7	4,7	4,7
China	%	8,6	3,0	4,9	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7
India	%	7,9	8,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0
Russia	%	6,5	10,7	6,3	6,1	6,1	6,1	6,1	6,1	6,1	6,1	6,1
South Africa	%	7,9	6,6	7,2	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0
OECD(c,d)	%	2,0	0,8	1,0	1,7	2,0	2,1	2,1	2,1	2,1	2,1	2,1

WORLD OIL PRICE												
Brent crude oil price *USD/bl*		77,0	77,0	77,0	78,5	80,8	83,3	85,8	88,4	91,1	93,9	96,7

a) For OECD member countries, historical data for population, real GDP, private consumption expenditure deflator and GDP deflator were obtained from the *OECD Economic Outlook* No. 86, December 2009. For non-member economies, historical macroeconomic data were obtained from the World Bank, November 2009. Assumptions for the projection period draw on the recent medium term macroeconomic projections of the OECD Economics Department, projections of the World Bank, and for population, projections from the United Nations World Population Prospects Database, 2009 Revision (medium variant). Data for the European Union are for the euro area aggregates.
b) Annual per cent change. The price index used is the private consumption expenditure deflator
c) Excludes Iceland.
d) Annual weighted average real GDP and CPI growth rates in OECD countries are based on weights using purchasing power parities (PPPs).
Source: OECD and FAO Secretariats.

Table A.2. World prices[a]

		Average 07/08-09/10est.	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
WHEAT												
Price (b)	USD/t	275,9	218,5	200,9	206,2	210,5	214,4	227,4	229,0	226,6	227,7	225,4
COARSE GRAINS												
Price (c)	USD/t	193,6	185,5	182,0	185,8	187,0	191,8	200,7	197,8	193,3	190,0	187,2
RICE												
Price (d)	USD/t	539,0	452,9	436,0	425,9	426,6	429,7	426,2	425,1	425,8	422,5	422,5
OILSEEDS												
Price (e)	USD/t	468,7	409,9	412,0	405,3	401,4	409,0	416,6	416,0	416,5	415,5	418,8
PROTEIN MEALS												
Price (f)	USD/t	374,1	308,0	298,2	283,7	280,0	283,3	287,2	284,6	283,2	283,6	287,9
VEGETABLE OILS												
Price (g)	USD/t	946,7	875,2	897,8	930,2	932,4	954,0	992,1	1 006,4	1 021,7	1 030,1	1 042,7
SUGAR												
Price, raw sugar (h)	USD/t	401,4	397,8	331,1	290,7	275,8	310,6	296,3	281,0	306,8	326,8	371,7
Price, refined sugar (i)	USD/t	462,2	448,4	402,6	368,5	338,3	371,9	360,0	355,0	377,2	395,0	439,2
BEEF AND VEAL												
Price, EU (j)	EUR/t dw	2 882,5	2 600,3	2 441,1	2 454,1	2 520,8	2 542,0	2 583,1	2 574,2	2 561,5	2 524,7	2 508,4
Price, USA (k)	USD/t dw	3 165,0	3 143,1	3 298,6	3 403,5	3 576,8	3 645,7	3 674,6	3 659,0	3 649,5	3 624,4	3 561,9
Price, Brazil (l)	USD/t pw	3 279,3	3 350,9	3 137,9	3 159,8	3 245,3	3 266,2	3 312,7	3 294,3	3 273,0	3 217,4	3 196,2
PIG MEAT												
Price, EU (m)	EUR/t dw	1 467,4	1 355,1	1 227,2	1 417,9	1 493,4	1 485,2	1 464,5	1 483,5	1 497,3	1 503,3	1 521,1
Price, USA (n)	USD/t dw	1 384,5	1 364,0	1 506,4	1 554,0	1 677,7	1 708,6	1 694,9	1 679,4	1 714,0	1 717,7	1 681,0
Price, Brazil (o)	USD/t dw	2 269,9	2 233,5	2 399,4	2 396,8	2 493,3	2 397,3	2 401,3	2 401,8	2 318,2	2 311,0	2 259,3
POULTRY MEAT												
Price, EU (p)	EUR/t rtc	1 192,7	1 132,6	1 125,6	1 118,9	1 130,5	1 127,0	1 121,9	1 109,4	1 098,0	1 086,0	1 090,1
Price, USA (q)	USD/t rtc	1 066,0	1 118,6	1 137,6	1 160,5	1 172,0	1 200,4	1 226,9	1 245,3	1 265,5	1 284,5	1 320,3
Price, Brazil (r)	USD/t pw	1 606,6	1 548,7	1 579,9	1 601,9	1 613,4	1 646,7	1 682,4	1 665,4	1 659,3	1 638,2	1 638,4
SHEEP MEAT												
Price, New Zealand (s)	NZD/t dw	2 575,8	3 467,5	3 268,0	3 076,0	3 070,4	3 236,4	3 460,7	3 251,8	3 555,2	3 400,0	3 673,7
BUTTER												
Price (t)	USD/t	2 978,5	3 042,6	2 820,7	2 716,4	2 709,1	2 693,5	2 741,6	2 765,5	2 921,6	2 919,2	2 958,3
CHEESE												
Price (u)	USD/t	3 886,9	3 716,4	3 272,0	3 126,0	3 139,7	3 250,7	3 337,8	3 427,9	3 541,7	3 589,7	3 640,7
SKIM MILK POWDER												
Price (v)	USD/t	3 308,8	2 530,4	2 434,3	2 417,2	2 493,1	2 590,1	2 653,2	2 759,1	2 917,6	2 942,9	3 000,1
WHOLE MILK POWDER												
Price (w)	USD/t	3 499,7	2 808,0	2 549,8	2 475,5	2 588,4	2 725,3	2 763,1	2 832,2	2 937,8	2 989,3	3 042,4
WHEY POWDER												
Wholesale price, USA (x)	USD/t	853,0	788,1	709,5	705,4	727,2	751,0	767,9	791,2	827,0	835,4	852,0

For notes, see end of the table.

Table A.2. World prices(a) (*cont.*)

		Average 07/08-09/10est.	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
CASEIN												
Price (y)	*USD/t*	6 299,8	5 774,5	5 529,4	5 450,6	5 474,2	5 688,8	5 861,8	6 060,6	6 267,8	6 342,7	6 439,8
ETHANOL												
Price (z)	*USD/hl*	43,8	47,4	51,4	50,0	50,2	50,7	51,1	52,0	53,3	53,9	54,4
BIODIESEL												
Price (aa)	*USD/hl*	118,0	117,7	118,5	124,4	126,4	131,8	140,2	142,6	145,0	143,2	144,3

a) This table is a compilation of price information presented in the detailed commodity tables further in this annex. Prices for crops are on marketing year basis and those for meat and dairy products on calendar year basis (e.g. 07/08 is calendar year 2007)

b) No.2 hard red winter wheat, ordinary protein, USA f.o.b. Gulf Ports (June/May), less EEP payments where applicable

c) No.2 yellow corn, US f.o.b. Gulf Ports (September/August).

d) Milled, 100%, grade b, Nominal Price Quote, NPQ, f.o.b. Bangkok (January/December).

e) Weighted average oilseed price, European port.

f) Weighted average meal price, European port.

g) Weighted average price of oilseed oils and palm oil, European port.

h) Raw sugar world price, ICE Inc.No11 f.o.b, bulk price, October/September.

i) Refined sugar price, Euronext, Liffe, Contract No. 407 London, Europe, October/September.

j) Producer price.

k) Choice steers, 1100-1300 lb lw, Nebraska - lw to dw conversion factor 0.63.

l) Brazil meat of bovine export price (HS 0201 and HS 0202)

m) Pig producer price.

n) Barrows and gilts, No. 1-3, 230-250 lb lw, Iowa/South Minnesota - lw to dw conversion factor 0.74.

o) Producer price

p) Weighted average farm gate live chickens, first choice, lw to rtc conversion of 0.75.

q) Wholesale weighted average broiler price 12 cities.

r) Weighted average wholesale price of different cuts.

s) Lamb schedule price, all grade average.

t) f.o.b. export price, butter, 82% butterfat, Oceania.

u) f.o.b. export price, cheddar cheese, 39% moisture, Oceania.

v) f.o.b. export price, non-fat dry milk, 1.25% butterfat, Oceania.

w) f.o.b. export price, WMP 26% butterfat, Oceania.

x) Edible dry whey, Wisconsin, plant.

y) Export price, New Zealand.

z) Brazil, Sao Paulo (ex-distillery).

aa) Producer price Germany net of biodiesel tariff.

est.: estimate.

Source: OECD and FAO Secretariats.

Table A3. World trade projections

IMPORTS			Average 2007-09est.	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Wheat	**World Trade**	*kt*	**121 483**	**120 014**	**122 727**	**126 917**	**128 222**	**130 878**	**132 135**	**135 012**	**137 284**	**140 050**	**142 271**
	OECD	*kt*	25 874	24 159	24 184	25 073	24 656	24 841	24 883	24 760	24 832	25 011	25 022
	Developing	*kt*	97 233	97 685	100 453	104 851	106 366	109 135	110 638	113 527	115 886	118 693	121 042
	Least Developed Countries	*kt*	12 224	13 006	13 412	13 605	14 186	14 692	15 052	15 622	16 122	16 424	16 872
Coarse Grains	**World Trade**	*kt*	**118 329**	**112 435**	**112 957**	**114 089**	**116 422**	**116 845**	**119 460**	**123 626**	**125 983**	**128 881**	**132 301**
	OECD	*kt*	56 908	50 815	49 976	50 104	51 146	49 878	51 428	53 660	52 623	52 874	53 134
	Developing	*kt*	81 184	82 634	84 214	85 374	86 687	88 647	89 723	91 803	95 807	98 753	102 454
	Least Developed Countries	*kt*	2 430	2 196	2 075	2 183	2 108	2 161	2 127	2 109	2 322	2 407	2 540
Rice	**World Trade**	*kt*	**31 325**	**32 057**	**32 622**	**33 184**	**33 823**	**34 635**	**35 411**	**36 333**	**37 153**	**37 861**	**38 446**
	OECD	*kt*	5 150	5 169	5 238	5 325	5 429	5 570	5 695	5 821	5 921	6 034	6 148
	Developing	*kt*	26 130	26 826	27 329	27 822	28 369	29 021	29 657	30 435	31 132	31 695	32 142
	Least Developed Countries	*kt*	6 557	6 247	6 582	6 669	6 812	6 945	7 185	7 312	7 394	7 479	7 596
Oilseeds	**World Trade**	*kt*	**92 647**	**93 131**	**94 479**	**96 430**	**98 733**	**99 900**	**102 336**	**104 098**	**105 592**	**107 352**	**108 686**
	OECD	*kt*	34 625	33 749	33 843	33 845	34 001	33 785	33 852	33 876	33 910	33 863	33 896
	Developing	*kt*	65 840	67 019	68 463	70 714	72 790	74 249	76 703	78 475	80 023	81 994	83 405
	Least Developed Countries	*kt*	290	313	335	344	366	377	387	399	414	428	442
Protein Meals	**World Trade**	*kt*	**66 297**	**69 617**	**71 994**	**73 687**	**75 399**	**77 435**	**78 870**	**80 522**	**82 211**	**83 910**	**85 871**
	OECD	*kt*	41 252	42 563	43 531	43 575	43 867	44 346	44 600	44 971	45 140	45 376	45 730
	Developing	*kt*	27 517	29 907	31 492	33 124	34 528	36 136	37 390	38 713	40 302	41 860	43 590
	Least Developed Countries	*kt*	409	462	485	509	534	556	576	593	607	620	629
Vegetable Oils	**World Trade**	*kt*	**56 447**	**58 868**	**61 510**	**62 854**	**64 888**	**67 070**	**68 906**	**71 353**	**73 867**	**76 288**	**78 859**
	OECD	*kt*	16 787	17 699	18 526	19 158	19 796	20 640	21 504	22 346	23 163	23 664	24 231
	Developing	*kt*	39 583	41 468	43 297	44 097	45 504	46 849	47 835	49 457	51 170	53 112	55 108
	Least Developed Countries	*kt*	3 928	4 145	4 342	4 512	4 709	4 902	5 088	5 289	5 502	5 720	5 942
Sugar	**World Trade**	*kt*	**48 712**	**52 966**	**54 815**	**55 066**	**55 589**	**56 954**	**59 022**	**59 778**	**61 306**	**63 171**	**63 234**
	OECD	*kt*	12 431	12 894	13 620	13 560	13 671	14 070	14 335	14 642	15 028	15 278	15 578
	Developing	*kt*	33 053	35 906	37 766	37 892	38 372	39 653	41 686	42 234	43 668	45 630	45 872
	Least Developed Countries	*kt*	4 834	5 293	5 608	6 001	6 248	6 096	6 197	6 287	6 292	6 280	6 144
Beef (a)	**World Trade**	*kt*	**6 623**	**6 739**	**6 727**	**6 850**	**7 308**	**7 412**	**7 619**	**7 828**	**7 951**	**8 076**	**8 168**
	OECD	*kt*	3 342	3 422	3 435	3 481	3 641	3 728	3 848	3 922	3 950	3 991	4 015
	Developing	*kt*	3 073	3 246	3 289	3 370	3 674	3 733	3 840	3 970	4 084	4 172	4 243
	Least Developed Countries	*kt*	142	174	174	139	197	173	165	169	123	153	81
Pigmeat (a)	**World Trade**	*kt*	**5 505**	**5 437**	**5 588**	**5 667**	**5 788**	**5 891**	**5 971**	**6 023**	**6 097**	**6 213**	**6 319**
	OECD	*kt*	2 961	3 018	3 171	3 223	3 258	3 333	3 377	3 395	3 421	3 455	3 485
	Developing	*kt*	2 405	2 563	2 796	2 747	2 833	2 873	2 941	2 968	2 996	3 080	3 121
	Least Developed Countries	*kt*	108	117	129	110	117	113	111	116	113	125	122
Poultry	**World Trade**	*kt*	**9 635**	**9 331**	**9 541**	**9 798**	**9 941**	**10 207**	**10 361**	**10 513**	**10 833**	**11 003**	**11 375**
	OECD	*kt*	2 357	2 518	2 565	2 649	2 733	2 784	2 848	2 910	2 949	3 022	3 078
	Developing	*kt*	6 139	6 190	6 408	6 615	6 720	6 933	7 028	7 097	7 349	7 452	7 723
	Least Developed Countries	*kt*	566	537	569	577	544	599	602	609	640	644	685
Butter	**World Trade**	*kt*	**822**	**755**	**760**	**765**	**749**	**762**	**772**	**779**	**770**	**778**	**781**
	OECD	*kt*	140	111	112	112	92	93	93	93	91	91	91
	Developing	*kt*	445	463	470	476	481	497	510	520	516	525	532
	Least Developed Countries	*kt*	12	9	12	13	13	14	15	15	15	16	16
Cheese	**World Trade**	*kt*	**1 707**	**1 730**	**1 736**	**1 744**	**1 762**	**1 788**	**1 838**	**1 865**	**1 885**	**1 914**	**1 937**
	OECD	*kt*	737	769	758	770	782	788	798	805	808	813	818
	Developing	*kt*	706	741	772	783	798	812	837	855	867	883	903
	Least Developed Countries	*kt*	14	14	14	14	14	14	14	14	14	14	14
Whole Milk Powder	**World Trade**	*kt*	**1 777**	**1 874**	**1 867**	**1 886**	**1 895**	**1 912**	**1 964**	**1 990**	**1 999**	**2 025**	**2 055**
	OECD	*kt*	101	99	101	102	100	99	101	101	98	96	94
	Developing	*kt*	1 659	1 775	1 772	1 794	1 807	1 823	1 871	1 896	1 906	1 930	1 960
	Least Developed Countries	*kt*	173	200	207	214	218	224	231	237	243	249	258
Skim Milk Powder	**World Trade**	*kt*	**1 167**	**1 207**	**1 199**	**1 209**	**1 226**	**1 243**	**1 266**	**1 281**	**1 284**	**1 307**	**1 321**
	OECD	*kt*	196	206	202	206	208	207	215	216	209	212	214
	Developing	*kt*	1 038	1 128	1 130	1 140	1 156	1 173	1 194	1 208	1 212	1 233	1 247
	Least Developed Countries	*kt*	54	61	62	64	66	68	70	71	73	75	77

Source: OECD and FAO Secretariats.

Table A3. World trade projections (*cont.*)

EXPORTS			*Average* 2007-09est.	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Wheat	OECD	kt	78 881	80 927	76 856	77 057	74 531	74 223	73 800	75 148	76 309	77 801	79 127
	Developing	kt	15 778	16 677	17 851	17 807	18 958	19 355	19 771	20 339	20 308	20 681	21 031
	Least Developed Countrie	kt	117	160	158	153	144	137	133	127	122	119	114
Coarse Grains	OECD	kt	77 994	71 830	76 199	76 845	77 063	75 272	75 585	77 577	79 368	80 954	83 118
	Developing	kt	28 652	31 904	28 553	29 578	31 008	32 964	34 663	36 255	36 998	38 222	39 037
	Least Developed Countrie	kt	2 750	3 109	3 017	2 807	2 936	2 878	2 908	2 913	2 677	2 592	2 496
Rice	OECD	kt	3 589	3 788	3 842	3 920	3 981	4 033	4 068	4 050	4 073	4 139	4 157
	Developing	kt	26 603	28 203	28 716	29 201	29 779	30 540	31 282	32 223	33 020	33 664	34 232
	Least Developed Countrie	kt	2 419	2 739	3 037	3 336	3 800	4 243	4 604	5 007	5 488	5 970	6 470
Oilseeds	OECD	kt	45 909	48 085	47 772	48 459	49 429	49 031	49 142	48 812	48 509	48 684	48 842
	Developing	kt	36 828	45 743	47 082	47 764	48 899	50 068	52 038	53 817	55 253	56 413	57 275
	Least Developed Countrie	kt	179	186	166	151	143	138	138	137	132	129	124
Protein Meals	OECD	kt	11 526	13 203	13 122	13 532	14 061	14 963	15 350	15 693	16 154	16 605	17 138
	Developing	kt	57 382	59 065	61 224	62 346	63 424	64 426	65 465	66 699	67 865	69 094	70 446
	Least Developed Countrie	kt	200	223	206	215	222	225	257	274	294	308	334
Vegetable Oils	OECD	kt	4 635	4 959	4 598	4 552	4 653	4 821	5 141	5 411	5 738	6 056	6 378
	Developing	kt	48 238	49 272	52 104	53 213	54 948	56 777	58 108	60 105	62 097	64 020	66 101
	Least Developed Countrie	kt	191	187	181	178	175	171	169	166	164	162	160
Sugar	OECD	kt	6 933	5 754	6 388	6 387	6 536	6 664	6 616	6 332	6 463	6 776	6 846
	Developing	kt	45 423	47 648	49 532	49 740	50 208	51 509	53 621	54 621	56 031	57 578	57 541
	Least Developed Countrie	kt	1 844	2 172	2 333	2 566	2 772	2 734	2 789	2 842	2 826	2 824	2 776
Beef (a)	OECD	kt	3 409	3 409	3 468	3 466	3 566	3 593	3 635	3 659	3 669	3 676	3 691
	Developing	kt	4 069	4 212	4 138	4 256	4 541	4 615	4 702	4 884	4 963	5 096	5 133
	Least Developed Countrie	kt	3	2	3	3	2	2	2	2	3	2	3
Pigmeat (a)	OECD	kt	4 673	4 730	4 832	4 850	4 895	4 968	5 028	5 060	5 116	5 210	5 292
	Developing	kt	1 207	1 174	1 243	1 292	1 374	1 392	1 401	1 419	1 415	1 442	1 443
	Least Developed Countrie	kt	0	0	0	0	0	0	0	0	0	0	0
Poultry	OECD	kt	4 501	4 277	4 122	4 162	4 190	4 220	4 239	4 280	4 330	4 369	4 491
	Developing	kt	5 744	6 147	6 618	6 951	7 165	7 512	7 749	7 962	8 346	8 581	8 921
	Least Developed Countrie	kt	7	9	9	9	7	6	5	5	4	3	3
Butter	OECD	kt	675	602	611	619	604	618	628	634	621	627	629
	Developing	kt	92	89	93	95	97	96	97	98	102	103	105
	Least Developed Countrie	kt	0	0	0	0	0	0	0	0	0	0	0
Cheese	OECD	kt	1 293	1 313	1 310	1 286	1 286	1 293	1 336	1 348	1 334	1 343	1 346
	Developing	kt	337	358	351	364	368	374	373	378	393	399	407
	Least Developed Countrie	kt	0	0	0	0	0	0	0	0	0	0	1
Whole Milk Powd	Developing	kt	1 236	1 341	1 317	1 330	1 322	1 317	1 364	1 375	1 359	1 368	1 381
		kt	579	552	566	570	587	607	612	626	650	666	684
	Least Developed Countrie	kt	7	8	8	8	8	8	8	8	8	8	8
Skim Milk Powde	OECD	kt	995	928	918	924	935	942	958	962	945	958	960
	Developing	kt	132	122	126	127	127	129	129	132	138	138	140
	Least Developed Countrie	kt	1	1	1	1	1	1	1	1	1	1	1
Biofuel (b)	Ethanol World Trade	Mil l	4 465	5 697	7 176	7 426	7 744	8 756	10 095	10 627	12 365	13 709	14 591
	Biodiesel World Trade	Mil l	2 250	1 888	2 000	2 226	2 452	2 735	3 016	2 980	2 931	2 944	2 957

a) Excludes trade of live animals.

b) Sum of all positive net trade positions

est.: estimate.

Source: OECD and FAO Secretariats.

Table A4. World cereal projections

Crop year (a)		Average 07/08-09/10est.	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
WHEAT												
OECD (b)												
Production	mt	267,9	273,7	277,5	273,5	274,1	278,1	281,1	286,0	288,3	290,7	293,6
Consumption	mt	210,3	217,7	223,6	225,0	226,7	230,2	233,2	234,8	236,2	237,8	239,2
Closing stocks	mt	52,6	63,5	64,7	61,2	58,8	57,3	56,3	57,1	57,7	57,9	58,3
Non-OECD												
Production	mt	387,9	403,1	412,1	412,5	418,3	425,2	430,6	437,5	442,5	447,3	452,5
Consumption	mt	428,8	442,4	451,9	460,0	465,0	471,3	476,4	482,0	488,0	494,2	500,9
Closing stocks	mt	140,3	166,8	176,0	176,7	176,2	175,7	175,0	177,2	179,5	181,7	183,7
WORLD (c)												
Production	mt	655,9	676,7	689,6	686,0	692,4	703,3	711,7	723,6	730,8	738,1	746,2
Consumption	mt	639,1	660,0	675,5	684,9	691,7	701,5	709,6	716,8	724,1	731,9	740,1
Closing stocks	mt	192,9	230,3	240,7	238,0	234,9	233,0	231,3	234,3	237,2	239,6	241,9
Price (d)	USD/t	275,9	218,5	200,9	206,2	210,5	214,4	227,4	229,0	226,6	227,7	225,4
COARSE GRAINS												
OECD (b)												
Production	mt	579,7	591,9	609,1	608,7	616,8	624,7	631,0	638,8	644,4	648,8	651,2
Consumption	mt	551,0	574,4	579,8	585,2	592,5	600,2	608,5	613,9	615,5	618,4	620,9
Closing stocks	mt	99,3	100,9	104,0	100,8	99,3	98,4	96,7	97,7	99,8	102,1	102,3
Non-OECD												
Production	mt	524,0	550,8	556,6	569,0	582,2	595,8	608,5	623,4	634,8	648,0	659,9
Consumption	mt	537,2	559,7	576,1	587,4	600,8	613,2	625,3	638,2	652,5	667,1	681,6
Closing stocks	mt	98,4	105,6	105,9	107,7	108,5	109,9	110,8	113,4	116,0	118,4	120,2
WORLD (c)												
Production	mt	1103,7	1142,7	1165,7	1177,7	1199,0	1220,4	1239,5	1262,2	1279,2	1296,7	1311,1
Consumption	mt	1088,1	1134,2	1155,9	1172,5	1193,3	1213,4	1233,8	1252,1	1268,0	1285,6	1302,5
Closing stocks	mt	197,7	206,5	209,9	208,6	207,8	208,4	207,5	211,1	215,8	220,5	222,6
Price (e)	USD/t	193,6	185,5	182,0	185,8	187,0	191,8	200,7	197,8	193,3	190,0	187,2
RICE												
OECD (b)												
Production	mt	22,6	23,0	22,6	22,8	23,1	23,2	23,4	23,3	23,3	23,4	23,5
Consumption	mt	24,4	24,2	24,3	24,5	24,6	24,7	24,9	25,0	25,1	25,3	25,4
Closing stocks	mt	5,8	6,4	6,1	5,9	5,8	5,9	6,0	6,0	6,0	6,0	6,0
Non-OECD												
Production	mt	432,0	454,3	458,4	461,8	465,7	473,0	478,2	483,2	488,3	493,4	498,2
Consumption	mt	427,4	447,2	455,1	458,1	463,0	469,7	475,3	480,7	485,8	491,1	496,1
Closing stocks	mt	93,6	99,6	101,5	104,0	105,3	107,2	108,5	109,5	110,3	111,0	111,2
WORLD (c)												
Production	mt	454,6	477,3	481,0	484,6	488,8	496,2	501,5	506,5	511,6	516,8	521,7
Consumption	mt	451,8	471,4	479,4	482,6	487,6	494,5	500,2	505,7	510,9	516,3	521,5
Closing stocks	mt	99,4	106,0	107,6	109,8	111,1	113,0	114,5	115,5	116,3	117,0	117,3
Price (f)	USD/t	539,0	452,9	436,0	425,9	426,6	429,7	426,2	425,1	425,8	422,5	422,5

a) Beginning crop marketing year. See Glossary of Terms for definitions.
b) Excludes Iceland but includes the eight EU members that are not members of the OECD.
c) Source of historic data is USDA.
d) No.2 hard red winter wheat, ordinary protein, USA f.o.b. Gulf Ports (June/May) less EEP payments where applicable.
e) No.2 yellow corn, US f.o.b. Gulf Ports (January/December).
f) Milled, 100%, grade b, Nominal Price Quote, NPQ, f.o.b. Bangkok (January/December).
est.: estimate.

Source: OECD and FAO Secretariats.

Table A.5. World oilseed projections

		Average 07/08-09/10est.	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
OILSEEDS (Crop Year (a))												
OECD (b)												
Production	mt	137,1	147,9	146,1	150,3	152,3	153,6	156,0	158,3	160,0	162,2	164,3
Consumption	mt	129,0	132,8	131,6	135,1	137,3	139,2	141,2	143,2	145,3	147,4	149,4
crush	mt	114,4	117,8	116,5	119,7	121,7	123,6	125,7	127,6	129,7	131,6	133,6
Closing stocks	mt	16,1	17,9	18,5	19,1	18,6	17,8	17,4	17,5	17,6	17,6	17,5
Non-OECD												
Production	mt	250,0	271,4	278,0	284,8	290,6	296,8	304,1	311,4	318,1	324,8	331,0
Consumption	mt	267,5	281,2	288,0	295,6	302,5	308,6	315,8	322,5	329,0	335,8	342,4
crush	mt	211,3	223,4	229,2	235,8	241,7	246,9	253,1	258,9	264,4	270,1	275,7
Closing stocks	mt	17,1	17,9	18,2	18,4	18,4	18,1	18,1	18,3	18,4	18,6	18,5
WORLD (c)												
Production	mt	387,1	419,3	424,1	435,1	442,9	450,3	460,2	469,7	478,2	486,9	495,3
Consumption	mt	396,5	414,0	419,6	430,7	439,8	447,8	456,9	465,8	474,3	483,2	491,8
crush	mt	325,7	341,1	345,7	355,5	363,4	370,5	378,8	386,5	394,1	401,8	409,3
Closing stocks	mt	33,1	35,9	36,7	37,5	37,0	35,9	35,5	35,8	36,0	36,1	36,0
Price (d)	USD/t	468,7	409,9	412,0	405,3	401,4	409,0	416,6	416,0	416,5	415,5	418,8
PROTEIN MEALS (marketing year)												
OECD (b)												
Production	mt	79,4	81,2	80,1	82,3	83,7	85,0	86,4	87,7	89,1	90,4	91,7
Consumption	mt	109,1	110,6	110,5	112,3	113,5	114,4	115,6	116,9	118,0	119,1	120,3
Closing stocks	mt	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
Non-OECD		0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Production	mt	151,9	159,8	164,3	169,3	173,8	177,9	182,6	187,0	191,2	195,6	199,9
Consumption	mt	116,9	124,8	128,5	133,8	138,6	143,0	147,8	152,2	156,7	161,3	165,8
Closing stocks	mt	6,2	6,0	6,0	6,1	6,2	6,2	6,3	6,4	6,5	6,6	6,6
WORLD (c)												
Production	mt	231,3	240,9	244,4	251,6	257,6	262,9	268,9	274,7	280,2	286,0	291,6
Consumption	mt	226,1	235,4	239,0	246,1	252,1	257,4	263,4	269,1	274,7	280,5	286,1
Closing stocks	mt	7,4	7,1	7,2	7,3	7,3	7,4	7,5	7,6	7,7	7,8	7,8
Price (e)	USD/t	374,1	308,0	298,2	283,7	280,0	283,3	287,2	284,6	283,2	283,6	287,9
VEGETABLE OILS (marketing year)												
OECD (b)												
Production	mt	30,4	31,9	31,8	32,7	33,3	33,8	34,5	35,1	35,7	36,3	36,9
Consumption	mt	42,7	44,7	45,8	47,3	48,5	49,7	50,9	52,0	53,1	53,9	54,7
Closing stocks	mt	2,2	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8
Non-OECD												
Production	mt	101,5	109,2	113,2	117,6	121,7	125,6	129,8	133,9	137,9	141,9	146,0
Consumption	mt	90,3	97,8	101,7	104,5	108,0	111,4	114,9	118,4	121,9	125,7	129,6
Closing stocks	mt	8,2	8,4	7,7	8,0	8,3	8,6	8,8	9,1	9,4	9,8	10,1
WORLD (c)												
Production	mt	131,9	141,1	145,0	150,3	155,1	159,5	164,3	169,0	173,6	178,2	182,8
of which palm oil	mt	131,9	141,1	145,0	150,3	155,1	159,5	164,3	169,0	173,6	178,2	182,8
Consumption	mt	133,0	142,5	147,5	151,8	156,4	161,0	165,8	170,4	175,0	179,6	184,3
Closing stocks	mt	10,4	10,3	9,6	9,8	10,2	10,4	10,5	10,9	11,2	11,6	11,9
Price (f)	USD/t	946,7	875,2	897,8	930,2	932,4	954,0	992,1	1 006,4	1 021,7	1 030,1	1 042,7

a) Beginning crop marketing year. See Glossary of Terms for definitions
b) Excludes Iceland but includes the eight EU members that are not members of the OECD.
c) Source of historic data is USDA.
d) Weighted average oilseed price, European port.
e) Weighted average protein meal price, European port.
f) Weighted average price of oilseed oils and palm oil, European port.
est: estimation.
Source: OECD and FAO Secretariats.

Table A.6. World sugar projections

Crop year (a)		Average 07/08-09/10est.	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
OECD												
Production	kt rse	37 425	37 390	36 491	36 786	37 100	37 316	37 044	36 743	36 754	36 897	37 048
Consumption	kt rse	43 488	43 638	43 945	44 068	44 154	44 447	44 642	44 881	45 157	45 435	45 736
Closing stocks	kt rse	20 326	20 720	20 499	20 390	20 472	20 746	20 866	21 038	21 200	21 163	21 208
NON-OECD												
Production	kt rse	123 688	137 436	140 149	143 581	143 602	144 669	144 096	149 584	155 222	158 840	163 029
Consumption	kt rse	116 822	123 302	127 078	130 546	134 075	136 431	138 646	141 130	144 772	148 253	152 087
Closing stocks	kt rse	49 250	49 036	53 363	57 713	58 593	57 914	54 133	52 765	53 138	53 712	54 409
WORLD												
Production	kt rse	161 113	174 826	176 640	180 367	180 703	181 985	181 139	186 327	191 975	195 737	200 077
Consumption	kt rse	160 310	166 940	171 023	174 614	178 228	180 878	183 288	186 011	189 928	193 689	197 823
Closing stocks	kt rse	69 576	69 757	73 862	78 103	79 065	78 660	74 999	73 803	74 338	74 875	75 617
Price, raw sugar (b)	USD/t	401,4	397,8	331,1	290,7	275,8	310,6	296,3	281,0	306,8	326,8	371,7
Price, white sugar (c)	USD/t	462,2	448,4	402,6	368,5	338,3	371,9	360,0	355,0	377,2	395,0	439,2

a) Beginning crop marketing year. See the Glossary of Terms for definitions.

b) Raw sugar world price, ICE Inc.No11 f.o.b, bulk price, October/September

c) Refined sugar price, Euronext, Liffe, Contract No. 407 London, Europe, October/September.

est.: estimate.

Source: OECD and FAO Secretariats.

Table A.7. World meat projections

Calendar year (a)		*Average* *2007-09est.*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
OECD (b)												
BEEF AND VEAL												
Production	kt cwe	27 569	27 094	27 010	26 811	26 836	26 944	27 175	27 423	27 752	27 956	28 204
Consumption	kt cwe	27 259	26 895	26 743	26 585	26 637	26 773	27 045	27 310	27 660	27 892	28 151
Ending stocks	kt cwe	1 062	1 050	1 084	1 093	1 131	1 179	1 237	1 306	1 374	1 439	1 493
Per capita consumption	kg rwt	15	15	15	15	15	15	15	15	15	15	15
Price, EU	EUR/t dw	2 882	2 600	2 441	2 454	2 521	2 542	2 583	2 574	2 562	2 525	2 508
Price, USA (c)	USD/t dw	3 165	3 143	3 299	3 403	3 577	3 646	3 675	3 659	3 649	3 624	3 562
Price, Brazil (d)	USD/t dw	3 279	3 351	3 138	3 160	3 245	3 266	3 313	3 294	3 273	3 217	3 196
PIG MEAT												
Production	kt cwe	39 315	39 238	39 768	39 340	39 569	40 022	40 608	40 854	41 084	41 377	41 729
Consumption	kt cwe	37 394	37 232	37 879	37 455	37 691	38 137	38 702	38 941	39 144	39 370	39 666
Ending stocks	kt cwe	927	926	913	929	926	928	932	929	925	927	933
Per capita consumption	kg rwt	23,3	23,0	23,3	22,9	22,9	23,1	23,3	23,4	23,4	23,5	23,5
Price, Brazil (e)	USD/t pw	2 270	2 233	2 399	2 397	2 493	2 397	2 401	2 402	2 318	2 311	2 259
Price, USA (f)	USD/t dw	1 384	1 364	1 506	1 554	1 678	1 709	1 695	1 679	1 714	1 718	1 681
POULTRY MEAT												
Production	kt rtc	38 870	38 302	38 873	39 476	39 768	40 198	40 612	41 255	41 930	42 470	42 997
Consumption	kt rtc	36 741	36 505	37 315	37 964	38 310	38 761	39 220	39 885	40 548	41 121	41 582
Ending stocks	kt rtc	1 132	1 089	1 089	1 088	1 089	1 090	1 091	1 091	1 092	1 093	1 095
Per capita consumption	kg rwt	25,8	25,4	25,9	26,2	26,3	26,5	26,7	27,0	27,4	27,6	27,9
Price, Brazil (g)	USD/t pw	1 607	1 549	1 580	1 602	1 613	1 647	1 682	1 665	1 659	1 638	1 638
Price, USA (h)	USD/t rtc	1 066	1 119	1 138	1 161	1 172	1 200	1 227	1 245	1 266	1 284	1 320
SHEEP MEAT												
Production	kt cwe	2 893	2 780	2 767	2 762	2 748	2 734	2 728	2 714	2 702	2 695	2 679
Consumption	kt cwe	2 389	2 301	2 285	2 271	2 255	2 234	2 221	2 206	2 186	2 176	2 151
Ending stocks	kt cwe	81	67	67	67	67	67	67	66	70	76	81
Per capita consumption	kg rwt	1,7	1,6	1,6	1,6	1,5	1,5	1,5	1,5	1,5	1,5	1,4
Price, Australia (i)	AUD/t dw	3 915	4 560	4 455	4 346	4 232	4 115	3 995	3 873	3 750	3 626	3 511
Price, Australia (j)	AUD/t dw	1 522	1 490	1 489	1 490	1 490	1 490	1 489	1 487	1 484	1 482	1 480
Price, New Zealand (k)	NZD/t dw	3 801	4 790	4 170	4 210	4 350	4 353	4 415	4 375	4 340	4 304	4 273
TOTAL MEAT												
Per capita consumption	kg rwt	66,1	64,9	65,5	65,4	65,5	65,9	66,5	67,0	67,6	68,0	68,4
Non-OECD												
BEEF AND VEAL												
Production	kt cwe	37 660	38 147	38 978	39 854	40 592	41 471	42 461	43 351	44 319	45 319	46 435
Consumption	kt cwe	36 971	37 359	38 190	39 051	39 751	40 598	41 507	42 392	43 358	44 294	45 422
Per capita consumption	kg rwt	4,7	4,6	4,7	4,7	4,8	4,8	4,8	4,9	4,9	5,0	5,1
Ending stocks	kt cwe	99	96	108	118	110	96	112	107	81	97	98

Table A.7. World meat projections *(cont.)*

Calendar year (a)		Average 2007-09est.	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
PIG MEAT												
Production	*kt cwe*	63 229	69 076	71 415	72 788	74 622	76 679	78 644	80 188	81 841	83 551	84 922
Consumption	*kt cwe*	65 061	70 793	73 085	74 424	76 267	78 322	80 304	81 862	83 545	85 316	86 738
Per capita consumption	*kg rwt*	9,2	9,8	10,0	10,0	10,2	10,3	10,5	10,5	10,6	10,7	10,8
Ending stocks	*kt cwe*	47	51	51	53	54	56	58	59	61	62	64
POULTRY MEAT												
Production	*kt rtc*	52 350	56 726	58 900	60 992	62 934	65 074	66 951	68 797	70 923	72 703	74 852
Consumption	*kt rtc*	54 027	57 540	59 417	61 372	63 156	65 177	66 911	68 632	70 672	72 320	74 463
Per capita consumption	*kg rwt*	8,7	9,0	9,2	9,3	9,5	9,7	9,8	10,0	10,1	10,3	10,4
Ending stocks	*kt rtc*	113	117	122	120	122	123	125	130	135	139	142
SHEEP MEAT												
Production	*kt cwe*	9 595	9 969	10 243	10 528	10 845	11 096	11 449	11 772	12 060	12 429	12 718
Consumption	*kt cwe*	10 004	10 339	10 616	10 906	11 236	11 475	11 861	12 168	12 465	12 833	13 133
Per capita consumption	*kg rwt*	1,6	1,6	1,6	1,7	1,7	1,7	1,7	1,8	1,8	1,8	1,8
Ending stocks	*kt cwe*	5	5	5	10	4	16	4	7	6	7	7
TOTAL MEAT												
Per capita consumption	*kg rwt*	24,2	25,1	25,5	25,8	26,1	26,5	26,9	27,1	27,5	27,8	28,1

a)   Year ending 30 September for New Zealand,
b)   Excludes Iceland but includes the eight EU members that are not members of the OECD.
     Carcass weight to retail weight conversion factors of 0.7 for beef and veal, 0.78 for pig meat and 0.88 for sheep meat.
     Rtc to retail weight conversion factor 0.88 for poultry meat.
c)   Choice steers, 1100-1300 lb lw, Nebraska - lw to dw conversion factor 0.63.
d)   Price received by producer.
e)   Brazil meat of swine export price (HS 0203)
f)   Barrows and gilts, No. 1-3, 230-250 lb lw, Iowa/South Minnesota - lw to dw conversion factor 0.74.
g) Brazil meat of poultry export price (HS 0207)
h)   Wholesale weighted average broiler price 12 cities.
i)   Saleyard price, lamb, 16-20 kg dw.
j)   Saleyard price, wethers, < 22kg dw.
k)   Lamb schedule price, all grade average.
est.: estimate.

Source: OECD and FAO Secretariats.

Table A.8. World dairy projections
(butter and cheese)

Calendar year (a)		Average 2007-09est.	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
BUTTER												
OECD (b)												
Production	kt pw	3 742	3 688	3 731	3 781	3 802	3 830	3 850	3 877	3 897	3 926	3 944
Consumption	kt pw	3 219	3 247	3 246	3 258	3 271	3 282	3 292	3 309	3 323	3 340	3 356
Stock changes	kt pw	10	-61	-27	3	6	7	7	11	28	34	34
Non-OECD												
Production	kt pw	5 931	6 393	6 623	6 840	7 035	7 248	7 450	7 667	7 901	8 130	8 437
Consumption	kt pw	6 464	6 859	7 104	7 328	7 528	7 756	7 967	8 190	8 413	8 648	8 957
WORLD												
Production	kt pw	9 673	10 081	10 354	10 622	10 837	11 078	11 300	11 543	11 798	12 056	12 381
Consumption	kt pw	9 683	10 106	10 350	10 587	10 799	11 038	11 259	11 498	11 736	11 988	12 312
Stock changes	kt pw	0	-54	-27	3	6	7	7	11	28	34	35
Price (c)	USD/t	2 979	3 043	2 821	2 716	2 709	2 694	2 742	2 766	2 922	2 919	2 958
CHEESE												
OECD (b)												
Production	kt pw	14 946	15 116	15 340	15 504	15 697	15 896	16 144	16 376	16 562	16 798	17 031
Consumption	kt pw	14 388	14 615	14 808	15 004	15 201	15 395	15 605	15 829	16 029	16 257	16 489
Stock changes	kt pw	0	-44	-22	-16	-9	-4	0	4	7	10	13
Non-OECD												
Production	kt pw	4 487	4 679	4 804	5 002	5 197	5 358	5 507	5 658	5 840	6 013	6 193
Consumption	kt pw	4 930	5 085	5 213	5 375	5 558	5 720	5 902	6 058	6 222	6 399	6 578
WORLD												
Production	kt pw	19 433	19 795	20 144	20 506	20 894	21 254	21 651	22 034	22 402	22 810	23 224
Consumption	kt pw	19 319	19 700	20 021	20 379	20 760	21 115	21 507	21 887	22 251	22 657	23 067
Stock changes	kt pw	1	-49	-22	-16	-9	-4	0	4	7	10	13
Price (d)	USD/t	3 887	3 716	3 272	3 126	3 140	3 251	3 338	3 428	3 542	3 590	3 641

a) Year ending 30 June for Australia and 31 May for New Zealand in OECD aggregate.

b) Excludes Iceland but includes the 8 EU members that are not members of the OECD.

c) f.o.b. export price, butter, 82% butterfat, Oceania.

d) f.o.b. export price, cheddar cheese, 39% moisture, Oceania.

Table A.9. World dairy projections
(powders and casein)

Calendar year (a)		Average 2007-09est.	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SKIM MILK POWDER													
OECD (b)													
Production	kt pw	2 639	2 503	2 574	2 526	2 515	2 508	2 535	2 548	2 569	2 589	2 592
Consumption	kt pw	1 725	1 754	1 804	1 807	1 803	1 805	1 819	1 822	1 798	1 807	1 809
Stock changes	kt pw	91	-11	15	-38	-54	-71	-67	-58	-5	-3	-3
Non-OECD													
Production	kt pw	791	865	893	918	938	970	995	1 027	1 067	1 097	1 130
Consumption	kt pw	1 512	1 591	1 613	1 641	1 669	1 709	1 743	1 777	1 807	1 847	1 880
WORLD													
Production	kt pw	3 430	3 368	3 468	3 444	3 453	3 478	3 530	3 575	3 635	3 685	3 722
Consumption	kt pw	3 237	3 345	3 418	3 448	3 472	3 514	3 562	3 598	3 605	3 654	3 690
Stock changes	kt pw	92	-11	16	-38	-54	-71	-67	-58	-4	-3	-3
Price (c)	USD/t	3 309	2 530	2 434	2 417	2 493	2 590	2 653	2 759	2 918	2 943	3 000
WHOLE MILK POWDER													
OECD (b)													
Production	kt pw	1 991	2 089	2 086	2 116	2 114	2 117	2 169	2 189	2 183	2 200	2 220
Consumption	kt pw	861	847	869	887	892	898	906	914	921	927	933
Non-OECD													
Production	kt pw	2 271	2 375	2 491	2 597	2 706	2 825	2 914	3 021	3 144	3 254	3 366
Consumption	kt pw	3 343	3 570	3 661	3 779	3 882	3 998	4 130	4 249	4 360	4 481	4 606
WORLD													
Production	kt pw	4 262	4 464	4 577	4 712	4 821	4 943	5 083	5 210	5 327	5 454	5 586
Consumption	kt pw	4 203	4 417	4 531	4 666	4 774	4 896	5 037	5 163	5 280	5 408	5 539
Price (d)	USD/t	3 500	2 808	2 550	2 476	2 588	2 725	2 763	2 832	2 938	2 989	3 042
WHEY POWDER													
Wholesale price, USA (e)	USD/t	853	788	710	705	727	751	768	791	827	835	852
CASEIN													
Price (f)	USD/t	6 300	5 775	5 529	5 451	5 474	5 689	5 862	6 061	6 268	6 343	6 440

a) Year ending 30 June for Australia and 31 May for New Zealand in OECD aggregate.

b) Excludes Iceland but includes the eight EU members that are not members of the OECD.

c) f.o.b. export price, non-fat dry milk, 1.25% butterfat,Oceania.

d) f.o.b. export price, WMP 26% butterfat, Oceania.

e) Edible dry whey, Wisconsin, plant.

f) Export price, New Zealand.

Table A.10. Biofuels projections: ethanol

	PRODUCTION (MIL L)		Growth^a (%)	DOMESTIC USE (MIL L)		Growth^a (%)	FUEL USE (MIL L)		Growth^a (%)	SHARE IN GAZOLINE TYPE FUEL USE(%)				NET TRADE^b (MIL L)	
										Energy Shares		Volume Shares			
	Average 2007-09est.	2019	2010-19	Average 2007-09est.	2019	2010-19	Average 2007-09est.	2019	2010-19	Average 2007-09est.	2019	Average 2007-09est.	2019	Average 2007-09est.	2019
North America															
Canada	1 018	1 891	3,16	1 603	2 609	2,17	1 397	2 403	2,39	2,3%	3,4%	3,4%	5,0%	-585	-718
United States	34 888	67 919	4,65	36 919	78 797	5,53	35 273	77 065	5,68	4,3%	8,4%	6,3%	12,1%	-2 031	-10 878
Western Europe															
EU(27)	4 890	17 987	11,28	6 336	21 223	10,81	3 907	18 716	13,39	1,8%	8,5%	2,7%	12,2%	-1 446	-3 237
Oceania Developed															
Australia	165	409	2,84	165	409	2,84	165	409	2,84	0,6%	1,3%	0,8%	1,9%	0	0
Other Developed															
Japan	107	618	18,17	604	1 128	5,60	9	518	36,46	n.a.	n.a.	n.a.	n.a.	-485	-510
South Africa	16	17	0,95	16	17	1,09	0	0	3,31	0,0%	0,0%	0,0%	0,0%	0	0
Sub-Saharian Africa															
Mozambique	21	42	4,93	21	29	3,35	0	9	75,27	0,0%	3,4%	0,0%	5,0%	0	13
Tanzania	28	87	13,76	32	56	6,87	0	24	41,52	0,1%	3,4%	0,1%	5,0%	-4	31
Latin America and Caribbean															
Argentina	319	571	3,02	173	509	4,84	31	268	5,53	0,4%	3,4%	0,7%	5,0%	146	62
Brazil	25 308	55 020	7,44	21 182	41 681	6,30	19 747	39 441	6,48	46,1%	70,2%	56,0%	77,9%	4 127	13 339
Colombia	343	879	7,13	349	494	1,55	285	429	1,80	4,0%	6,9%	5,9%	10,0%	-6	384
Mexico	63	90	2,88	135	270	2,88	0	0	–	0,0%	0,0%	0,0%	0,0%	-73	-179
Peru	18	194	14,31	10	124	12,87	0	116	22,88	0,0%	5,4%	0,0%	7,8%	0	0
Asia and Pacific															
China	3 917	5 999	3,55	3 725	4 809	3,03	1 970	3 873	7,01	1,8%	2,1%	2,7%	3,1%	192	1 190
India	1 949	2 803	4,50	2 026	2 852	3,80	171	895	17,37	0,9%	3,4%	1,3%	5,0%	-77	-49
Indonesia	215	648	7,07	162	396	4,95	0	241	57,47	0,0%	0,7%	0,0%	1,0%	53	252
Malaysia	65	70	0,61	90	85	0,06	0	0	3,63	0,0%	0,0%	0,0%	0,0%	-25	-14
Philippines	132	927	15,21	217	890	7,43	119	793	8,96	1,3%	6,9%	1,9%	10,0%	-85	37
Thailand	593	2 207	11,05	510	1 965	11,28	307	1 750	14,06	2,8%	14,3%	4,1%	20,0%	84	242
Turkey	54	67	0,32	92	119	2,56	47	72	3,68	0,6%	0,7%	0,8%	1,0%	-37	-53
Viet Nam	150	405	10,59	135	387	11,89	0	250	112,78	0,0%	3,4%	0,0%	5,0%	15	17
TOTAL	74 257	158 849	6,26	74 497	158 849	6,16	64 022	147 879	6,75	4,6%	9,0%	6,6%	12,9%	4 465	14 591

a) Least-squares growth rate (see glossary).

b) For total net trade exports are shown.

est.: estimate,

NA: Not available.

Source: OECD and FAO Secretariats.

Table A.11. Biofuels projections: biodiesel

| | PRODUCTION (MIL L) | | Growth^a (%) | DOMESTIC USE (MIL L) | | Growth^a (%) | SHARE IN DIESEL TYPE FUEL USE (%) | | | | NET TRADE^b (MIL L) | |
| | | | | | | | Energy Shares | | Volume Shares | | | |
	Average 2007-09est.	2019	2010-19	Average 2007-09est.	2019	2010-19	Average 2007-09est.	2019	Average 2007-09est.	2019	Average 2007-09est.	2019
North America												
Canada	138	457	5,02	137	765	11,48	0,3%	1,6%	0,4%	2,0%	0	-307
United States	2 319	3 818	5,27	1 286	3 837	6,80	0,4%	1,1%	0,5%	1,3%	1 033	-19
Western Europe												
EU(27)	8 041	20 521	7,68	8 971	24 362	7,97	3,4%	8,0%	4,2%	9,8%	-930	-3 841
Oceania Developed												
Australia	515	711	1,17	515	711	1,17	2,3%	2,7%	2,9%	3,3%	0	0
Other Developed												
South Africa	48	50	0,96	48	62	3,32	0,0%	0,0%	0,0%	0,0%	0	-12
Sub-Saharian Africa												
Mozambique	45	67	6,10	0	23	82,95	0,0%	4,0%	0,0%	5,0%	45	44
Tanzania	44	35	0,78	0	21	134,03	0,0%	8,2%	0,0%	10,0%	44	14
Latin America and Caribbean												
Argentina	1 286	3 860	6,43	70	903	9,71	0,5%	6,0%	0,7%	7,4%	1 216	2 957
Brazil	958	3 057	4,88	958	3 057	4,88	1,7%	4,0%	2,1%	5,0%	0	0
Colombia	143	876	9,56	137	438	3,22	1,1%	4,0%	1,3%	5,0%	5	437
Peru	140	344	10,06	140	185	3,94	1,1%	4,0%	1,3%	5,0%	0	159
Asia and Pacific												
India	130	3 035	34,50	244	3 176	32,05	0,0%	6,7%	0,0%	8,2%	-114	-141
Indonesia	102	1 148	18,39	15	1 117	29,67	0,5%	5,7%	0,7%	7,0%	87	31
Malaysia	515	972	4,60	50	400	12,60	1,1%	4,0%	1,3%	5,0%	465	572
Philippines	102	305	5,91	102	246	3,73	1,1%	1,6%	1,3%	2,0%	0	60
Thailand	451	1 585	9,41	424	1 532	8,87	1,1%	4,0%	1,3%	5,0%	27	52
Turkey	188	26	0,10	188	36	3,69	0,0%	0,0%	0,0%	0,0%	0	-11
Viet Nam	6	306	39,35	0	299	110,93	0,0%	4,0%	0,0%	5,0%	6	7
TOTAL	15 170	41 171	7,33	13 286	41 171	7,55	1,6%	4,2%	2,0%	5,2%	2 250	2 957

a) Least-squares growth rate (see glossary).

b) Exports for total net trade.

est.: estimate.

Source: OECD and FAO Secretariats.

OECD-FAO Agricultural Outlook 2010-2019

This is the sixteenth edition of the *Agricultural Outlook* and the sixth co-edition prepared by the Organisation for Economic Cooperation and Development (OECD) and the Food and Agriculture Organization of the United Nations (FAO). This edition covers the outlook for commodity markets during the 2010 to 2019 period, and brings together the commodity, policy and country expertise of both organisations. The report analyses world market trends for the main agricultural products, as well as for biofuels. It provides an assessment of agricultural market prospects for production, consumption, trade, stocks, and prices of the commodities analysed.

The macroeconomic assumptions that condition the commodity projections examined are more positive in this year's edition as compared to last year. The anticipated return to global economic growth, a rising population, emerging biofuel markets, and a higher cost structure are expected to underpin international commodity markets and prices over the outlook period under study. Developing countries are expected to be the driving force behind the expected growth in agricultural production, consumption and trade. The projections and past trends are presented in the statistical annex and can be viewed in more detail at *www.agri-outlook.org*.

This year's report also includes a special section on price volatility and price transmission from world to domestic markets. Governments are concerned about price volatility because it affects farm viability, food security and needed investment. The report analyses the evidence of, and changes in, price volatility over the longer term and summarises policy advice from both FAO and OECD on this issue.

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