Agricultural Outlook and Situation Analysis Reports

First Semi-annual Medium-term Agricultural Outlook Report

Under the Project Commissioned by the National Food Security Mission Ministry of Agriculture

February, 2013

Prepared by
National Council of Applied Economic Research

About the Project

The need for monitoring and analysis of emerging food scenarios is important for India both because of significant dependence of output on the monsoon rains and the fact that globally India is one of the major consumers of food crops influencing markets. Management of agriculture from a public policy perspective requires organisation of this information and analysis as inputs to policy making.

Against this backdrop, the National Food Security Mission (NFSM), Ministry of Agriculture, commissioned a 3-Year study to National Council of Applied Economic Research (NCAER) in 2011–12 to bridge this important gap in analytical inputs for understanding the emerging agricultural scenarios both in the short-term of one or two quarters and also in the medium to longer term.

Accordingly, the agricultural outlook and scenario analysis undertaken in this study refers to the main crop based food items: cereals (specifically rice, wheat, jowar, bajra, maize, and overall coarse grains), pulses (gram, tur), selected fruits and vegetables (banana, potato, and onion), sugarcane and edible oils (groundnut, and rapeseed/ mustard, and soybean). In addition, the analysis also covers milk, one livestock product.

The three main outputs of the proposed work will be:

(1) A **Quarterly Agricultural Outlook Report** that integrates the assessment of key indicators relating to agriculture with a focus on food sectors. The reports will include assessment of the current situation on inputs, output and market conditions and also forecasts of key indicators for the full year based on models developed for the purpose.

(2) A **Semi-annual Agricultural Outlook and Scenario Analysis Report** which provides a longer term perspective for the food sector. These reports will present an analysis of alternative scenarios of output and consumption for the food crops taking into account the available information and based on the suitable economic models that permit longer term projections.

(3) **Monthly briefings** on the prevailing agricultural conditions.

Implementation

NCAER has set up a study team to carry out the study.

An advisory committee has been formed to provide broad guidance to the implementation of the study. The Committee comprises of Dr Shekhar Shah, DG, NCAER as Chair; Dr Ashok Gulati, Chairman, Commission on Agricultural Costs and Prices; Prof. Ramesh Chand, Director, National Centre for Agricultural Policy (NCAP), New Delhi; Prof. Mahendra Dev, Director, Indira Gandhi Institute for Development Research (IGIDR), Mumbai; Mr Mukesh Khullar, Joint Secretary (Crops), Ministry of Agriculture; and Mrs S. Bhavani, Principal Adviser, Ministry of Agriculture. Representative from FAO and DFID are Special Invitees to the Committee meetings.

A Technical Support Group comprising of key officers from different departments of the government and experts has also been formed to interact with the study team to improve the work under the study.

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Shekhar Shah
Director-General

PREFACE

As India continues to grow its economy, its agriculture must also keep pace in improving its infrastructure, efficiency and productivity in a sustainable manner, and contribute to the food security of a population of over a billion. The performance of India's food sector has implications not only for India but also for world markets.

India's concerns on food security came to the fore in 2008 with the persistently high prices of food around the world and rising food inflation in India. While rising food demand from the high-growth emerging economies was cited as one of the reasons for the increase in prices, the use of agricultural inputs for bio-fuels production was also an important driver of the price rise. Growing population and rising income will mean increased demand for food and also a changing composition of food. Policies in developing economies will have to address these dynamic features of the demand for food while focusing on the mechanisms that assure availability of basic foods at reasonable prices. Such policies require informed, on-going assessments of emerging scenarios for food commodities addressing production, demand, trade, and prices.

This is the first of a series of semi-annual assessments on India's Medium-term Agricultural Outlook that NCAER will prepare to assist the National Food Security Mission in the Ministry of Agriculture. NCAER is privileged to have been asked by the Union Ministry of Agriculture to undertake this activity on a multi-year basis. These semi-annual reports provide a longer term perspective for the next five to six years. These will complement the quarterly reports that NCAER has already started issuing. This report describes the emerging agricultural scenario over the next five years covering the period of the Twelfth Five Year Plan.

The report carefully reviews the scenarios prepared by a number of agencies and experts. These also take into account the global perspective provided by international agencies and the scenarios for India analysed by the Working Groups on Agriculture and Food Supply and Demand Balances for the Twelfth Five Year Plan. We also present the findings from an econometric model for foodgrains and oilseeds at NCAER that reinforces the view that greater policy efforts will be needed to increase the productivity of Indian agriculture. Given the limited opportunities to use input subsidies to enhance production, more sustained strategies will have to focus on investments that promote productivity.

I acknowledge the sustained support of the Ministry of Agriculture in preparing these periodic reports. The encouragement and support of Mr Ashish Bahuguna, Secretary, Ministry of Agriculture, and other senior officials of the Ministry, has been critical for this work. The work is also being supported by an Advisory Committee and a Technical Support Group set up by the Ministry for this purpose. As part of this process, we are also building a network of researchers and other institutions to aid the monitoring of developments in Indian agriculture on an on-going basis. I am grateful to Dr Shashanka Bhide, Senior Research Counsellor and Senior Fellow at NCAER, for leading this work, and to the highly capable team that is working on it. I wish them well in this important work.

Shekhar Shah
Director-General

New Delhi
February 25, 2013

ASHISH BAHUGUNA
SECRETARY

भारत सरकार
कृषि मंत्रालय
कृषि एवं सहकारिता विभाग
Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation

FOREWORD

      Food availability is a key concern for our country. Planning for adequate supplies of food commodities to meet the requirements of our burgeoning population requires analysis of a wide range of issues such as inputs, prices, markets, technology and the state of farm enterprises. The preferences and purchasing power of consumers are also necessary to be examined to balance supply and demand. Finally, it is also necessary to have a global perspective on these issues. Assessment of all these concerns on an ongoing basis is necessary to enable informed discussion on policies.

      Policies are motivated as much by longer term considerations as they are by the immediate concerns. With this broad perspective, the Ministry of Agriculture had commissioned a study by NCAER to bring out quarterly and semi-annual reports on short term and medium term scenarios for food commodities. The present report on Medium Term Agricultural Outlook – the first in the series – provides an assessment of the food supply and demand conditions over the next five years. The report has taken into account recent studies by international and other agencies and examined the scenarios relating to production, prices and trade.

      The second half of the last decade was marked by rising food prices not only in India but also in the international markets. Further expansion in supplies are necessary to meet the demand of the rising population and their rising incomes. Efforts to improve efficiencies are therefore needed not only in production but also in marketing, processing and utilization of food.

      I hope that this report will help in understanding the changing dynamics of the different dimensions of the food sector which will be useful to a wide range of stakeholders.

(Ashish Bahuguna)

Date: February 27, 2013

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Highlights

The Backdrop

The annual growth of agricultural and allied sector's GDP during the period 2007–08 to 2011–12 works out to 3.6 per cent close to the targeted growth of 4 per cent for the Eleventh Five Year Plan. Reviewing the performance of the sector in the recent years, the Working Group on Agriculture set up to develop strategies for the Twelfth Five Year Plan noted that the turnaround in the performance of agriculture in the post 2006–07 period may be attributed to a number of factors ranging from technology to institutional initiatives. An important explanation was also in the favourable terms of trade. Both, public and private investment improved during this period of recovery of growth. The need to sustain this growth both from the perspective of ensuring adequate food supplies and achieving faster poverty reduction is well recognised. An assessment of the medium term outlook of the food sector over the next 5–6 years is, therefore, valuable to policies for the sector both in the public sector and private sector.

In this report we attempt to provide an assessment of the outlook for the selected major food commodities over the medium term. The key objectives of this report are to provide

(1)   A review of the production conditions at the global level based on the assessments provided by international agencies

(2)   An assessment of the supply and demand conditions for food commodities at the national level

Key Findings

Global scenario

Review of the assessments of global trends suggests that while supply would respond to the rising demand due to population increase and income growth particularly in the developing economies, the price pressures would remain, although there is likely to be some moderation from the increases experienced in the recent five years.

World production of wheat and rice is expected to increase to meet the rising demand with the overall price situation easing from the recent high commodity prices. The slower increase in demand is an important factor in moderating price situation.

Livestock demand for feed is projected to increase at a lower rate, because of slower growth in demand in the developed economies. This may ease pressure on the prices of coarse grains.

Vegetable oil demand is expected to be firm in the developing countries keeping up the pressure on prices to be at high levels. In the case of dairy sector and sugar also prices are expected to remain firm either because of rising costs in the case of dairy sector or production fluctuations in the case of sugar.

In spite of a slowdown in demand growth, consistent further investment in agriculture is needed to tackle yield stagnation and more frequent weather events in order to ensure an adequate supply response.

Domestic food economy

While there are opportunities to increase crop area under specific crops by shifting production from one crop to another, the potential for increasing crop area either by increasing net sown area or cropping intensity is limited in the medium term. This implies that raising productivity per hectare is the only main instrument to increase production in the food sector.

The policy environment for agriculture is changing from input subsidies to more fiscally sustainable strategies. While prices of inputs such as fertliser, diesel, electricity and pesticides rose at relatively moderate rates in the last 5–6 years, with the reduction in input subsidies on fuel and fertilisers, input prices are likely to increase at higher rates. In the case of labour, wage rates have increased at double digit rates per year in the last five years. Diversification of the economy is giving new opportunities for labour, raising the wage rates. The rise in wage rates may make further mechanisation of farming operations feasible if there are additional improvements in productivity as a consequence of mechanisation.

The MSP and procurement of grains by the government have provided incentives for raising production of rice and wheat. However, government has not been able to distribute all the grain it has procured at the MSP leading to large stocks. The Food Security Bill aims to provide grains at highly subsidised price requiring the government to increase its procurement efforts to meet the demands of the enhanced distribution. Increased demand for grain because of the subsidy, will require production growth to accelerate.

The twin objectives of ensuring adequate food supplies to the growing population and at the same time design a subsidy regime that is fiscally sustainable point to the need to increase productivity of the sector.

Supply-demand balances

The assessment of supply-demand scenario by the Working Group on Foodgrains for the 12th Five Year Plan indicates that domestic supplies are likely to exceed demand in the case of cereals in the plan period ending in 2016–17. The projected domestic supply exceeds demand in the case of sugar also (derived from the estimates for sugarcane). The supply projection of pulses and oilseeds lags estimated demand even at the end of the projection period of 2016–17.

The additional analysis carried out in the report shows that growth in demand is likely to outpace production in the case of fruits, vegetables and livestock products.

Production prospects of the major food commodities that included rice, wheat, coarse cereals and oilseeds examined within a framework of an econometric model showed that in the medium-term production of cereals, foodgrains and oilseeds is greater than upper limit of the range of estimates provided by the Working Group for the 12th Five Year Plan. Our projection of production of pulses in 2016–17 is lower than the upper limit of projections of the Working Group. The estimates of rice production by FAO are closer to our own projections than the projections of the Working Group but FAO projections are significantly lower than ours in the case of wheat. The projections from the present analysis seem to be more in line with the recent production trends in 2011–12 and 2012–13.

The projections of the present analysis indicate surplus of production relative to domestic demand in the case of cereals. Domestic production falls short of demand in the case of pulses and oilseeds.

Spatial dimension

In an attempt to explore the implications of current trends in the allocation of cultivated areas to different crops, we have presented the contribution of five regions of the country to crop area under the selected food crops. We have also examined the importance of each major food crop to the total crop area under these crops in each region.

The analysis points to rising share of horticulture crops such as potato, onion, and banana in a number of regions, while the area under sugarcane and foodgrain declines relative to total area under food crops. These changes are more prominent in the Central, Eastern and Southern regions. The changes in North and West are relatively small. The shifting patterns of crop areas, if the present trends continue also indicate the need for development of marketing and other infrastructure support for the changes in production pattern.

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CHAPTER I
Introduction

I.1 The Backdrop and Objectives of the Report

The report of the Working Group on Agriculture[1] sets out the overall framework for assessing outlook for agriculture over a medium term perspective of the twelfth five year plan. Noting that an annual growth rate of 4 per cent per year has been pursued by the three five year plans starting from the ninth five year plan, it examines the growth experience of the sector over a longer period starting from 1950–51. The target of 4 per cent growth was seen as important for ensuring food and nutritional security, inclusive growth and bridging rural-urban divide. Looking at the rolling 10 year and 5 year average annual growth rates starting from 1951, the report makes following observations:

- "Decadal trend growth rates and average growth of five years since the beginning of XI Plan have been higher than long-run growth rate in Indian agriculture, which is 2.86 per cent.

- Indian agriculture faced serious slowdown during 1996–97 to 2005–06.

- There is an unambiguous recovery from 2006–7 onward".

The report then asks, "what has contributed to this recovery? How far those factors can go?"

The recovery in growth rate of GDP from agriculture, though short of the targeted 4 per cent, coinciding with the period of the Eleventh Five Year Plan has been attributed by the report to a number of factors:

- Improvement in terms of trade

- Public and private investments

- Quality seed, hybrid

- Technology

- Institutional efforts

Using the ratio of a price index of agriculture to non-agricultural sector prices, it is found that there was a reversal of the declining trend of the 1990s in the first decade of the new century. There was also a mild increase in public investment in agriculture and a sharp increase in private investment in agriculture in the years following early 2000s until 2009–10. The great global financial crisis of 2008 and its aftermath also had a significant adverse impact on investments in agriculture. The annual growth rate of Gross Fixed Capital Formation (constant prices) in agriculture fell from 15 and 21 per cent in the two

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1. Report of the Working Group on Crop Husbandry, Agricultural Inputs, Demand and Supply Projections and Agricultural Statistics for the Twelfth Five Year Plan (2012–2017), Planning Commission, Government of India, October 2011; http://planningcommission.nic.in/aboutus/committee/wrkgrp12/agri/crop_husbandry.pdf

years of 2006–07 and 2007–08 to 2.2 per cent in 2009–10. There was recovery in GFCF in the subsequent year to 8.6 per cent over the previous year on the strength of the rise in private investment. However, during this period of 2004–05 to 2010–11, relatively higher proportion of GDP from the sector was invested in agriculture in the period coinciding with the Eleventh Five Year Plan.

Public investment in agriculture is clearly a critical factor influencing agricultural growth as it provides conditions favourable for increased private investment. What affects agriculture is not only public investment in areas such as technology, extension and irrigation but also in related areas such as roads, power and communication that improves infrastructure for agriculture. The strategies for enabling growth of agricultural sector over the medium term will have to address these factors.

Increase in agricultural production is constrained by limited land area that can be brought under cultivation. The net sown area under the crops is now stagnant or declining as other demands for land are rising. The net sown area in 2000–01 was 141.3 million hectares. It was 141.9 million ha in 2008–09 and down again to 140 million ha in 2009–10. The increase in crop area is achieved by increasing cropping intensity. The cropping intensity-ratio of gross cropped area to net sown area has increased from 1.31 in 2000–01 to 1.37 in 2009–10. The increase in cropping intensity has been possible because of expansion in irrigation, availability of suitable crop varieties and mechanisation. Further increase in intensity is, however, constrained by the extent to which irrigated area can be increased.

Increased production through productivity improvements is determined by technology and investments that help improve productivity of land. Economic incentives such as remunerative prices and markets for output would play important role in the adoption of technology and practices that raise productivity. Marketing reforms that ensure farmers' access to markets and efficiency in the distribution system are expected to be part of the policy strategy for sector for the medium term. Market reforms may be needed not only for the products but also for factors of production such as land, capital and labour. Declining average size of farm holdings will necessitate measures that allow flexibility in land markets and credit system so that land can be used efficiently.

Meeting the requirements of food through market or other mechanism would be the challenge for the food sector over the medium term. The accumulation of large stocks of foodgrain in excess of what is required for distribution and import of large quantities of edible oils and pulses reflects the need for adjustment in cropping pattern.

In this report we attempt to provide an assessment of the outlook for the selected major food commodities over the medium term.

The key objectives of this report are to provide:

(1) A review of the production conditions at the global level based on the assessments provided by international agencies.

(2) An assessment of the supply and demand conditions for food commodities at the national level.

The report is organised in four chapters: (1) Overview, (2) Global Perspectives, (3) Supply and Demand in the Domestic Economy, and (4) Conclusions.

I.2 Broad Patterns of Change in the Food Economy

I.2.1 Declining share of agriculture in the national economic output

The sectoral GDP data reveals that the share of agriculture in the aggregate GDP has declined steadily over the past several decades from as high as over 50 per cent in the fifties to around 14 per cent in recent years, a pattern typically exhibited by economies as they develop with rising per capita income. This is largely attributed to demand conditions and also relatively lower demands on limited natural resources by the non-agricultural sectors, particularly the services sector. With agricultural sector growth rate likely to fall significantly short of overall economic growth of 6 to 7 per cent in coming years, the contribution of agriculture to overall GDP will continue to decline. If the current trend continues, agriculture's share in the aggregate GDP may decline to less than 10 per cent by 2019–20 (Figure I.1).

Figure I.1: The Declining Share of Agriculture in Overall GDP

Forecast

$y = -0.807x + 23.21$
$R^2 = 0.995$
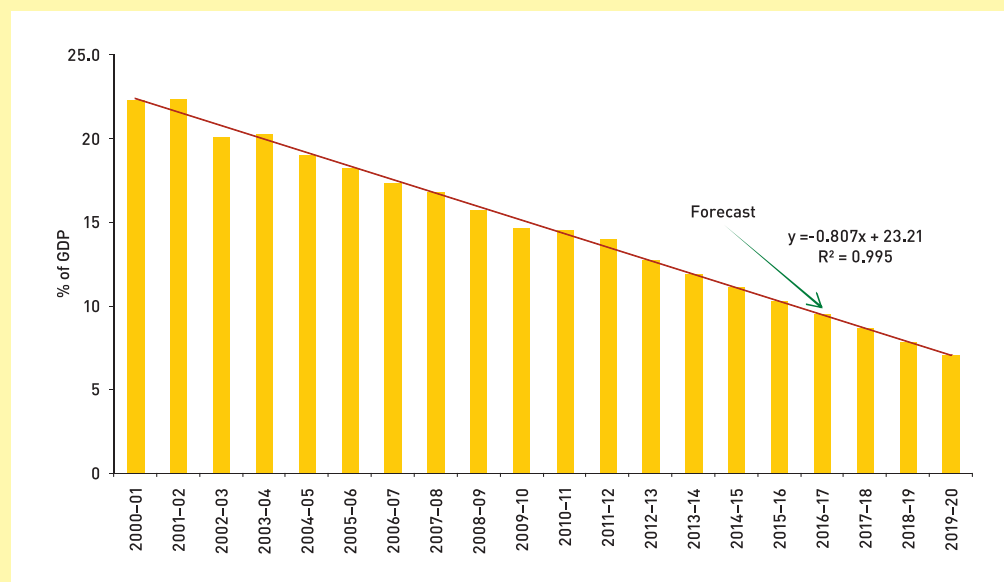
The declining share of agriculture relative to services and industry in overall GDP is more pronounced when we consider the contribution of different sectors to growth of GDP (Figure I.2). Continuation of this trend would imply that year-to-year fluctuation in output, a characteristic of agriculture is unlikely to be less pronounced in the overall GDP in the coming years.

With agricultural sector growth rate likely to fall significantly short of overall economic growth of 6 to 7 per cent in coming years, the contribution of agriculture to overall GDP will continue to decline. If the current trend continues, agriculture's share in the aggregate GDP may decline to less than 10 per cent by 2019–20.

Inclusive growth would be possible only when agriculture provides livelihood to those engaged in its operation and it supplies food at affordable prices.

Figure I.2: Declining Contribution of Agriculture Sector to Growth in GDP: % Share of Major Sectors to Annual GDP Growth
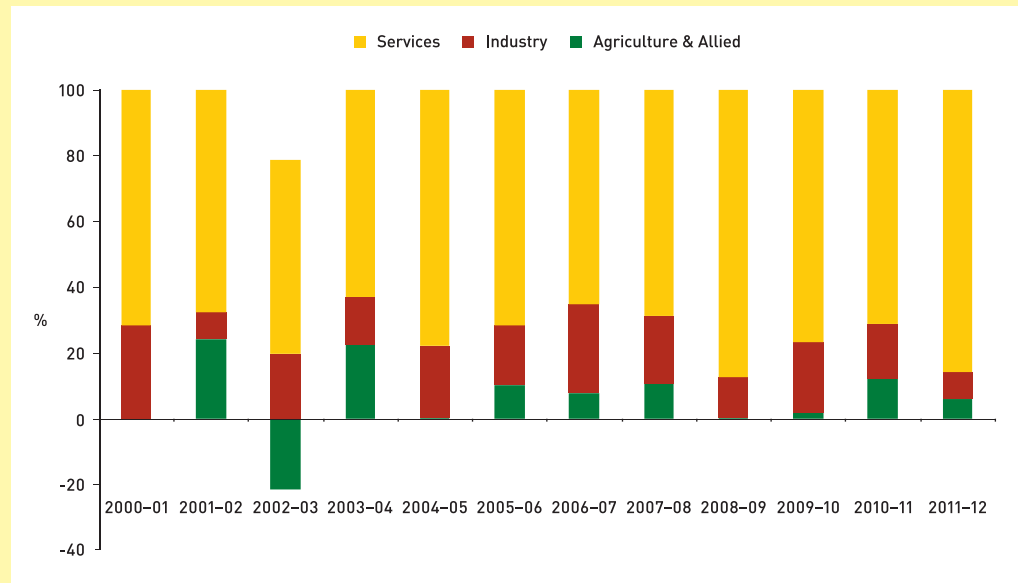
Source: Based on data on sectoral GDP at 2004–05 prices available from Central Statistical Organisation.

The declining share of agriculture in the overall economy is a consequence of higher rate of growth of the non-agricultural sectors. Although the share of agricultural sector in GDP is expected to decline continuously, its significance in sustaining India's growth momentum is expected to remain unchanged because of following factors.

- Roughly half of India's work force is still engaged in agriculture for its livelihood. Being both a source of livelihood and food security for a vast majority of low income, poor and vulnerable sections of society, its performance assumes greater significance.

- Given the fact that India has the largest number of poor and malnourished people in the world, increasing food supply is paramount to achieving the objective of poverty and malnutrition reduction as well as of inclusive growth.

- Since agriculture forms the resource base for a number of agro-based industries and agro-services, agriculture should not be viewed only as farming activity but part of a wider value chain, which includes farming, wholesaling, warehousing (including logistics), processing, and retailing.

- The rising population combined with income growth should generate increased demand for agricultural products and processed food products, necessitating increased investment in agriculture and agro-processing industry.

Inclusive growth would be possible only when agriculture provides livelihood to those engaged in its operation and it supplies food at affordable prices.

Agricultural growth could be achieved through improvement in productivity, through investments in irrigation, infrastructure development, research and development activities in agriculture and agro-processing and efficient use of water and fertilizers.

I.3 Farm Holding Size Projected to Decline

Average farm holding size is getting smaller with the average farm size in 2010–11 estimated at 1.16 hectares[2] compared to 1.23 hectares in 2005–06, and 2.26 hectares in 1970–71. The number of marginal and small holdings (2 hectares and less) shows a continuous increase where as the medium and large holdings (4 hectares and above) show a steady downtrend. Total number of farm holdings has almost doubled from 71 million in 1970–71 to 137.8 million in 2010–11. If this trend continues, farm holdings in 2020–21 would number around 154 million with the small and marginal holdings accounting for almost 85 per cent of the total holdings and the average holding size projected to decline to just one hectare (Figure I.3).

Figure I.3: Indian Farm Holding Size Shrinking
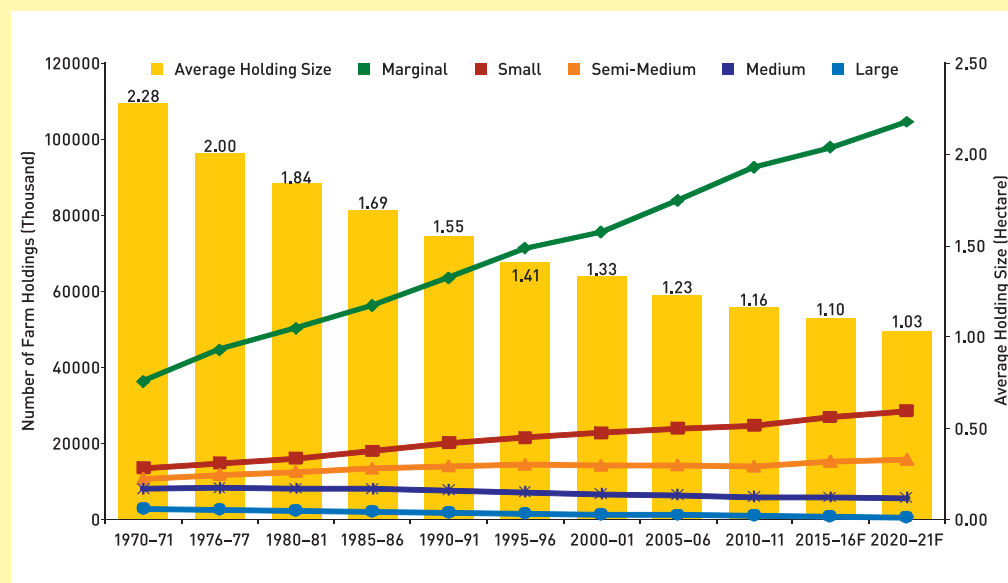
Source: Data from Directorate of Economics & Statistice, Ministry of Agriculture; extrapolations beyond 2010–11 are based on trend growth in each variable between 1970–71 to 2010–11.

Although the increasing number of small and marginal holdings does not directly imply a negative impact on agricultural productivity, it will have significant implications on the economy, which include:

- Farm population per hectare of operated area will increase and per capita farm income will decline.

- Delivering agricultural credit to increasing number of small and marginal farmers will pose a challenge.

- Farm mechanization will become difficult unless there is pooling of farm land or joint use of machinery across farms.

- Marketable surplus of agricultural produce will decline with continued increase in on-farm consumption.

- Sourcing of agricultural produce for processing and retailing will become difficult as marketable surplus will become more fragmented making grading and standardization difficult.

2. Agricultural Census 2010–11 (http://agcensus.nic.in/document/agcensus2010/agcen2010rep.htm)

Total number of farm holdings has almost doubled from 71 million in 1970–71 to 137.8 million in 2010–11. If this trend continues, farm holdings in 2020–21 would number around 154 million with the small and marginal holdings accounting for almost 85 per cent of the total holdings and the average holding size projected to decline to just one hectare.

Most of the increase in cropped area during the past decade was in wheat, maize, soybeans, pulses and cotton with most of the decline coming from coarse grains (excluding maize), which has declined by 5 to 6 million hectares.

The key to offset the disadvantages of declining farm size would be higher productivity per hectare of crop area operated by the farms.

I.4 Changes in Cropping Pattern

Total planted area under major crops (foodgrains, oilseeds, cotton, and sugarcane) has increased by around 9 per cent since 2000–01 to 170 million hectares in 2011–12, reflecting increased irrigarion availability leading to increased cropping intensity (Figure I.4).

Most of the increase in cropped area during the past decade was in wheat, maize, soybeans, pulses, and cotton with most of the decline coming from coarse grains (excluding maize), which has declined by 5 to 6 million hectares. Area under rice and sugarcane has remained more or less unchanged, except for some year-to-year variations. The increase in cotton area occurred in recent years coinciding with the introduction of Bt cotton. Area under pulses was stagnant between 2003–04 and 2009–10 and increased in the past two years with the rising prices inducing higher production and support from programs, such as, the National Food Security Mission.

Figure I.4: Trends in Crop Area (million hectares)
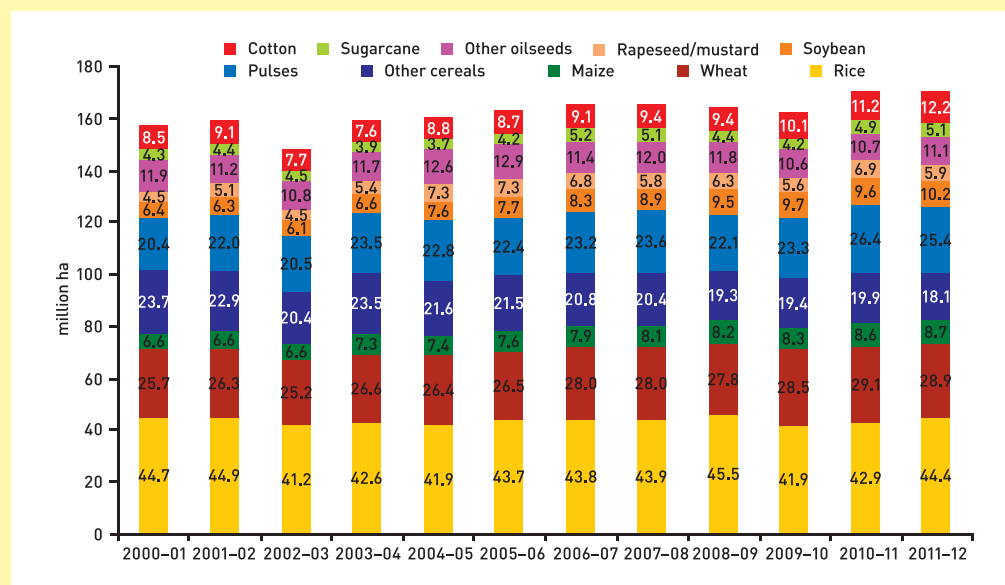
Note: "Other oilseeds" = Total 9 major oilseeds - rapeseed &mustard - soybean; "Other coarse grains = Total coarse cereals - maize; data for 2011–12 are 4th Advance Estimates.
Source: Directorate of Economics and Statistics.

The emerging scenario points to the dominance of wheat, cotton, soybeans, and maize in India's overall cropping pattern and the declining importance of coarse grains (excluding maize). The share of rice in the total cropped area has also declined. Assuming this trend in cropping pattern will continue, the projected share of various crops in total planted area during 2012–13 to 2019–20 is shown Figure I.5 shows the changing cropping pattern during 2000–01 to 2011–12 and projection for 2019–20. Continuation of trends will be affected by the constraints such as suitability of soil and climatic conditions, availability of irrigation and changing input availability.

Figure I.5: Cropping Pattern – Past, Present, and Future

2000–01

Other oilseeds 8%
Cotton 5%
Rapeseed 3%
Sugarcane 3%
Soybeans 4%
Rice 29%
Pulses 13%
Other Coarse grains 15%
Maize 4%
Wheat 16%

2011–12

Cotton 7%
Sugarcane 3%
Other oilseeds 6%
Rapeseed 3%
Soybeans 6%
Rice 26%
Pulses 16%
Other Coarse grains 10%
Maize 5%
Wheat 18%

2019–20

Other oilseeds 5%
Cotton 8%
Rapeseed 4%
Sugarcane 3%
Soybeans 8%
Rice 24%
Pulses 16%
Other Coarse grains 8%
Maize 6%
Wheat 18%
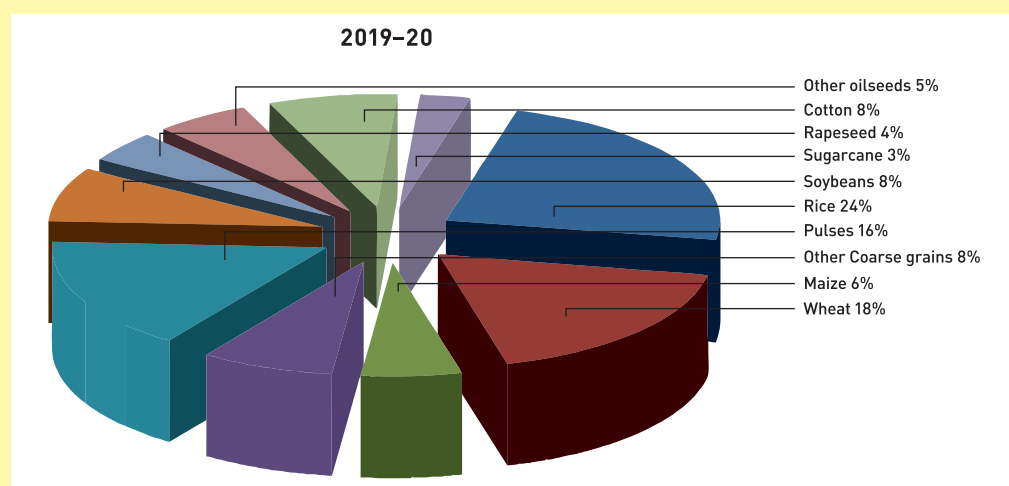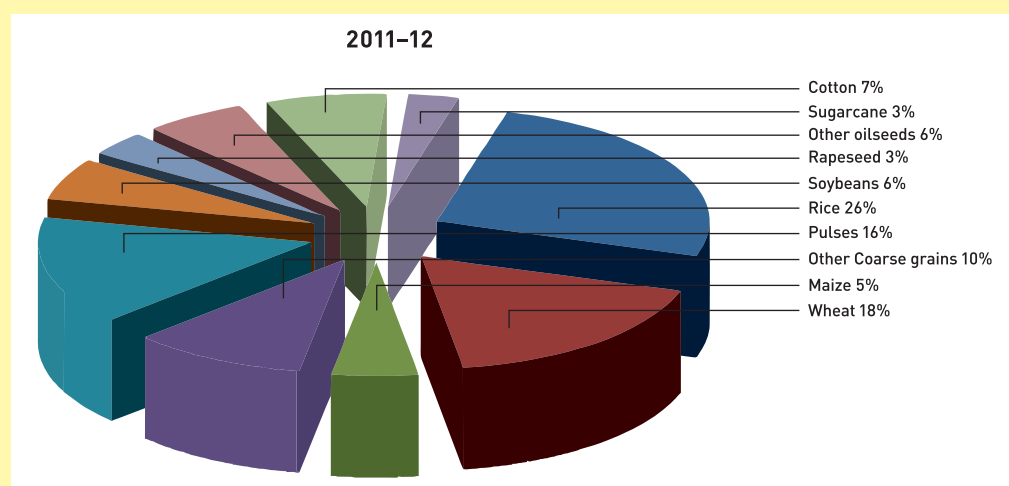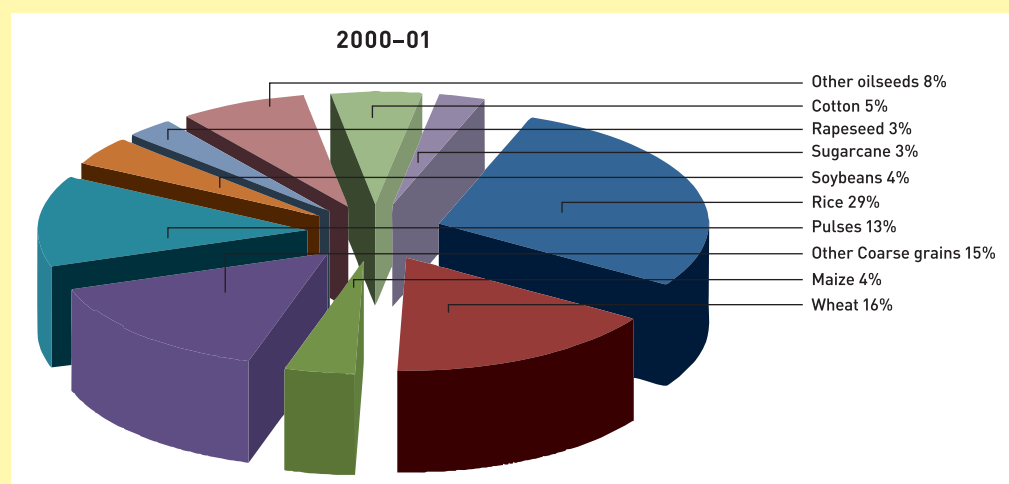
Source: Based on data on crop areas upto 2011–12 and trends from 2000–01 to 2011–12.

I.5 Trends in Input Use

Given that the land area is at its maximum use, much of the increase in agricultural production in recent years is attributed to increased input use. Table I.1 shows the trends in the quantum and intensity of input use since 2000–01.

Table I.1: Trend in Input Use Level

	Gross Irrigated Area (Million Hectares)	% Irrigated Area to Gross Cropped Area	Certified/Quality Seed Distributed (Million Quintals)	Consumption of Fertilizer (N+P+K) (Million Tonnes)	Consumption of Pesticides (Technical Grade Materials) (1000 tonnes)	Electricity Use (GWh)
2000–01	76.19	41.11	8.63	16.70	43.58	84,729
2001–02	78.42	41.65	9.18	17.36	47.02	81,673
2002–03	73.09	41.81	9.80	16.09	48.30	84,486
2003–04	78.03	41.11	10.86	16.80	41.00	87,089
2004–05	81.07	42.38	12.02	18.40	40.67	88,555
2005–06	84.28	43.65	12.68	20.34	39.77	90,292
2006–07	86.77	44.84	15.50	21.65	41.51	99,023
2007–08	87.98	45.05	17.91	22.57	44.77	104,182
2008–09	88.86	45.32	21.58	24.91	43.86	107,776
2009–10	86.42	44.96	25.71	26.49	41.82	119,492
2010–11	NA	NA	27.73	28.12	55.54	NA
2011–12	NA	NA	28.39	27.74	50.58	NA

Source: Agriculture at a Glance, 2012, Directorate of Economics and Statistics, Ministry of Agriculture.

Although latest data on irrigated area is not available, growth in irrigated area has slowed down in recent years. Consequently, percentage of irrigated area to gross cropped area has tended to level off. One of the main drivers of increased cropping intensity is increased area coverage under irrigation. Hence, substantial investment in irrigation projects – or to improved efficiency of available water resources for irrigation will be required to accelerate growth in the agricultural output.

Distribution of certified and quality seedshas shown a significant increase in recent years, which is a major factor contributing to increased yields of most crops.

Fertilizer consumption has increased by around 70 per cent during 2000–01 to 2010–11. Per hectare use of fertilizer (nutrient basis) has also increased from 89.6 kilograms in 2000–01 to 144.14 kilograms in 2010–11 and an estimated 144.33 kilogram/ha in 2011–12, contributing to yield growth. Another noteworthy feature is the shift in the composition of major nutrients in the total usage of fertilisers in favour of phosphatic and potassic nutrients in recent years but for the reversal in 2011–12 (Table I.2). The nutrient based subsidy approach may have been one of the factors influencing this trend besides the changes in cropping pattern over time.

Fertilizer consumption has increased by around 70 per cent during 2000–01 to 2010–11. Per hectare use of fertilizer (nutrient basis) has also increased from 89.6 kilograms in 2000–01 to 144.14 kilograms in 2010–11 and an estimated 144.33 kilogram/ha in 2011–12, contributing to yield growth.

Table I.2: Trends in the Use of Chemical Fertilisers

	% Share of Total Nutrients Use			Nutrient Use
	N	P	K	Per Hectare (Kg)
2000–01	65.4	25.2	9.4	89.63
2001–02	65.2	25.2	9.6	91.13
2002–03	65.1	25.0	9.9	91.45
2003–04	65.9	24.5	9.5	88.05
2004–05	63.7	25.1	11.2	94.52
2005–06	62.6	25.6	11.9	105.5
2006–07	63.6	25.6	10.8	111.76
2007–08	63.9	24.4	11.7	115.27
2008–09	60.6	26.1	13.3	127.21
2009–10	58.8	27.5	13.7	135.27
2010–11	58.9	28.6	12.5	144.14
2011–12	62.4	28.5	9.1	144.33

Source: Agriculture at a Glance, 2012, Directorate of Economics and Statistics, Ministry of Agriculture.

Increased availability of institutional credit has supported input use by farmers. Overall credit to agriculture has grown dramatically – nearly 10 times in the course of 10 years between 2000–01 and 2010–11 (Table I.3) as the interest rate on farm credit was lowered to 4 per cent (after taking into account the 3 per cent subvention in interest for timely repayment of crop loans) since 2006. The interest rate subvention and the other input subsidies are a reflection of poor returns to farming especially given the inability of the smaller farms to provide adequate income to these farmers.

Table I.3: Agricultural Credit Trend (Rs million)

Year	Short-term	Medium & Long Term	Total
2000–01	333,140	195,130	528,270
2001–02	405,090	215,360	620,450
2002–03	455,860	239,740	695,600
2003–04	549,770	320,040	869,810
2004–05	740,640	512,450	1,253,090
2005–06	1,053,500	753,160	1,806,660
2006–07	1,384,550	904,550	2,289,100
2007–08	1,835,190	660,660	2,495,850
2008–09	2,104,610	914,470	3,019,080
2009–10	2,766,560	1,078,580	3,845,140
2010–11	3,749,265	1,113,645	4,682,910
2011–12	3,961,580	1,148,710	5,110,290

Source: Agriculture at a Glance, 2012, Directorate of Economics and Statistics, Ministry of Agriculture.
Note: Complete break up of data for 2010-11 is not available. Therefore, data for Medium & Long Term is first obtained as an average of 2009-10 and 2011-12 and Short Term is the balance from the Total credit. Data for 2011-12 is provisional.

I.6 Trends in Consumption of Food Commodities

There has been a steady decline in the proportion of expenditure on food items over the past four decades both in urban and rural areas. Continuing the earlier trend, share of expenditure on food declined from 64 per cent in 1987–88 to 53.6 per cent in 2009–10 in rural areas and from 53.6 per cent to 40.7 per cent in urban areas (Table I.4). The proportion of expenditure on non-food items has increased from 36 per cent to 46.4 per cent in rural areas and from 43.6 per cent to 59.3 per cent in urban areas during the same period. Most of the increase in non-food expenditure was in services.

Table I.4: Composition of Consumer Expenditure (%)

Item		1987–88	1993–94	1990–00	2004–05	2009–10
Food total	Rural	64.0	63.2	59.4	55.0	53.6
	Urban	56.4	54.7	48.1	42.5	40.7
Non-food total	Rural	36.0	36.8	40.6	45.0	46.4
	Urban	43.6	45.3	51.9	57.5	59.3
Total expenditure	Rural	100.0	100.0	100.0	100.0	100.0
	Urban	100.0	100.0	100.0	100.0	100.0

Source: NSSO Household Consumer Expenditure Survey 2009–10.

At a disaggregated level of consumption of specific items, the data reveal that food consumption is undergoing a dramatic change in recent years. Analysis of various rounds of the Consumer Expenditure Survey conducted by the National Sample Survey Organization (NSSO) shows that while per capita consumption of cereals in general and coarse cereals in particular has declined both in rural and urban households, there has been a steady increase in the consumption of high value food products such as fruits and vegetables, vegetable oils, milk, and animal products (Figure I.6). Per capita consumption of pulses has also steadily declined.

Per capita consumption of cereals in general and coarse cereals in particular has declined both in rural and urban households, there has been a steady increase in the consumption of high value food products such as fruits and vegetables, vegetable oils, milk, and animal products.

Figure I.6: Changing Pattern of Food Consumption

Urban

Rural
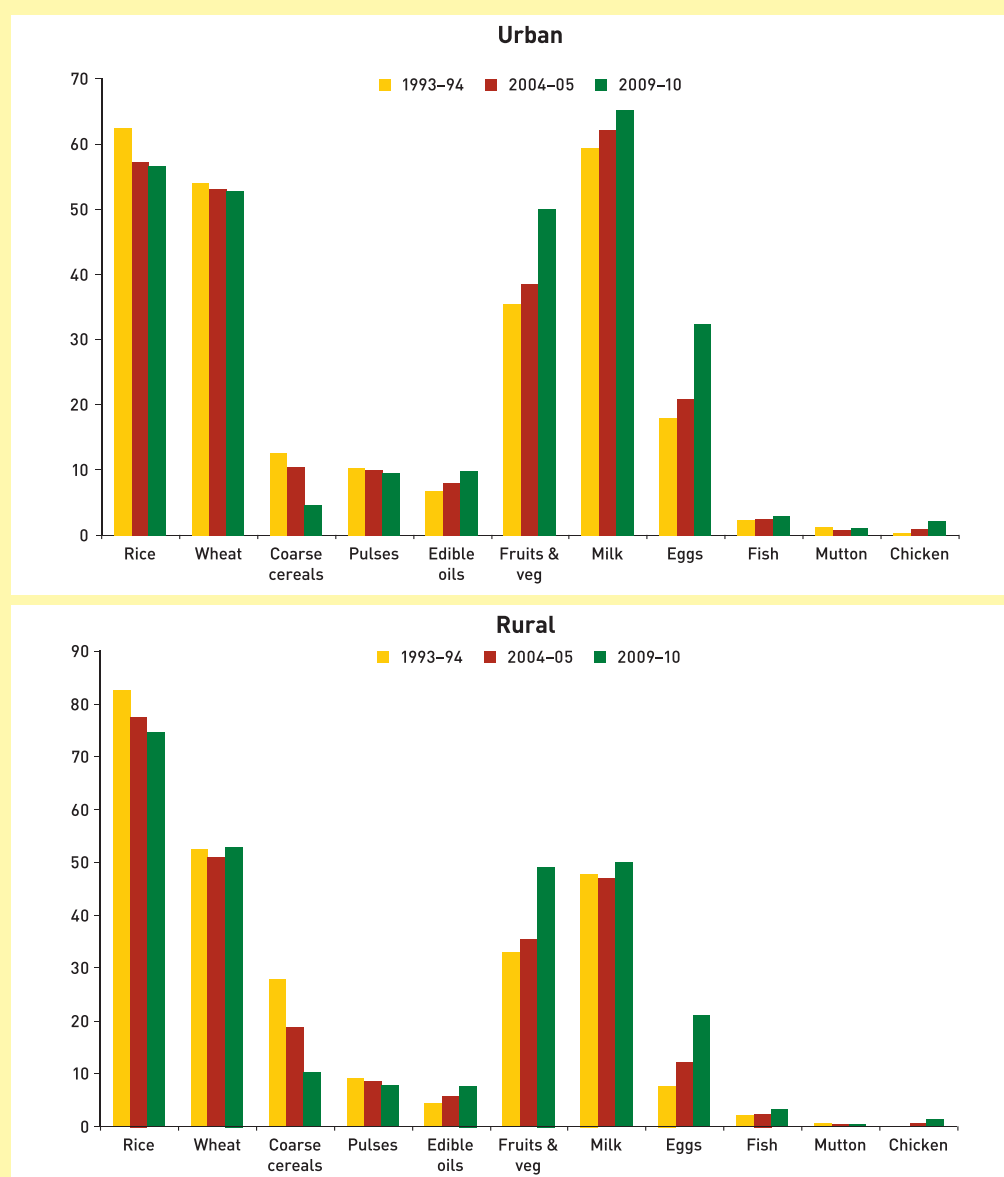
Source: Based on Consumption Expenditure Surveys, various rounds by the National Sample Survey Organization, GoI.
Note: All units in Kgs/annum, except milk (litres) and eggs (numbers)

I.7 Domestic Terms of Trade Outlook

The domestic terms of trade between agriculture and non-agriculture have been long recognised as a powerful tool to reflect the economic incentives to attract investments. At the sectoral level, farmers' decisions on investments and input use are influenced not only by prices they receive for their produce but also by prices they pay for goods and services used by them.

The terms of trade data are being compiled by the DES as prices received over prices paid by the farmers. The prices paid by the farmers are collected for three broad categories of goods for final consumption, intermediate consumption and for capital consumption. Terms of trade data for 2000–01 to 2009–10 (the latest year for which data is available) are given in Table I.5.

Table I.5: Index of Terms of Trade and Output-Input Price Parity

| Year | Index of Prices Received | Index of Prices Paid for | | | | Index of Terms of Trade | Index of Output-Input Price Parity |
		Final consumption	Intermediate consumption	Capital formation	Combined Index		
Weights		73.54	21.63	4.83	100		
2000–01	225.0	220.5	230.4	227.0	223.0	100.9	97.9
2001–02	235.3	226.4	235.2	240.4	229.0	102.8	99.6
2002–03	247.9	234.9	252.7	245.2	239.3	103.6	98.6
2003–04	251.2	245.2	259.1	255.7	248.7	101.0	97.2
2004–05	258.2	252.3	264.5	305.6	257.5	100.3	95.0
2005–06	275.8	266.0	277.1	310.5	270.6	101.9	97.4
2006–07	291.2	283.4	284.6	327.8	285.8	101.9	99.6
2007–08	324.3	323.2	301.5	356.1	320.1	101.3	104.2
2208–09	350.9	350.8	332.8	380.1	348.3	100.7	102.8
2009–10	411.6	415.1	355.0	394.0	401.1	102.6	113.6

Source: DES and CACP.
Note: The Index of Output-Input Price Parity does not consider price index of final consumption.

The movement of relative prices has become more favourable for agriculture, except for the case of diesel, in recent years.

The Index of terms of trade has remained relatively stable, marginally favoured agriculture in recent years after declining in 2003–04 from the levels seen in the preceding two years. The index of output-input price parity, which is another measure of terms of trade, shows more discernible improvement in the recent years. To understand the trends for the more recent period we have worked out the output-input relative price index using the wholesale price index of various agricultural produce and inputs (Table I.6). The movement of relative prices has become more favourable for agriculture, except for the case of diesel, in recent years.

Table I.6: Ratio of Wholesale Prices of Agricultural Produce and Farm Inputs

Commodity	Input	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12
Grain	Diesel	89.5	94.0	104.2	107.0	125.1	115.0	109.8
	Electricity	98.2	106.2	113.3	124.4	145.3	138.5	136.5
	Fertiliser	104.9	117.3	123.1	136.0	153.8	149.3	136.3
Oilseeds	Diesel	75.5	72.6	90.2	96.6	101.5	93.2	96.5
	Electricity	82.7	82.0	98.0	112.3	117.9	112.2	119.9
	Fertiliser	88.4	90.5	106.5	122.8	124.8	121.0	119.7
Cotton	Diesel	75.3	74.2	89.0	104.0	104.2	131.4	136.9
	Electricity	82.5	83.8	96.8	120.9	121.0	158.3	170.1
	Fertiliser	88.2	83.8	96.8	120.9	121.0	158.3	170.1
Sugarcane	Diesel	83.7	77.5	81.0	74.6	80.1	103.1	101.1
	Electricity	91.7	87.6	88.0	86.8	93.1	124.2	125.7
	Fertiliser	98.0	96.7	95.6	94.8	98.5	133.9	125.5

Source: Based on data on WPI available from the Office of Economic Adviser, Department of Industrial Promotion and Policy, Ministry of Industry and Commerce.

The framework of MSP,'open-ended procurement' and subsidised distribution has meant rising subsidies. The two central government major agricultural subsidies provided in the central government budget are food and fertilizer subsidies. The subsidy on fuels is a more generalised and spread across all sectors. In addition to these central government subsidies, various state governments provide subsidies to farmers mainly in the form of free or subsidised electricity and irrigation water.

There are pressures to reduce subsidies on account of their adverse effect on overall fiscal deficit and the crowding out effect it has on public investment. While the subsidies would mean emergence of rigidities in cropping pattern as these are tied to crop specific price incentives, investments in technologies may also be affected by these subsidy incentives. Diversification of output mix to respond to demand pattern will require more flexible subsidy mechanisms with more funds for investments in technology and infrastructure including marketing infrastructure.

I.7.1 Food Subsidies

The food subsidy emanates from the difference in the government's economic cost of procuring food grains, mostly wheat and rice, and the price at which the government sells grains through the PDS (issue price) and the quantities of grains procured and distributed. The economic cost includes the minimum support price (MSP), the procurement incidentals, and the distribution cost[3].

Increasing economic costs of handling foodgrains, record procurements in recent years and widening difference between the economic cost of foodgrains and the central issue price have led to rising food subsidies in recent years (Table I.7). Although the MSP of wheat and paddy has doubled over the past ten years, there has been no revision to the PDS – issue price of wheat and rice under various distribution programs since July 2002.

Table I.7: Trends in Food Subsidy

| Marketing Year | MSP | | PDS Issue Price Wheat | | | PDS Issue Price Rice | | | Food Subsidy |
| | Rs Per tonne | | Rs per tonne | | | Rs per tonne | | | Rs Billion* |
	Wheat	Paddy #	APL	BPL	AAY	APL	BPL	AAY	
2002–03	6,200	5,800	6,100	4,150	2,000	8,300	5,650	3,000	241.8
2003–04	6,300	5,800	6,100	4,150	2,000	8,300	5,650	3,000	251.8
2004–05	6,300	5,900	6,100	4,150	2,000	8,300	5,650	3,000	258.0
2005–06	6,400	6,000	6,100	4,150	2,000	8,300	5,650	3,000	230.8
2006–07	6,500	6,500	6,100	4,150	2,000	8,300	5,650	3,000	240.1
2007–08	8,500	7,750	6,100	4,150	2,000	8,300	5,650	3,000	313.3
2008–09	10,000	9,300	6,100	4,150	2,000	8,300	5,650	3,000	437.5
2009–10	10,800	10,300	6,100	4,150	2,000	8,300	5,650	3,000	584.4
2010–11	11,000	10,300	6,100	4,150	2,000	8,300	5,650	3,000	638.4
2011–12	11,700	11,300	6,100	4,150	2,000	8,300	5,650	3,000	728.2
2012–13	12,850	12,800	6,100	4,150	2,000	8,300	5,650	3,000	**750.0

Source: http://fciweb.nic.in/
* Fiscal Year (Apr–Mar) basis; ** Budgeted;
# Grade A; APL = Above Poverty Line; BPL - Below Poverty Line; AAY - Antyodaya Anna Yojana; Marketing Year: Wheat –Apr–Mar; Rice - Oct–Sep

While policies relating to MSP for agricultural crops and the central issue price for the PDS served the twin objectives of providing remunerative prices to farmers and affordable prices to PDS consumers, the spread between the government's economic cost and the issue price of wheat and rice has widened leading to the rising food subsidy (Table I.8).

Diversification of output mix to respond to demand pattern will require more flexible subsidy mechanisms with more funds for investments in technology and infrastructure including marketing infrastructure.

3.   http://www.iimahd.ernet.in/assets/snippets/workingpaperpdf/5337679172012-08-02.pdf

Table I.8: Trends in Procurement Incidentals, Distribution Costs and Economic Cost of Rice and Wheat (Rs per tonne)

	Procurement Incidentals		Distribution Cost		Economic Cost	
	Wheat	Rice	Wheat	Rice	Wheat	Rice
2002–03	1,376	617	1,455	1,577	8,840	11,650
2003–04	1,382	307	1,697	2,145	9,187	12,361
2004–05	1,827	585	2,228	2,565	10,190	13,036
2005–06	1,712	391	2,345	2,724	10,418	13,397
2006–07	1,802	1,937	2,694	2,896	11,778	13,912
2007–08	1,640	2,149	2,444	2,978	13,117	15,499
2008–09	1,796	2,269	2,454	2,808	13,806	17,407
2009–10	2,069	2,886	2,004	1,849	14,246	18,201
2010–11	2,007	2,946	2,161	2,236	15,264	20,024
2011–12 (RE)	2,131	3,168	2,525	2,913	16,519	21,842
2012–13 (BE)	3,052	3,833	2,963	3,971	18,225	24,187

Source: FCI and the Department of Food & Public Distribution.

> **Unless there are changes in the pricing and method of procurement food subsidies may rise further in coming years with the implementation of the proposed National Food Security Bill (NFSB) if implemented in its existing form.**

Unless there are changes in the pricing and method of procurement food subsidies may rise further in coming years with the implementation of the proposed National Food Security Bill (NFSB) if implemented in its existing form[4]. The objective of the Bill is "to provide for food and nutritional security in human life cycle approach, by ensuring access to adequate quantity of quality food at affordable prices to people to live a life with dignity". In line with this objective, the Bill provides a legal entitlement to receive foodgrains at subsidized prices by persons belonging to priority households and general households under TPDS. The entitlement shall be provided up to 75 per cent of the rural population and up to 50 per cent of the urban population. Furthermore, in order to improve the nutritional security, the NFSB brings various other ongoing welfare schemes of the government under one umbrella (Table I.9).

Table I.9: Right to Receive Foodgrains at Subsidized Prices

	Priority	General
Foodgrains Entitlement	7 kg per person per month	3 kg per person per month
Price	Not exceeding Rs 3 per kg for rice, Rs 2 per kg for wheat and Rs 1 per kg for coarse grains	Not exceeding 50% of the MSP for wheat & coarse grains; not exceeding 50% of derived MSP for rice.
Coverage		
Rural population - Up to 75%	At least 46% of rural population	Up to 29% of rural population
Urban population - Up to 50%	At least 28% of urban population	Up to 22% of urban population

Source: NFSB Bill, 2011-As introduced in Lok Sabha.

The Parliamentary Standing Committee constituted to look into the NFSB has recommended that both the Priority category and the General category would be entitled to 5 kg of grains per person per month at a uniform price of Rs 3 for rice, Rs 2 for wheat and Re 1 for coarse grains. The number of people eligible for the entitlement will be determined on the basis of the ongoing socioeconomic caste census (SECC) and may cover about 67 per cent of the country's population. The recommendations will go through the process of approvals and would have to be passed by the Parliament for its implementation.

4.   http://cacp.dacnet.nic.in/NFSB.pdf

Rigidity in the central issue price of grain and a significant rise in the number of recipients of subsidised grain under the NFSB combined with the MSP to cover the rising costs of production will mean higher food subsidies in coming years. As for the cropping pattern, the current production levels of rice and wheat would be adequate to cover the demand but rising demand for other food such as pulses, oilseeds, fruits and vegetables would have to be met from increased productivity and efficiency of supply system.

I.7.2 Fertiliser Subsidy

Fertiliser subsidy accounts for about 37 per cent of total subsidies that the central government provides and has increased almost five times during TE2003–04 and TE2012–13. The subsidy has supported increase in the use of fertilisers. Sharp increases in both domestic and imported fertiliser prices as well as raw material/feedstock and rising imports have contributed to increasing fertiliser subsidies (Table I.10). While there is a need to use fertilisers more efficiently, the requirement of fertilisers is expected to increase to support higher crop yields in the medium term.

Table I.10: Trend in Fertilizer Subsidy (Rs million)

	Indigenous Urea	Imported Urea	Decontrolled Fertilizer	Total
2000–01	94,800	10	43,190	138,000
2001–02	80,440	470	45,040	125,950
2002–03	77,900	0	32,250	110,150
2003–04	85,210	0	33,260	118,470
2004–05	102,430	4,940	51,420	158,790
2005–06	106,530	12,110	65,960	184,600
2006–07	126,500	32,740	102,980	262,220
2007–08	129,500	66,060	129,340	324,900
2008–09	179,690	100,790	485,550	766,030
2009–10	175,800	46,030	390,810	612,640
2010–11	150,810	64,540	407,660	623,010
2011–12 R	191,080	138,830	342,080	671,990
2012–13 B	190,000	133,980	285,760	609,740

R- Revised; B- Budgeted
Source: Government of India Budget Documents.
Note: Actual subsidy distributed may be different as these figures do not include subsidy in the form of bonds issued by the government to fertilizer manufacturers in lieu of cash subsidies.

The fertiliser subsidies have come under increased scrutiny in recent years. The recent Kelkar Committee Report on Road Map for Fiscal Consolidation[5] observes that *"there is an alarming distortion in fertilizer usage pattern mainly caused due to asymmetry in the pricing formula for Urea and P&K fertilizers. On the P&K front, since the prices are decontrolled and subsidy is capped, domestic prices reflect international prices. However, the prices of urea which are administratively set, have been revised only once since 2002. This has caused severe under pricing and correspondingly excessive usage of urea. This will further exacerbate the adverse impact on soil quality and agricultural productivity over the medium and long term"*.

The Committee has recommended revision in the priceof urea and supports linking the MRP of urea to increase in the pooled gas price and in fixed cost.

As for the cropping pattern, the current production levels of rice and wheat would be adequate to cover the demand but rising demand for other food such as pulses, oilseeds, fruits and vegetables would have to be met from increased productivity and efficiency of supply system.

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5.   http://finmin.nic.in/reports/Kelkar_Committee_Report.pdf

Medium-term Outlook for Global and Indian Agricultural Markets

Medium-term agricultural outlook present an assessment of the key dimensions of emerging agricultural scenario in the next 5-10 years. It provides description of the merging scenario with respect to production, consumption, trade and prices. The projections of future scenarios generally are based on normal or average weather and macroeconomic conditions and assume that current agricultural and trade policy will remain in force during the projection period.

Three institutions provide a medium-term global Agricultural Outlook every year: USDA[6], FAPRI[7] and OECD-FAO[8]. In this report we have used these detailed medium-term projections as a reference scenario, particularly in the global context.

II.1 Three Major Medium-term Outlook Models[9]

II.1.1 USDA Agricultural Outlook

The Economic Research Service (ERS) of the United States Department of Agriculture (USDA) prepares a set of 10-year projections for U.S. and world agricultural commodity markets. The commodity coverage is focused on such products for which US government support programs exist. The 10-year USDA baseline is developed using a composite of models and analysis of other available information. The baseline is based on specific assumptions regarding macroeconomic conditions, policy, weather, and international developments. A set of economic models is used as a starting point for generating the baseline projections:

- A domestic crop-area allocation model.

- A number of U.S. commodity market models.

- A U.S. agricultural sector model, the Food and Agricultural Policy Simulator (FAPSIM), to analyze detailed technical and policy options. FAPSIM is an annual agricultural sector model, covering major US crop and livestock commodities.

- A global agricultural trade model, "Country-Commodity Linked Modeling System" that links 24 commodity markets in 39 countries/regions, to cover global agricultural markets.

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6. USDA Agricultural Projections to 2021, published in February 2012, available at http://www.ers.usda.gov/media/273343/oce121_2_.pdf
7. FAPRI-ISU 2011 World Agricultural Outlook, published in April 2011, available at http://www.fapri.iastate.edu/outlook/2011
8. OECD-FAO Agricultural Outlook 2012–2021, available at www.oecd.org/site/oecd-faoagriculturaloutlook/
9. We have referred http://www.ilr.uni-bonn.de/agpo/rsrch/capri-rd/docs/d4.1.pdf for comparison of the three models and some regional models.

Projections cover production, demand and trade for agricultural commodities, as well as aggregate indicators on the sector, such as farm income.

II.1.2 FAPRI Projections for Agricultural Markets

The Food and Agricultural Policy Research Institute (FAPRI) housed jointly at Iowa State University and the University of Missouri, Columbia prepares every year multi-year baseline projections for US and world agricultural markets. Results of the FAPRI baseline are published yearly in the FAPRI US and World Agricultural Outlook, which is intended to serve as the point of comparison for evaluating alternative policy scenarios. The FAPRI baseline is prepared using comprehensive data, a computer modelling system and an expert review process. The model FAPRI uses to develop the baseline contains over 3,000 equations representing supply and demand relationships in the United States and other major countries around the world, and consists of a set of partial equilibrium models, covering the US crops model, as well as the international cotton, dairy, livestock, oilseeds, rice, and sugar models. The commodity models are largely independent with some linkages between each other.

II.1.3 OECD-FAO Outlook for World Agricultural Commodity Markets

The OECD-FAO annual Agricultural Outlook is prepared jointly by the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organisation (FAO) of the United Nations. The Agricultural Outlook provides a baseline for further analysis of alternative economic or policy assumptions. Markets for cereals, oilseeds, sugar, meats, dairy products and biofuels are covered.

The methodological approach involves a set of assumptions on exogenous and policy-related drivers, a collaborative expert system and a joint modelling system that facilitate the consistency of the projections.

The Outlook brings together the commodity, policy and country expertise of OECD and FAO, providing an assessment of agricultural market prospects for production, consumption, trade, stocks, and prices of the included commodities.

A jointly developed modelling system, based on the OECD's Aglink (a recursive-dynamic, partial equilibrium, supply-demand model of world agriculture) and FAO's Cosimo models, provides the analytical framework for the projections. The new model component is termed COSIMO (Commodity Simulation Model). The general programming structure of COSIMO was taken over from AgLink while the behavioural parameters for the new country modules were taken from its predecessor at FAO, the World Food Model.

II.2 Comparison of the three Medium-term Projections[10]

Although the projections using these three models differ to some extent due to the assumptions made regarding various macroeconomic, agriculture and policy variables, weather, and international developments, there seems to be unanimity of opinion on the following:

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10. A detailed report on the comparison and contrast of the projections by the three agencies is available in Agricultural Commodity Markets Outlook 2011–20: A comparative analysis published by European Commission (http://ec.europa.eu/agriculture/analysis/tradepol/worldmarkets/outlook/2011_2020_en.pdf)

- Current high commodity prices result in a supply response which puts downward pressure on prices, easing from current high in real and nominal terms. However, prices remain high compared to their historic averages.

- Although absolute growth in supply and demand remains considerable, slowing population growth results in slower demand growth over the projection period compared to the previous decade.

- Despite declining demand growth rate and the supply response to higher prices, the average rate of demand growth in some commodities exceeds that of supply putting continuous pressure on stock levels and supporting steadily elevated prices.

- Concerns about consumer inflation prevail as high prices for commodities are passed through the food chain, raising concerns in particular in developing and emerging economies, where food still represents a substantial part of disposable income.

- Slower production growth rates are expected for most crops caused by a slowdown in yield growth and high marginal cost of bringing in additional land in some areas while livestock growth rates do not change significantly. As in the previous years, a larger share of production and consumption is shifting toward emerging economies.

- The higher share of production in emerging countries comes with an uncertainty of higher yield variability, thus likely to result in volatile prices in the future.

- Strong growth in the biofuel sector is largely driven by biofuels mandates and support policies. At high oil prices biofuel production becomes viable without policy support.

- In spite of a slowdown in demand growth, consistent further investment in agriculture is needed to tackle yield stagnation, more frequent weather events etc in order to ensure an adequate supply response.

These assessments also point to various risks involved in the supply and demand conditions such as the macroeconomic risks – labour market risks in developed economies, financial market risks, currency risks (including USD, Eurozone), inflation in emerging countries, prospects of economic growth and income levels in developing countries on the demand side and climatic conditions on the supply side. Some newer risks, such as uncertainties associated with increasing linkages with the energy market are likely to have ripple effects across commodity markets.

Additional commodity specific uncertainties include increased reliance on a few key producers and exporters, as well as unexpected government interventions in the policy space to protect domestic markets.

We have summarised the highlights of the assessments by the three agencies in Table II.1.

In spite of a slowdown in demand growth, consistent further investment in agriculture is needed to tackle yield stagnation, more frequent weather events etc in order to ensure an adequate supply response.

Table II.1: Highlights of Commodity Specific Projections by the three Agencies

OECD/FAO	USDA	FAPRI
WHEAT		

OECD/FAO

World wheat production is projected to reach 761 million tonnes by 2021, 12 per cent higher than in the base period (average of 2009–11), but slower annual growth relative to the previous decade. By 2021, wheat planted area is projected 3 per cent higher than the base period, with largest area expansion for Russian Federation, Ukraine, and Kazakhstan. Average global wheat yield growth is projected at 0.7 per cent per annum, slower than historical trend, influenced by lower yields in regions of area expansion.

By 2021, wheat prices in nominal terms are projected above the previous decade at $279 per tonne, but below those prices seen during the last two years, supported by strong energy prices and spill over effects in coarse grain markets. Prices in real terms are expected to remain flat to moderately declining from 2012.

Trade of wheat increases at a slightly slower pace than in the past reaching 152 million tonnes, 17 per cent higher than the base period, with the largest increase in imports in China, European Union, Indonesia and Iran. India to become a net importer of wheat. The CIS becomes an even more important source of wheat exports by 2021 than in the base period.

World wheat utilization is projected at 755 million tonnes with per capita consumption remaining steady at around at 65 kg. Feed use of wheat is projected a 154 million tonnes, growing at slightly lower pace, representing 20 per cent of total use. Wheat use for biofuels in developed countries is projected at 2.1 per cent up from the base period 0.9 per cent, with most of the increase in EU.

Stocks are projected at 219 million tonnes by 2021, a slight increase over the projected period, mostly in CIS countries. Stocks-to-use ratio in major exporting countries is projected at 32 per cent, slightly lower than the base period.

USDA

World wheat trade is projected to expand by 15 per cent between 2012 and 2021, rising to nearly 157 million tonnes. The traditional five largest wheat exporters (United States, Australia, Canada, The EU, and Argentina) are projected to account for almost 62 per cent of world trade in 2021, compared with 69 per cent during the last decade. This decrease in share is mostly due to increased exports from the Black Sea area, which are expected to reach about 30 per cent of world exports by 2021. Net U.S. wheat exports decline from 22.8 million tonnes at the beginning of the projection period to 21.0 million tonnes at the end of the projection period, and account for less than 16 per cent of global wheat trade, down from about 23 per cent in the past 5 years.

The largest growth markets for wheat imports include Asian countries, West Africa, Egypt, Indonesia, and Saudi Arabia, and other countries in the Africa and Middle East region. Egypt projected to maintain its position as the world's largest wheat-importing country, as its imports climb to more than 12 million tonnes. China's imports remain small as per capita consumption of wheat continues to decline.

As incomes rise in Indonesia, Vietnam, and some other Asian countries, consumers shift marginally from rice to wheat. Nonetheless, overall global per capita wheat consumption is projected to decline slightly during the coming decade.

FAPRI

The world wheat price is projected to increase and then to decline to $260.37 in 2025–26. Net wheat trade grows at an annual average rate of 2.51 per cent, reaching 136.66 million tonnes in 2025–26. The U.S. market share of wheat declines to 15.4 per cent in 2025–26 because of strong competition from other exporting countries. China and India will be net exporters of wheat. Net wheat imports by Asian countries increase by 1.19 million tonnes over the next 15 years. African countries increase their net imports by 13.46 million tonnes over the next 15 years.

(Contd...)

Table II.1: Highlights of Commodity Specific Projections by the three Agencies (Contd...)

OECD/FAO	USDA	FAPRI
	RICE	

OECD/FAO

World rice production is projected to reach 542 million tonnes, 75 million tonnes higher than base production (average of 2009–11). Annual growth rate is projected at 1.2 per cent, significantly lower than the 2.5 per cent in the previous decade. Yield growth at 1.2 per cent per annum is the main driving force behind global production increase, with little change in rice area. India, Cambodia, Myanmar, and African countries to account for projected increase, while Chinese production is projected to decline 6 million tonnes due to declining domestic consumption and strong competition for land and water.

World rice utilization is set to reach 542 million tonnes in 2021 up from 460 million tonnes in the base period, driven by population growth. Annual consumption growth is projected to decline to 1.2 per cent from 1.9 per cent. Per capita consumption is anticipated to rise slightly from 56.7 kg in 2009–11 to 59.9 kg in 2021. South East Asia consumption is expected to expand by 1.1 per cent to 2.5 per cent. In China consumption is projected to decline, whereas in Africa consumption is expected to grow at a high rate of 3.7 per cent.

Rice trade is expected to increase faster than in the past at 1.9 per cent per annum from 33 million tonnes to 43 million tonnes by 2021, driven by growing shipments from Myanmar and Cambodia, and by increasing imports by African countries. Vietnam is projected to be largest rice exporter displacing Thailand. Indian rice exports are projected at around 5 million tonnes.

Rice prices are projected to decline gradually in real terms, reflecting ample supply in a few rice exporting countries in Southeast Asia, combined with slowing import demand. Rice to wheat price ratio is expected to hover at around 1.6 compared to 1.8 seen in the past decade. In nominal terms, the

USDA

Driven largely by population growth in developing countries, global rice trade seen growing at 2.9 per cent per year from 2012 to 2021 is projected to reach 45 million tonnes, 42 per cent above the 2007 record.

Long-grain varieties account for around three-fourths of global rice trade and are expected to account for the bulk of trade growth over the next decade. Medium- and short-grain varieties account for 10 to 12 per cent of global trade. Aromatic rice, primarily basmati and jasmine, makes up most of the rest of global rice trade.

Altogether, the entire Africa and Middle East region accounts for nearly half of the increase in world rice trade between 2012 and 2021. The Philippines and Indonesia become the largest individual rice-importing countries by the end of the projection period. Other major importers will be the EU, Iraq, Iran, Saudi Arabia, and Bangladesh. Rice exports from Thailand and Vietnam, the world's largest rice-exporting countries, account for more than 45 per cent of world trade and for more than 50 per cent of the growth in world exports in the coming decade. Thailand's exports increase 4.1 million tonnes, to more than 14 million by 2021. Vietnam's export expansion is smaller, rising from 6.5 to 8.1 million tonnes. India's rice exports are projected to rise to about 4.7 million tonnes by 2021, making it the third-largest exporter.

FAPRI

Rice is not covered in the medium term projections by FAPRI

Table II.1: Highlights of Commodity Specific Projections by the three Agencies (Contd...)

OECD/FAO	USDA	FAPRI
RICE		

benchmark rice price is likely to be around $454 per tonne in 2021.

World rice stocks are projected to peak 157 million tonnes in 2013 drifting moderately downward reaching 145 million tonnes by 2021, with most of the decline in India and China.

COARSE GRAINS

OECD/FAO	USDA	FAPRI

World coarse grain production is expected to reach 1359 million tonnes by 2021 up 20 per cent from the base period (2009–11), with significant increases projected for Argentina, Brazil, China, Russian Federation, Ukraine, and the United States. Area is projected to increase by 7 per cent from the base year. Annual yield growth is projected at 0.7 per cent.

World coarse grain utilization is projected to increase by 19 per cent by 2021 to reach 1350 tonnes due to increasing demand by feed and biofuel sectors. Nevertheless, projected annual growth of 1.5 per cent is lesser than observed over the base period's 2.7 per cent. Food use is projected to reach 239 million tonnes, up 18 per cent and feed use to 922 million tonnes. Biofuel use is projected to grow by 34 per cent over the base period to 185 million tonnes, 13.6 per cent of total world consumption.

World coarse grain trade is projected to reach 146 million tonnes, 20 per cent higher than in the base period, with the U.S. keeping its leading position.

Stocks of coarse grains are projected to rise by 12 per cent from its critically low level in the base period, mostly in the U.S. and Brazil. Stocks-to-use ratio in major exporting countries is projected to recover to 16 per cent.

Average world corn yields are projected to trend upwards 1 per cent a year while barley and sorghum yields both increase less than two-thirds of a per cent a year.

Corn's increasing share of world production and trade of coarse grains is attributable to yield growth that is more rapid than for other grains, to new varieties that enable it to be competitive in a wider range of climatic regions, and to its preferred qualities for feed, biofuels, and other industrial uses.

World coarse grain trade is projected to expand to 37 million metric tonnes (29 per cent) from 2012 to 2021. World corn trade is projected to increase by 31 million metric tonnes (31 per cent) to 131 million tonnes between 2012–13 and 2021–22, with U.S. export share projected to decline to less than 47 per cent from the current 55 per cent.

China's net imports of corn are projected to reach 18 million tonnes by the end of the projection period driven by its expanding livestock and industrial sectors. The increase in China's imports accounts for 45 per cent of the 2012–13 to 2021–22 growth in world corn trade. South and Southeast Asian corn imports rise 3 million tonnes (39 per cent) by 2021 in response to increased demand from livestock producers. The region accounts for 10 per cent of the growth in world corn imports.

The share of global coarse grain production used as animal feed

The world corn price to continue to increase throughout the projection period but then falls slightly, ending at $191.35 in 2025–26.

With an increase in consumption, the stocks-to-use ratio continues to decline over the projection period, ending at 13.74 per cent in 2025–26.

Corn trade is projected to increase over the projection period, reaching 129.05 million tonnes in 2025–26. The U.S market share drops in 2010–11 and 2011–12 because of lower U.S exports, but it increases over the rest of the projection period with declines in Brazil and Argentina's market shares. China becomes a net importer of corn in 2016–17 The world sorghum price declines in 2011–12 because of higher production. It reaches $249.67 in 2025–26.

World sorghum net trade grows over the projection period, reaching 10.76 million tonnes by 2025–26 with growth in demand. The world barley price reaches $198.49 in 2025–26. Net trade reaches 28.06 million tonnes in 2025–26.

(Contd...)

Table II.1: Highlights of Commodity Specific Projections by the three Agencies (Contd...)

OECD/FAO	USDA	FAPRI
	COARSE GRAINS	
	trended downward from 66 per cent a decade ago to about 57 per cent in 2011 and is projected to remain just below 60 per cent during the coming decade. Industrial uses, such as starch, ethanol, and malt production, are much smaller than feed use but are increasing twice as fast.	
	OILSEEDS	
Oilseeds production and exports continue to be dominated by traditional players, but emerging exporters, such as Ukraine and Paraguay, are expected to increasingly contribute to global export growth. While South American soybean producers continue to dominate global meal exports, Indonesia and Malaysia expand their share of vegetable oil exports to over 60 per cent. Compared to the 2009–11 average, world oilseeds production is expected to expand by only 20 per cent over the coming decade, about half the rate observed over the previous decade. Strong demand for food, feed, and biofuel feedstock combined with high production costs underpin a sustained increase in nominal prices of oilseeds, protein meals, and vegetable oils over the projection period. Significant growth in biodiesel use is expected in developed and developing countries. However, food consumption stagnates in the developed world while per capita annual food use in developing countries is expected to expand by 2 kg or 12 per cent over the next ten years.	Economic growth and population increases in developing countries are projected to boost demand for vegetable oils for food consumption and for protein meals used in livestock production. Vegetable oil used for biodiesel production also is projected to increase. With demand for vegetable oils increasing at a faster rate than for protein meals, prices rise more rapidly for vegetable oils than for oilseeds and protein meals, particularly for rapeseed oil compared with rapeseed meal. World soybean meal trade is projected to climb by more than 10 million tonnes (17 per cent) to 71.9 million tonnes by 2021–22. India's soybean meal exports decline as domestic use strengthens and export competition from South America intensifies. Exports fall from more than 4 million tonnes in most recent Years, to 1.5 million by 2021, as rapidly increasing poultry, egg, and milk production absorbs more of India's domestic soybean meal production. World soybean oil imports climb by 12 per cent to 9.9 million tonnes over the 2012–13 to 2021–22 projection period, bolstered by rising food use. Growth in world soybean oil trade will be constrained by competition with palm oil, which is the leading vegetable oil traded internationally. India is projected to replace China as the world's largest soybean oil importer. In the projections, India's soybean oil imports climb 28 per cent to 1.2 million tonnes.	Soybean production is projected to expand by 23 per cent to 315 million tonnes by the end of the outlook period as a result of higher area and yields. The demand for soybean oil to increases by 12.3 million tonnes by 2025–26, a growth of 1.7 per cent per year, driven by growth in food and industrial use. Because of their rising incomes, China and India present the highest growth in demand. Rapeseed production to reach 75 million tonnes (a 29 per cent increase from the 2010–11 season) by the end of the projection. Strong prices to encourage production of palm oil and net exports to grow by 59 per cent and 65 per cent, respectively, by 2025–26. The biodiesel industry use of palm oil is projected to increase. Net imports of palm oil by China and India to grow by 78 per cent and 54 per cent, respectively, over the outlook period. By 2025–26, Ukraine is projected to hold 76 per cent and 66 per cent share of the net export markets for sunflower meal and sunflower oil, respectively Global production of peanuts increases by 12 per cent over the outlook, mostly because of increasing yields. In India, both production and usage to increase by about 30 per cent by 2025–26.

(Contd...)

Table II.1: Highlights of Commodity Specific Projections by the three Agencies (Contd...)

OECD/FAO	USDA	FAPRI
OILSEEDS		
	Argentina soybean oil exports-the world's leading exporter-are projected to climb 8 per cent to 5.4 million tonnes by 2021–21. Brazil is projected to use more soybean oil for biodiesel production, but the expansion of soybean production into new areas of cultivation is expected to enable the country to increase soybean oil exports.	
SUGAR		
Global sugar production is projected to reach 208 million tonnes by 2021–22, up 43 million tonnes or 26 per cent above the average for 2009–11. Steady global consumption growth of 2.1 per cent per annum, on average, is expected to eat into sugar supplies and lead to a decline in the global stocks-to-use ratio in the second half of the projection period, providing support for high market prices. Sugar prices are expected to remain on an elevated plateau and to average higher over the projection period in both nominal and real terms than in the last decade. Further bouts of price surges and volatility remain a clear possibility in response to unforeseen production shocks in major producing countries, while global stocks remain at historically low levels.	Sugar not covered in USDA projections.	Sugar prices remain high throughout the projection period but begin to decline in 2020–21. Both world sugar production and consumption projected to increase by 27.2 per cent and 28.2 per cent, respectively, by 2025–26. By 2025–26, sugar net exports are projected to increase for all major exporters, by 52 per cent for Brazil, 9.5 per cent for Australia, 22.4 per cent for Thailand, and 28.3 per cent for Guatemala. Over the projection period, net imports are projected to increase for all major importers. India follows its historical pattern of switching from net importer to net exporter and back to net importer by the end of the projection period.
DAIRY		
The average annual growth rate of global milk production for the projection period is estimated at 2 per cent, only slightly below the 2.1 per cent level witnessed in the last decade. 70 per cent of global milk production gain over the outlook period is anticipated to come from developing countries, particularly India and China. Prices in nominal terms are projected to increase by about 2 per	Dairy is not covered in USDA projections.	Economic growth and population growth favour higher dairy demand, which puts upward pressure on dairy prices in the long run. Strong demand and growing incomes boost world milk production. Over the projection period, world milk production increases 32.47 per cent. While the EU and the U.S. are still the major milk producing countries, high production growth is seen in Asia, especially in China and India, as well as in Argentina

(Contd...)

Table II.1: Highlights of Commodity Specific Projections by the three Agencies (Contd...)

OECD/FAO	USDA	FAPRI
DAIRY		

OECD/FAO	USDA	FAPRI
cent annually from 2014 onwards, reflecting increasing production costs and growing demand driven by rising population and incomes. Price volatility is likely to remain an issue for the outlook as dairy markets remain thin in volumes of milk traded and the small number of players that dominate export trade. Dairy product consumption in developed countries may increase only modestly, while in developing regions the consumption of all dairy products is expected to increase at around 30 per cent from the base period, reflecting increasing population, income levels, and the growing influence of retail chains and multinational companies.		and Brazil. Growth in milk production facilitates higher dairy product production. Total butter production increases 48.07 per cent over the baseline, with India accounting for 88 per cent of the growth. Total cheese production grows 36.32 per cent, with the U.S. and the EU together accounting for about 53.15 per cent. NFD and WMP production increase 50.63 per cent and 36.98 per cent, respectively.

II.3 Ramifications for India

The projections by the three agencies summarized above have implications for India's food commodities. We highlight the key issues:

- While FAO/OECD projects India as a net importer of wheat by 2021 both USDA and FAPRI projections show India as self-sufficient or exporter of wheat. Global wheat prices are projected to be lower than in recent years, which combined with India's increasing support prices and increasing competition from Black Sea Region could make Indian wheat exports non-competitive in coming years. There is need to improve the quality of Indian wheat and resolve phyto-sanitary issues with some major importing countries such as Iran, so that Indian wheat becomes acceptable in Egypt, and China, which are likely to remain major importers of wheat in future.

- As bulk of the growth in rice trade in future will be in long-grain rice, production of long-grain rice needs to be encouraged by providing incentives such as higher support prices for such varieties. There is likely to be increased competition from Vietnam and Thailand. Export growth in basmati rice is projected to be limited.

- With a surge in import demand for maize in Southeast Asian countries and China in the coming years, India has an opportunity to expand exports to these countries due to India's geographical proximity to these countries. However, this would require stepping up domestic production through better yield realization. Larger area should be brought under hybrid maize, so that yields could be increased from the current low levels.

- Projected significant growth in palm oil production in Indonesia and Malaysia would ensure adequate supplies at reasonable prices to meet India's increasing demand for vegetable oils. However, increased use of vegetable oil, particularly palm oil for

> There is need to improve the quality of Indian wheat and resolve phyto-sanitary issues with some major importing countries such as Iran, so that Indian wheat becomes acceptable in Egypt, and China, which are likely to remain major importers of wheat in future.

There is an urgent need to increase the productivity of Indian oilseeds in general and soybeans in particular, which is currently much below the world average, so that the country could maintain or improve its market share for oil meals in the global market and become less dependent on imported vegetable oils.

biodiesel production may change this scenario. India's soybean meal exports are projected to decline as domestic use increases and export competition from South America intensifies. Hence there is an urgent need to increase the productivity of Indian oilseeds in general and soybeans in particular, which is currently much below the world average, so that the country could maintain or improve its market share for oil meals in the global market and become less dependent on imported vegetable oils.

- Global sugar prices are projected to remain volatile due to a steady increase in consumption combined with significant year-to-year variations in production. India should aim to reduce the volatility in sugar production through appropriate policy measures to ensure a stable economic environmentfor the sector.

- With milk consumption likely to increase significantly in developing countries, including India, production will have to keep pace with consumption to assure milk availability at reasonable prices. Cattle breed improvement and feed availability enhancement, preconditions for increasing milk production, should get increased importance.

The outlook for global and Indian production, consumption, trade, stocks, and prices of major commodities, namely wheat, rice, maize, soybean, soybean oil and sugar for the next 10 years (up to 2021) are summarized in a series of tables below (Tables II.2–II.6) using the projections by FAO/OECD and USDA. The estimates in the tables II.2–II.6 are from

http://stats.oecd.org/viewhtml.aspx?QueryId=36355&vh=0000&vf=0&l&il=blank&lang=en for OECD-FAO;

http://www.ers.usda.gov/data-products/international-baseline-data.aspx#26234 for USDA.

Table II.2: Projections of Global and Indian Production, Consumption, Trade, Stocks, and Prices: Wheat

	2012	2013	2017	2020	2021
World Production ('000 tonnes)					
FAO/OECD	702,580	706,149	730,197	756,259	760,926
USDA	679,889	684,620	708,508	730,033	735,791
India Production ('000 tonnes)					
FAO/OECD	84,951	85,364	85,598	88,476	88,739
USDA	83,564	84,750	89,193	92,410	93,476
World Exports ('000 tonnes)					
FAO/OECD	137,003	137,488	144,100	150,474	152,492
USDA	136,810	138,194	147,128	154,311	156,844
India net Exports ('000 tonnes)					
FAO/OECD	1,657	866	-3,181	-2,660	-2,921
USDA	1,500	2,000	688	502	452
World Consumption ('000 tonnes)					
FAO/OECD	693,957	700,199	729,786	752,155	758,648
USDA	682,140	685,636	708,880	728,567	735,298
India Consumption ('000 tonnes)					
FAO/OECD	85,343	86,380	88,901	90,960	91,602
USDA	83,751	84,772	89,137	92,384	93,456
World Year End Stocks ('000 tonnes)					
FAO/OECD	208,563	214,156	211,045	217,263	219,183
USDA	200,581	199,565	197,222	199,911	200,404
India Year End Stocks ('000 tonnes)					
FAO/OECD	16,952	15,070	14,172	14,701	14,759
USDA	13,903	11,881	8,799	7,231	6,799
World per capita Consumption (kg/year)					
FAO/OECD	67.4	67.0	66.1	65.6	65.4
USDA	NA	NA	NA	NA	NA
India per capita Consumption (kg/ year)					
FAO/OECD	62.4	62.5	61.3	60.5	60.2
USDA	NA	NA	NA	NA	NA
World Price (US$/ tonne)					
FAO/OECD	248.58	250.82	264.52	276.86	279.33
USDA	NA	NA	NA	NA	NA

Table II.3: Projections of Global and Indian Production, Consumption, Trade, Stocks, and Prices: Rice

Item	2012	2013	2017	2020	2021
World Production ('000 tonnes)					
FAO/OECD	488,044	492,961	514,976	535,211	542,072
USDA	468,606	473,548	488,349	500,358	504,606
India Production ('000 tonnes)					
FAO/OECD	104,572	106,191	112,3088	117,096	118,507
USDA	100,102	101,676	106,318	109,418	110,376
World Exports ('000 tonnes)					
FAO/OECD	35,755	36,687	40,159	41,806	42,775
USDA	34,819	36,129	41,063	44,102	45,043
India net Exports ('000 tonnes)					
FAO/OECD	7,014	5,824	4,623	4,905	5,127
USDA	4,014	4,260	4,875	4,856	4,711
World Consumption ('000 tonnes)					
FAO/OECD	483,937	492,674	517,856	536,620	542,359
USDA	465,529	471,242	489,573	502,487	506,697
India Consumption ('000 tonnes)					
FAO/OECD	100,588	101,972	108,352	112,842	113,176
USDA	95,454	96,862	102,146	105,820	106,995
World Year End Stocks ('000 tonnes)					
FAO/OECD	156,272	156,662	149,469	144,731	144,546
USDA	103,643	105,949	104,083	98,484	96,393
India Year End Stocks ('000 tonnes)					
FAO/OECD	20,970	19,364	16,717	14,786	14,991
USDA	25,133	25,688	24,699	21,368	20,038
World per capita Consumption (kg/year)					
FAO/OECD	58.0	58.4	59.2	59.7	59.9
USDA	NA	NA	NA	NA	NA
India per capita Consumption (kg/ year)					
FAO/OECD	75.4	75.8	76.8	77.3	77.1
USDA	NA	NA	NA	NA	NA
World Price (US$/ tonne)					
FAO/OECD	493.6	465.3	425.9	450.3	454.5
USDA	NA	NA	NA	NA	NA

Table II.4: Projections of Global and Indian Production, Consumption, Trade, Stocks, and Prices: Maize

	2012	2013	2017	2020	2021
World Production ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	918,318	921,130	984,442	1,036,729	1,056,392
India Production ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	21,469	22,167	24,360	26,246	26,861
World Exports ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	100,365	103,171	117,840	127,820	131,267
India net Exports ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	1,810	1,920	1,928	2,027	2,012
World Consumption ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	897,621	917,896	984,445	1,037,960	1,055,852
India Consumption ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	19,635	20,226	22,410	24,194	24,822
World Year End Stocks ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	142,267	145,501	140,864	138,497	139,037
India Year End Stocks ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	587	608	694	767	793
World per capita Consumption (kg/year)					
FAO/OECD	67.4	67.0	66.1	65.6	65.4
USDA	NA	NA	NA	NA	NA
India per capita Consumption (kg/ year)					
FAO/OECD	62.4	62.5	61.3	60.5	60.2
USDA	NA	NA	NA	NA	NA
World Price (US$/ tonne)					
FAO/OECD	248.58	250.82	264.52	276.86	279.33
USDA	NA	NA	NA	NA	NA

Table II.5: Projections of Global and Indian Production, Consumption, Trade, Stocks, and Prices: Soybean

	2012	2013	2017	2020	2021
World Production ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	273,590	280,039	308,232	328,482	335,703
India Production ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	10,751	10,957	11,518	12,109	12,314
World Exports ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	105,116	107,911	123,002	133,802	137,430
India net Exports ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	10	10	10	10	10
World Consumption ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	273,844	279,653	307,717	328,077	335,181
India Consumption ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	10,744	10,944	11,509	12,100	12,305
World Year End Stocks ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	63,301	63,686	66,514	67,906	68,429
India Year End Stocks ('000 tonnes)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	262	265	264	261	260
World per capita Consumption (kg/year)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	NA	NA	NA	NA	NA
India per capita Consumption (kg/ year)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	NA	NA	NA	NA	NA
World Price (US$/ tonne)					
FAO/OECD	NA	NA	NA	NA	NA
USDA	NA	NA	NA	NA	NA

Table II.6: Projections of Global and Indian Production, Consumption, Trade, Stocks, and Prices: Sugar

	2012	2013	2017	2020	2021
World Production ('000 tonnes)					
FAO/OECD	176,400	179,294	192,981	203,957	207,915
USDA	NA	NA	NA	NA	NA
India Production ('000 tonnes)					
FAO/OECD	28,745	26,779	28,332	29,313	29,348
USDA	NA	NA	NA	NA	NA
World Exports ('000 tonnes)					
FAO/OECD	47,052	47,967	52,362	56,617	57,978
USDA	NA	NA	NA	NA	NA
India net Exports ('000 tonnes)					
FAO/OECD	3,765	447	-629	-1,659	-2,459
USDA	NA	NA	NA	NA	NA
World Consumption ('000 tonnes)					
FAO/OECD	16,256	171,104	185,253	197,738	202,205
USDA	NA	NA	NA	NA	NA
India Consumption ('000 tonnes)					
FAO/OECD	24,776	25,855	28,510	30,861	31,813
USDA	NA	NA	NA	NA	NA
World Year End Stocks ('000 tonnes)					
FAO/OECD	58,115	60,631	65,929	67,989	68,024
USDA	NA	NA	NA	NA	NA
India Year End Stocks ('000 tonnes)					
FAO/OECD	10,400	10,877	11,195	11,328	11,323
USDA	NA	NA	NA	NA	NA
World per capita Consumption (kg/year)					
FAO/OECD	23.7	24.0	24.9	25.8	26.2
USDA	NA	NA	NA	NA	NA
India per Capita Consumption (kg/ year)					
FAO/OECD	19.7	20.3	21.3	22.3	22.7
USDA	NA	NA	NA	NA	NA

Note: World price projections not available from the two sources.

II.4 Onion and Potato Projections

There are no global medium-term projections for potato and onions. Using the FAO data on global area, production and yield of these commodities (2000–2010) and applying a trend growth rate, we have estimated a baseline projection for potato and onions for the period up to 2020 (Table II.7). For India, production level is projected using lower growth rates than observed for the period 2006–07 to 2011–12 keeping in view the likely constraints on expansion of crop area over the medium term. These projections are based on the assumption of average weather and a status quo on policy issues during the projection period. The trend line projection also assumes that the relative incentive structure on the allocation of land to these crops and productivity improvements seen in the last 5–10 years would continue.

Global potato area is projected to decline by around 7 per cent during the projection period over the base period, whereas yield is projected to increase by around 9 per cent, resulting in an overall 2 million tonne increase in production during 2012 to 2021. India's potato production is projected to increase at a rate of 7 per cent per year. India's share in global potato production is projected to increase from 11.4 per cent in 2012 to 18.8 per cent in 2020.

Table II.7: Potato and Onion Production – Global and India

Crop/ region/ variable	2012	2013	2017	2020
		Potato		
World				
Area (THA)	17,999	17,853	17,271	16,835
Yield(MT/H)	18.1	18.3	19.0	19.5
Production (MMT)	326.6	327.0	328.0	328.3
India				
Production (MMT)	37.2	38.5	50.5	61.8
India share in world %	11.4	11.8	15.4	18.8
		Onion		
World				
Area (THA)	4,201	4,317	4,781	5,129
Yield(MT/H)	20.5	20.7	21.7	22.4
Production (MMT)	86.0	89.4	103.7	114.9
India				
Production (MMT)	17.0	16.7	20.3	23.5
India share in world %	19.8	18.7	19.6	20.4

Note: The area and yield estimates are extended to period after 2012 based on the estimated growth rates for the period 2000 to 2012 in the case of world production. For India projections are based on a review of growth rate of production for the period 2006–07 to 2011–12.

Global onion production is projected to increase by 38 per cent to 115 million tonnes. India's share in global onion production is projected to remain stagnant at about 20 per cent during the period upto 2020 with her production rising from the current 16–17 million tonnes to 23.5 million tonnes in 2020.

An Assessment of the Medium Term Outlook for the Food Commodities

The assessment of the global supply-demand conditions by international agencies provide a reference point for the development of a medium term outlook scenario for food commodities at the national level. The review points to the likely changes in the trade patterns in food commodities with the projected changes in supply-demand balances in the domestic markets of various countries. For India, potential for surplus is seen in the case of rice, maize, and occasionally sugar with edible oil imports expected to increase.

In the context of preparation of the 12th Five Year Plan, a Working Group has provided the supply-demand estimates for the period 2012–13 to 2016–17. For our own analysis in this report we have taken this time horizon for an assessment of the medium term outlook.

In this chapter we will first review the assessment provided by the global agencies and also the Working Group and then present supplementary assessment based on our own analysis.

III.1 The 12th Five Year Plan Foodgrains Working Group's Projection of Demand and Supply of Major Commodities

The working Group on Foodgrain supply-demand for the 12th Five Year Plan (2012–17)[11] has worked out demand and supply projections for major agricultural commodities using various approaches. For demand projection four approaches were used namely:

- Household Consumption Approach (NSSO estimates of household food consumption plus Feed, Seed, Wastage, and other Uses).

- Normative Approach: Based on recommendations of Indian Council of Medical Research (ICMR).

- Behavioural Approach: Based on income elasticities of demand.

- Absorption Approach: based on pattern of absorption of production and imports into alternative uses.

For supply projections, five approaches were followed:

- Simple Regression model

- Exponential Growth model

- Multiple Regression model

- Average Annual Growth Rates

- Compound Annual Growth Rates

11. Report of Working Group on Food grains – Balancing Demand and Supply during 12th Five Year Plan, Crops Division, Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi, 2011. Available at http://planningcommission.nic.in/aboutus/committee/wrkgrp12/agri/crop_husbandry.pdf

For the simple regression, exponential growth and the multiple regressions, data for the period 2000–01 to 2009–10 were used. For working out supply projections on the basis of average annual growth rate and the compound annual growth rate, production data for the period 2005–06 to 2009–10 were used.

Although year wise projections are not provided in this report, demand projection based on Behavioural Approach provides a detailed commodity wise break up of demand for various food items and their annual growth rate. This is shown in Table III.1.

Table III.1: Demand for Food Based on Behavioural Approach (million tonnes)

Food Item	2004–05	2011–12	2016–17	Annual Growth Rate %
Rice	93.96	103.48	110.21	1.10
Wheat	70.04	80.79	89.06	1.90
Maize	13.88	16.86	19.27	2.43
Total coarse grains	31.49	34.60	36.40	0.27
Gram	5.71	7.02	8.22	3.47
Tur	3.80	4.48	5.10	2.86
Total pulses	14.91	18.84	21.68	3.09
Total food grains	210.40	237.71	257.34	1.45
Edible oils	10.16	14.23	16.64	3.54
Sugar	20.24	23.70	26.50	2.22
Potato	29.95	35.76	41.19	3.15
Onion	12.47	15.00	17.42	3.39
Milk	94.21	117.83	141.14	4.17

A number of studies point to the negative expenditure elasticity (a proxy for income elasticity) of demand in the case of cereals. There is some variation in the case of pulses although the estimated elasticity is generally less than 0.5. The elasticity is higher – between 0.5 and 1 in the case of milk, vegetables, fruits, sugar, and edible oils and exceeds 1.0 in the case of other livestock food products[12]. The demand pressures are, therefore, greater in the case of protein foods as compared to just calorie supplying foods.

Supply projections for selected crops for 2016–17 based on various approaches used are given in Table III.2.

Table III.2: Supply Projections of Major Agricultural Commodities during the 12th Plan Period (million tonnes)

Crops	Simple Regression Method	Exponential Growth	Multiple Regression	Average Annual Growth Rate	Compound Annual Growth Rate
Rice	104	106	103	98	102
Wheat	93	95	93	104	99
Coarse grains	45	46	44	49	42
Total cereals	242	247	240	251	243
Pulses	18	19	19	21	18
Total foodgrains	261	266	259	272	261
Oilseeds	37	41	36	33	30
Sugarcane	365	371	369	411	396

12. Some recent studies projecting demand for various commodities for the year 2020 are Mittal (2006), Chand (2007).

The Working Group's estimates on Demand and Supply are summarised in Table III.3.

Table III.3: 12th Five Year Plan Working Group Assessment of Demand and Supply of Major Agricultural Commodities in 2016–17

Crops	Demand (million tonnes)	Supply (Production) (million tonnes)
Cereals	235	240 to 251
Pulses	22	18 to 21
Total food grains	257	258 to 272
Oilseeds	59	33 to 41
Edible oils	26.5	NA
Sugarcane	279	365 to 411
Sugar	26.5	NA

The estimates point to the surplus position in the cereals as a group and deficit relative to domestic supplies in the case of pulses and oilseeds (edible oils). In the case of sugar also, production is expected to keep pace with the requirement.

III.2 Emerging Outlook for Supply-Demand Balances

We may also consider the emerging supply-Demand balances based on a set of broad parameters on the demand side as shown in Table III.4 below.

Table III.4: Emerging Supply-Demand Balances for the Food Commodities

Item	Income elasticity of demand	Annual growth in demand due to increase in national income by 6.5% and population growth of 1.2% per year	Annual growth in production during 2005–06 to 2011–12
Cereals	0	1.2	3.7
Pulses	0.5	3.7	4.2
Edible oils	0.8	5.2	5.7 (Nine Oilseeds)
Sugar	0.8	5.2	5.0
Milk	1.0	6.2	3.8
Fruits & Vegetables	0.8	5.2	4.8 (4 years upto 2010–11)
Eggs, Fish, and Meat	1.0	6.2	4.6 (4 years upto 2010–11)

Note: The projections assume that all uses of commodities (seed, feed, wastage, and industrial uses) also rise at the same rate as the growth in food use.

It should be pointed out that production growth is a function of changes in area and also yield per hectare of crop area. The changes in area would essentially be due to re-allocation of land across commodities, given the constraints on further expansion of crop area. In this sense, the production growth would be constrained by productivity growth unless there are shifts in crop area also.

The estimates above suggest that cereals production growth is expected to surpass demand growth over the medium term, if we continue to achieve production growth seen in the recent 5 – 6 years. In the case of pulses and edible oils, although growth in production may match the growth in demand, the current imbalance or need for imports will continue over the medium term.

The situation with respect to other commodities reflects the faster growth of demand relative to production. There is significant export demand in commodities such as livestock and fisheries. In this sense, faster growth of demand may also increase the supply-demand gap in the medium-term.

The estimates point to the surplus position in the cereals as a group and deficit relative to domestic supplies in the case of pulses and oilseeds (edible oils). In the case of sugar also production is expected to keep pace with the requirement.

Table III.5: Changes in Prices in the Domestic and International Markets for Selected Commodities, Inputs and Products (average of the YoY % change for the 5-year period ending)

Item	2007–08	2011–12	Item	2007–08	2011–12	Item	2007–08	2011–12
Wholesale Price Index								
WPI all items	5.5	7.0	Milk	4.2	12.4	Fertilizers	1.5	5.0
Food articles	5.2	10.8	Egg, Fsh, meat	3.2	14.0	Diesel	10.9	5.0
Food products	4.8	7.3	Oilseeds	5.5	11.1	Pesticides	1.5	1.2
Food grain	6.0	8.2	Groundnut seeds	9.1	13.2	Electricity	2.5	1.8
Cereals	5.6	8.6	Rape Mustard Seed	8.1	8.9	Agricultural wage rates(*1)	13.7	11.3
Rice	4.5	9.5	Soybean	5.5	13.0	Manufactured Products	5.0	5.2
Wheat	7.2	6.2						
Jowar	9.8	15.2	Sugarcane	2.9	11.8			
Bajra	4.4	9.7	Sugar	2.9	11.8			
Maize	5.4	11.1	Gur	4.3	15.0			
Barley	6.1	7.9	Khandsari	5.8	11.4			
Ragi	5.7	13.2	Edible oil	5.9	6.0			
Pulses	7.7	6.6	Groundnut Oil	11.0	8.8			
Gram	7.6	5.1	Palm Oil	3.3	3.9			
Tur	7.7	12.9	R&M Oil	2.9	7.3			
Vegetables	7.9	9.7						
Potatoes	10.4	6.9						
Onions	16.0	13.3						
Fruits	4.5	11.3						
Banana	6.6	8.5						
International Prices								
Average for 5 years ending (*2)								
Food Index	10.3	9.4	Banana	10.3	9.2			
Rice	14.9	18.3	Palm oil	21.2	22.5			
Wheat	16.7	12.2	Soy oil	19.2	17.8			
Maize	12.5	18.2	Sugar	-0.5	11.9			
Cereals	16.2	15.3	Dairy	26.4	14.9			
Vegetable oils	19.3	19.0	Meat	8.1	8.7			
Average for 3 years ending (*2)								
Food Index	11.9	6.2	Banana	6.85	5.2			
Rice	13.3	-7.5	Palm oil	33.78	13.99			
Wheat	28.0	4.7	Soy oil	24.14	7.84			
Maize	20.0	14.7	Sugar	0.45	19.86			
Cereals	24.2	5.3	Dairy	27.2	6.3			
Vegetable oils	26.9	10.1	Meat	4.3	6.6			

Note: *1. The data are annual average wage rates of male labour used for ploughing and planting for the major states obtained from Directorate of Economics and Statistics
*2. The International Price Indices Cereal, Dairy, Meat, and Vegetable Oils are from FAO and the other international price series are from IMF websites.

The pattern of supply-demand balances is also reflected in the price trends. While more recent trends show sharp increase in the prices of commodities such as pulses, vegetables, and sugar which may be affected by short-term fluctuations in output, the trends over the last 5 years are indicative of the emerging imbalances (Table III.5).

Some important patterns that emerge from the comparison of price data for the period 2003–04 to 2007–08 and 2007–08 to 2011–12 are:

- Prices of food articles and food products have increased much faster than the prices of overall price index and the price index for manufactured products.

- Prices of inputs have increased at a much slower pace in both the periods as compared to the commodity prices with the exception of agricultural wage rates. The wage rates have increased sharply during both the periods for which comparisons have been made. The input subsidies in the case of fertiliser and diesel helped to maintain modest rise in input prices in the past. However, given the fiscal pressures, the input prices may see higher increase in the coming few years. The increase in wage rates point to the likelihood of increasing level of mechanisation in agriculture.

- Prices of food articles and food products increased at nearly double the rate in the period upto 2011–12 as compared to the increase seen in the earlier five year period.

- Among the major commodity groups, fruits, milk, oilseeds, sugar, and livestock products registered average annual double digit price rise during the five year period ending 2011–12. The vegetables experienced close to double digit price rise per year during this period. These trends suggest that the supply response was not adequate in meeting the rising demand for commodities such as fruits, vegetables, and particularly livestock products including milk. The coarse grains also experienced high rates of price rise in the domestic markets.

- During the two periods considered, international prices also saw sharp increase for most of the commodity groups. Weather fluctuations, increase in demand from developing economies and demand for coarse grains for producing ethanol have been commonly cited as the reasons for this price increase. Nevertheless, the international price environment was not conducive to maintaining a stable food price scenario in the domestic markets. Although, the international price situation eased in the more recent three year period till 2011–12, there is a need for efforts to improve India's food supply systems given the potential for fluctuations in supplies even at the global level.

III.3 The Incentive Signals in the Evolving Medium-term Scenario

III.3.1 International Prices

The price environment in the international markets in the recent 5–6 years has also been marked by significant volatility. The prices rose sharply in 2008, dropped subsequently and then rose again in 2011 to decline again in 2012 (Figure III.1). The price variations are effected by fluctuations in supplies caused by weather fluctuations and structural changes in demand especially in the developing economies.

> Although the international price situation eased in the more recent three year period till 2011–12, there is a need for efforts to improve India's food supply systems given the potential for fluctuations in supplies even at the global level.
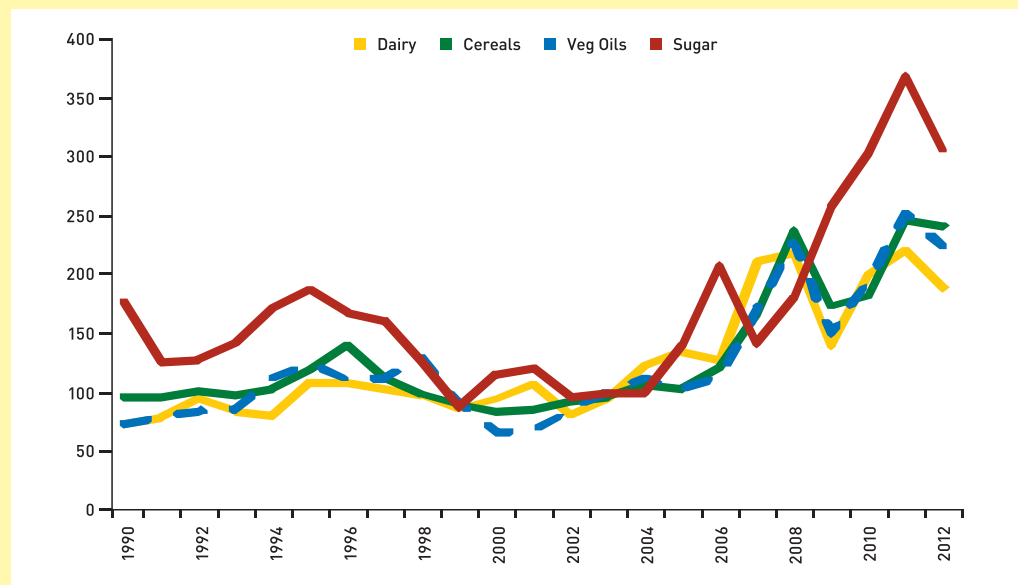
Figure III.1: Trends in Food Commodity Prices in International Markets: FAO Food Price Indices

Source: FAO Website.

> **Although India's agricultural markets are not fully integrated with the international markets they are also not insulated completely from each other. India's large imports of edible oils and pulses influence international markets and its exports of rice, wheat and sugar are affected by price competitiveness.**

Although, India's agricultural markets are not fully integrated with the international markets they are also not insulated completely from each other. India's large imports of edible oils and pulses influence international markets and its exports of rice, wheat and sugar are affected by price competitiveness. If international market prices continue to rise, domestic prices are also not likely to be unaffected by this trend. While year to year weather related changes may not reflect medium term trends, the structural factors will imply upward pressure on prices. The other demand such as for biofuels is likely to be influenced by changing oil supply situation globally. Within the food system, rising demand and demand pattern moving up the value chain will imply that prices would show an upward trend. The links to domestic prices are influenced by the nominal exchange rate. Given the likelihood of continued current account deficit, the exchange rate would also provide upward pressure on prices.

III.3.2 Domestic Price and Productivity Trends

As noted in chapter I, the terms of trade or the price of output relative to input prices has now become favourable to agriculture. Although this pattern is influenced by the input subsidies and minimum support prices, the outcome has been that output prices have increased faster than the input prices in the period following 2000–01. There have also been attempts from the policy side to improve supplies of yield enhancing inputs and credit needed to purchase inputs. There are now pressures to reduce input subsidies and this may make it necessary to intensify the use of inputs, higher prices of output and improve productivity to maintain or increase profitability of farm enterprise. While the output prices in the case of grains increased faster than the rise in the prices of diesel, fertilizer and electricity, one area where the input prices have increased faster than output prices in the recent years is the wage rates. The CACP Rabi Season Report for 2012–13 notes that compound annual growth rate of wage rates between Dec–May 2008 and Dec–May 2012 was 20.17 per cent. While the increase in wage rates may not be at this rate in the longer term, the input prices would be under pressure depending on the policy approach to subsidy issue.

While input price scenario reflects the cost side of the incentives, revenue side is affected by output prices and yields. As shown in Table III.6, for the recent six years, the yield and price increases are comparable in the case of rice and wheat. The increase in yield of bajra and maize is higher than in the case of rice and wheat and price rise is also higher. In the case of coarse grains, therefore, the critical issue is the actual yield per hectare of land that would influence net returns per hectare as compared to the return from rice and wheat.

In the case of pulses, inability to achieve significant improvement in yield has also led to higher price increases. The price rise may be necessary to incentivise production unless there are productivity improvements or increased supplies of imports at competitive prices so that food demand can be met.

In the case of soybean, price rise has been more than 10 per cent per year in the recent six years and yield growth has been modest. The yield growth in groundnut is significant but it is also volatile. This is reflected in the high rate of increase in prices. Imports of edible oils have kept prices in check and this aspect of the supply-demand balances is likely to continue.

In the case of potato, onion and banana, price increase is significant even though there has also been increase in yields. The relatively higher increase in prices even with significant improvement in yields reflect rising demand for fruits and vegetables. This feature of the food economy is likely to continue over the medium-term.

In the case of sugarcane, there is no significant increase in yields. The prices have increased by almost 10 per cent per year in the last six months. While the price rise is supported by government's price policy, demand growth is expected to be strong as average income levels increase over the medium term.

The price increase in the recent six years is sharper than in earlier six year period for most of the commodities considered here (Figure III.2). In other words, the supply-demand balances, price policies and international price environment have led to higher price rise in the recent 5-6 years. There have been efforts at the policy level to improve production conditions through emphasis on improving productivity and international trade.

The supply-demand balances, price policies and international price environment have led to higher price rise in the recent 5-6 years. There have been efforts at the policy level to improve production conditions through emphasis on improving productivity and international trade.

Table III.6: The Annual Average Percentage Change in Area, Yield, Production, and WPI for Selected Food Commodities: 2006–07 to 20011–12

Commodity	Area	Yield	Production	WPI
Rice	0.37	1.91	2.35	8.65
Wheat	1.49	3.72	5.23	8.38
Maize	2.25	5.24	7.71	10.58
Jowar	-5.18	3.00	-2.65	14.97
Bajra	-0.80	8.02	7.78	9.90
Gram	-1.31	5.96	4.69	10.39
Arhar	2.46	-1.20	1.45	12.50
Pulses	2.34	2.19	4.68	10.74
Foodgrain	0.55	3.12	3.73	9.17
Groundnut	-3.71	7.27	6.60	13.20
Rape/ mustard	-0.59	-1.22	-1.37	8.15
Soybean	4.81	3.06	7.69	10.31
Nine oilseeds	-0.32	2.56	2.53	
Cotton	5.87	5.96	12.44	17.35
Sugarcane	3.95	0.94	5.07	9.92
Potato	5.48	5.15	10.79	7.67
Onion	8.83	2.79	11.90	9.65
Banana	12.82	3.55	17.31	7.81
Milk	-	-	3.75	11.64
Sugar				9.85

The domestic policies would also seek to rebalance production structure to achieve more efficient balancing of supply and demand. One indication of this effort is the higher increase in the prices of pulses and oilseeds than the increase in rice and wheat (Table III.7). While the rate of increase in MSP is expected to moderate in the medium term, the need for improved incentives to increase production of pulses and oilseeds is also highlighted by the growing import bill for these commodities.

Figure III.2: Average Annual % Change in WPI for Selected Food Commodities

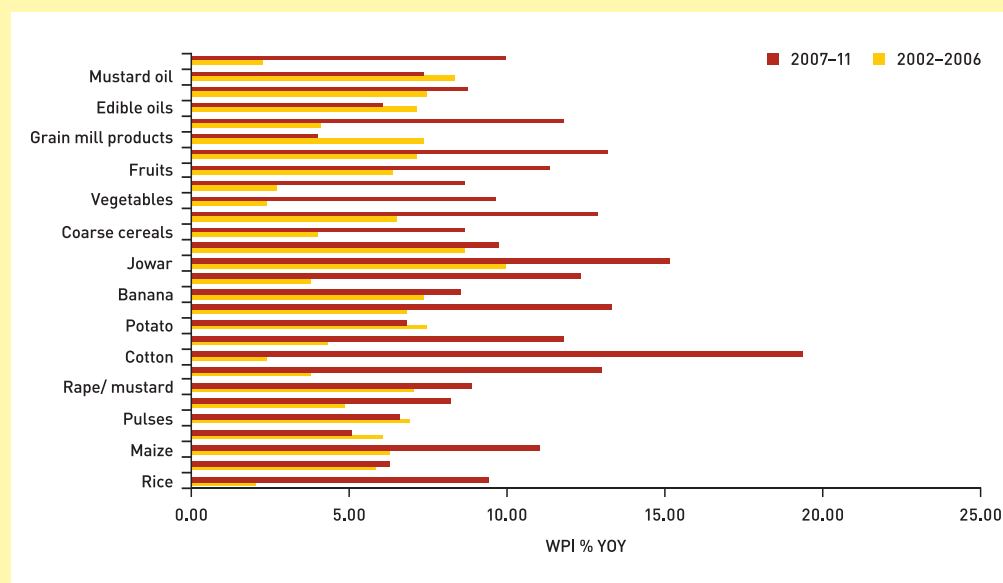**The domestic policies would also seek to rebalance production structure to achieve more efficient balancing of supply and demand. One indication of this effort is the higher increase in the prices of pulses and oilseeds than the increase in rice and wheat**

Table III.7: Average Annual % Change in MSP (plus bonus) for Selected Food Commodities

Commodity	2007–08 to 2011–12	2010–11 to 2012–13
Cereals		
Paddy Common	12.0	7.9
Wheat	8.7	8.7
Jowar	13.4	23.1
Bajra	13.4	12.0
Maize	13.3	12.0
Ragi	15.6	19.0
Pulses		
Arhar	22.3	19.3
Mung	22.2	14.0
Urad	21.2	15.6
Gram	14.6	19.9
Oilseeds		
Soybean black	14.2	18.3
Soybean yellow	11.3	17.8
Rapeseed/ Mustard	8.6	18.7
Groundnut in shell	12.9	21.3
Sugarcane	14.5	3.8

Source: Based on data available in the reports of the Commission on Agricultural Costs and Prices.

While the changes in prices and yields provide the incentives in the margin, the estimates of costs and returns in CACP reports suggest that net returns from farming are small. The returns may significantly vary depending on yields. This clearly indicates the need for significant increase in productivity to raise farm income in the context of declining farm size over time.

III.3.3 Variability in Production and Prices

The rising trend in nominal domestic prices reflects both the increase in overall price level and the supply-demand imbalances. The increasing prices may not have the same positive impact on new investments if the price or revenue environment is not stable. There is a need to reduce variability in prices and yields to attract productivity improving investments.

The price variability in the medium-term can be significant. In the case of main food commodities such as rice and wheat the coefficient of variation in annual WPI for a 5- year period has exceeded 10 per cent over five years in the recent years (Figure III.3). In the case of maize, the variability has continued for longer period in the recent years. Only if the high variability is combined with rising average prices, productivity improving investments may be attracted. Therefore, in the medium-term, the goal of moderate price increase can be achieved only with improved productivity.

Figure III.3: Coefficient of Variation in Annual WPI in the Five Year Period ending in Specified Year
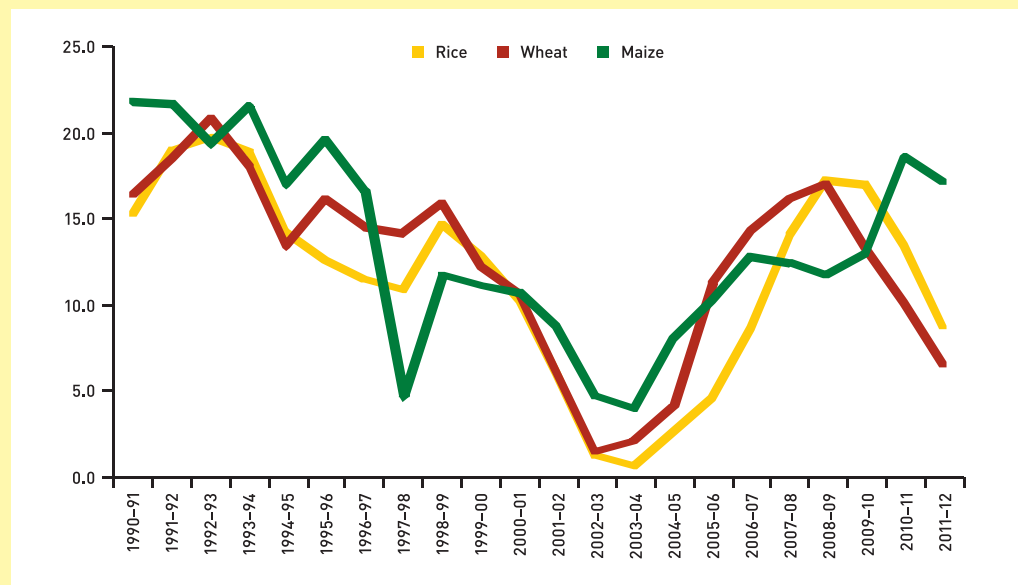
The need for public investments in agriculture and infrastructure for agriculture would be critical for sustaining productivity improvements in agriculture over the medium-term.

III.4 Projection of Area, Production, Exports and Prices of Major Food Commodities

In collaboration with Institute for Social and Economic Change (ISEC), Bangalore we have applied an econometric model of production, exports and prices for the major food commodities to obtain projections at the national level. Annual national level data on a range of factors influencing supply and demand has been used in estimating this model. The model was initially developed at NCAER to assess the supply-demand balances for food commodities. It has been updated using additional data upto 2010–11. A brief description of the model is provided in Annex 1. The key relationships captured in the model are:

- Production is estimated using either crop area and yield equations or directly production equations the choice determined by the statistical properties of the estimated equations. The factors influencing production are lagged area of the crop, lagged price of the crop relative to the price of other commodities competing with it for land and other inputs, irrigated area, price of fertiliser relative to crop price. When area and yield equations are estimated independent variables are selected in a logical manner.

- Net exports are modeled as a function of world income, export prices, domestic production, domestic price, exchange rate.

- Domestic price is estimated as a function of domestic production, MSP, export price and own lagged value.

Based on a set of assumptions relating to the exogenous variables, the estimated set of equations have been used to project the values of production, net exports and prices in the case of rice, wheat, coarse cereals, pulses and oilseeds. These do not cover the entire set of food commodities considered in the study. The remaining commodities will be taken up for model based assessment in the subsequent reports.

In order to obtain a range of outcomes for the medium term, we have generated two medium term scenarios using the estimated model. In the first scenario, we have used the annual average growth rates of exogenous variables observed for the period of 1993–94 to 2003–04. In the second scenario, we have used the average of annual growth rates of exogenous variables observed for the period 1980–81 to 1989–90. The period of 1980s had experienced higher rates of agricultural production as compared to the second period. In this sense, Scenario 1 represents a baseline scenario and Scenario 2 represents a relatively more optimistic scenario. The assumptions are summarised in Annexure Table A1.

In the case of potato and onion, production is projected for the medium-term based on a review of the rates of growth in area and yield in the recent five years. In both the cases, the rate of increase in production is about 10 per cent per year. Significant portion of this increase has come from an increase in area (Table III.8.). The increase in the future years is likely to come more from productivity increase rather than area growth. We have projected growth in production at a moderate rate of 7 per cent per year in the case of potato and 5 per cent per year in the case of onion in the medium-term. In both the cases, projected production in 2016–17 is higher than the demand projected by the Working Group indicating the need for expanding exports to absorb rising production. In the case of banana also, we have used a lower rate of increase of 5 per cent per year for the medium-term projections as compared to the growth rate of 17 per cent in the recent five years. Although, there has been a sharp increase in area in the recent years, growth rate of yield has been low. Taking this into account a moderate rate of growth over the medium term is more likely.

The projected level of production under the two scenarios for the selected commodities is presented in Table III.8. For a comparison, we have also presented the projections by the Working Group, projections by FAO in the case of rice and wheat for 2017 and also estimates of production for 2012–13. The 2012–13 estimates are from the Quarterly Agricultural Outlook Report of December 2012.

We have projected growth in production at a moderate rate of 7 per cent per year in the case of potato and 5 per cent per year in the case of onion in the medium-term.

Table III.8: Projected Production of Selected Food Commodities for 2016–17 (million tonnes)

Commodity	Estimates for 2012–13	2016–17 Scenario 1	2016–17 Scenario 2	2016–17 Working Group Projections	Projections by FAO for 2017
Rice	101.8	119.6	121.6	98-106	112.31
Wheat	92.3	93.3	100.6	93-104	85.6
Coarse cereals	38.5	50.2	46.5	42-49	
Cereals	232.6	263.1	268.7	240-251	
Pulses	17.6	18.8		18-21	
Foodgrain	250.1	277.8	284.3	258-272	
Oilseeds	29.5	42.2	43.7	33-41	
Potato	43.5-44.5	57.0			
Onion	16.7	20.3			
Banana	31.9	38.8			
Sugarcane	334.5	375.4			
Milk	131.8-132.1	152.7			

Note:
1. The 2012–13 estimates are the Second Advance Estimates by the Ministry of Agriculture except for potato, onion, banana and milk which are estimates from the third Quarterly Agricultural Outlook Report of NCAER.
2. In the case of pulses, potato, onion, banana, sugarcane and milk, Scenario 1 projections for 2016–17 are based on an assumed annual rate of growth as explained in the text. Projections by FAO are extracted from the information presented in Chapter II.

The projections of the present analysis indicate larger surplus of production relative to domestic demand in the case of cereals. The deficit in the case of pulses is similar to the case of Working Group projections and it is smaller in the case of oilseeds.

The projected production of cereals, foodgrains and oilseeds under both the scenarios is greater than upper limit of the range of estimates provided by the Working Group for the 12th Five Year Plan. Our projection of production of pulses in 2016–17 is lower than the projections of the Working Group. The specific empirical model adopted in this study is different from the approach followed by the Working Group and in this sense the differences in the projections are to be expected. The estimates by FAO are closer to our own projections in the case of rice but significantly lower than ours in the case of wheat. The projections from the present analysis seem to be more in line with the recent production trends in 2011–12 and 2012–13.

The assessment of the Working Group has pointed to the situation of supply (production) exceeding domestic demand in the case of cereals and sugarcane. Pulses and oilseeds production is seen to lag behind demand necessitating larger imports than now. The projections of the present analysis indicate larger surplus of production relative to domestic demand in the case of cereals. The deficit in the case of pulses is similar to the case of Working Group projections and it is smaller in the case of oilseeds.

In the case of pulses, we have replaced the model based projections with an assumed growth rate of 2 per cent per year between 2012–13 and 2016–17. The model results projected nearly stagnant production during the assessment period. In the case of potato, onion, banana, sugarcane and milk, we have projected production levels into the medium-term based on the trend growth rates between 2006–07 and 2011–12. The growth rates assumed for projection are: 7 per cent, 5 per cent, 5 per cent, 3 per cent and 3.75 per cent per year for potato, onion, banana, sugarcane and milk, respectively.

The projections from the model are presented in Table III.9 and III.10 in terms of annual growth rates of area, production and other dimensions for the projection period of 2012–13 to 2016–17 (coinciding with the 12th Five Year Plan) and a longer time period of 2012–13 to 2020–2021.

Three key points emerging from the analysis are summarized below:

- The projected growth rates of area and production are lower in the longer assessment period as compared to the period of 2012–13 to 2016–17.

- The growth rate of area is projected to be higher under both the future scenarios in the case of rice and oilseeds as compared to the actual change observed during the period 2001–02 to 2009–10. In the case of wheat the increase is seen only in the shorter outlook horizon of 2012–13 to 2016–17. Thus, the medium-term scenario is more favourable to allocation of land to rice, wheat and oilseeds than the recent experience. The coarse cereals present a mixed picture. The area under coarse cereals increases faster under Scenario 1.

- Production trends follow the pattern seen in the case of area. In general, projected growth rates of production are higher in the future periods as compared to the experience of 2001–02 to 2009–10.

In general, projected growth rates of production are higher in the future periods as compared to the experience of 2001–02 to 2009–10.

Table III.9: Actual and Projected Rates of Growth in the Selected Food Commodities: Area and Production (% Change YoY)

Commodity	Area					Production				
	2001–2011 Actual	Projected: Scenario1		Projected: Scenario2		2001–2011 Actual	Projected: Scenario1		Projected: Scenario2	
		2012–2017	2012–2020	2012–2017	2012–2020		2012–2017	2012–2020	2012–2017	2012–2020
Rice	0.35	1.10	0.94	0.25	-0.01	2.32	2.65	2.47	2.89	2.62
Wheat	0.67	0.76	0.59	0.54	0.10	1.82	1.91	1.69	2.64	1.31
Coarse cereals	-0.34	0.99	0.50	-1.24	-1.95	3.15	3.66	2.96	2.22	1.27
Foodgrains	0.35	0.78	0.54	0.18	-0.17	2.22	2.42	2.15	2.55	1.82
Oilseeds	1.90	2.31	2.00	2.60	2.33	5.47	4.89	4.47	5.30	4.75

The estimated model is also used to provide an assessment of the export and price scenarios.

In the case of rice, exports are projected to increase at a higher rate in the assessment period of 2012–13 to 2016–17 as compared to the actual increase during 2001–02 to 2011–12. Exports of wheat are projected to decline in the assessment period. The decline may be attributed to the higher increase in domestic prices and weak international price scenario. In other words, the export competitiveness of wheat may decline because of the emerging price and productivity scenario.

In the case of coarse cereals, export momentum is expected to continue in the medium term. The trends are influenced by the experience in the case of maize. The prices are projected to increase at a higher rate than the recent experience. However, rising production trend is supporting the growth in exports.

In the case of pulses, we have not estimated net exports although the projected production trends clearly show that imports will rise from the current levels because of relatively slow rate of growth in production over the medium term.

In the case of oilseeds, net exports are projected to decline in the longer time horizon of the outlook assessment.

In the case of rice, exports are projected to increase at a higher rate in the assessment period of 2012–13 to 2016–17 as compared to the actual increase during 2001–02 to 2011–12. Exports of wheat are projected to decline in the assessment period.

Table III.10: Actual and Projected Rates of Growth in the Selected Food Commodities: Exports and Prices (% change, YoY)

Commodity	Exports (quantity)					Post-harvest Price				
	2001–2011 Actual	Projected: Scenario1		Projected: Scenario2		2001–2011 Actual	Projected: Scenario1		Projected: Scenario2	
		2012–2017	2012–2020	2012–2017	2012–2020		2012–2017	2012–2020	2012–2017	2012–2020
Rice	2.73	6.80	4.96	3.64	2.10	6.79	7.88	7.95	6.72	6.76
Wheat	47.78	-23.77	-21.80	-24.38	-24.34	6.39	9.42	8.88	7.77	7.38
Coarse cereals	65.76	11.18	8.43	4.96	-2.58	7.27	9.27	9.04	7.91	7.66
Pulses	-	-	-	-	-	7.65	7.80	7.69	6.66	6.57
Foodgrain	13.58	9.79	7.37	4.44	-0.77					
Oilseeds	17.19	9.45	9.48	-3.42	-3.47	6.83	8.89	8.82	7.37	7.28
Coarse cereals:										
Kharif						7.22	9.70	9.08	7.33	6.76
Coarse cereals: rabi						7.31	8.84	9.01	8.49	8.57
Pulses: kharif						7.98	7.81	7.81	7.81	7.81
Pulses: rabi						7.32	7.79	7.58	5.50	5.33
Oilseeds: kharif						8.32	9.78	9.78	7.13	7.13
Oilseeds: rabi						5.33	8.00	7.86	7.62	7.43

Note: In the case of post-harvest prices, we have taken average of % change in kharif and rabi prices for the overall commodity price in the case of coarse cereals, pulses, and oilseeds.

> **An important result of the projection exercise is that prices are expected to rise at 6.5-9.5 per cent in the range of two scenarios across commodities. The price increase is generally higher than the experience of 2001–02 to 2009–10.**

An important result of the projection exercise is that prices are expected to rise at 6.5-9.5 per cent in the range of two scenarios across commodities. The price increase is generally higher than the experience of 2001–02 to 2009–10.

III.5 Spatial Dimension

What are the implications of continuation of current trends of production on the contribution of different regions of the country over the medium-term? Clearly the regions experiencing higher growth rates of production will increase their shares in national production. But, how significant are these changes?: To provide an assessment, we estimated the state level growth rates in area, yield and production for the period 2001–02 to 2010–11 and extended the crop area series upto 2020–21 using these trends.

The resulting patterns in terms of share of regions in national crop areas are summarised in Tables III.11 and III.12.

A general pattern that emerges across the five regions is the increasing share of horticulture crops in the medium term. Although, not all the three crops in this group attract larger share of area in the period from 2012–13 to 2016–17, in each region at least two of the three crops do so.

In the Central region, area under foodgrain is projected to decline and larger proportion of area is allocated to oilseeds, onion, and banana.

The Eastern region is also projected to show increased area under horticulture crops with the decline in the area under foodgrain and to some extent oilseeds.

In the Northern region, the higher share of oilseeds and horticultural crops in area, is made possible by reduction in area under sugarcane. The area under foodgrain is nearly constant between 2012–13 and 2016–17.

In the Southern region also, there is a decline in the share of sugarcane to area under horticultural crops. The foodgrain share is stable.

The Western region does show some increase in the area under horticultural crops but the changes are relatively small.

Overall, the projected trends suggest gains for horticulture crops in all the regions with some decline in area share of foodgrain and sugarcane.

The projections are extension of the recent trends in area. The rising demand for fruits, vegetables and edible oils influence the trends in the allocation of area. The surprising trend is the decline in the share of sugarcane. The need for assured irrigation may have limited the expansion of area under sugarcane in the recent years leading to the declining share of the crop in total area.

Overall, the projected trends suggest gains for horticulture crops in all the regions with some decline in area share of foodgrain and sugarcane.

Table III.11: Composition of Area under Food Commodities: % of Area Within a Region

Zone	Year	Rice	Wheat	Coarse grain	Food-grain	Oil-seed	Sugar-cane	Potato	Onion	Banana	Total
Central	2012–13	20.92	18.14	7.62	71.97	26.97	0.31	0.29	0.32	0.14	100
Central	2016–17	19.18	18.54	6.29	70.28	28.34	0.34	0.34	0.46	0.24	100
East	2012–13	66.23	10.14	4.93	91.29	3.28	0.93	3.49	0.56	0.45	100
East	2016–17	62.69	9.88	5.06	89.93	3.13	1.13	4.22	1.09	0.51	100
North	2012–13	18.01	33.31	18.92	83.27	10.76	4.25	1.26	0.20	0.25	100
North	2016–17	17.33	32.42	18.43	82.13	11.93	4.01	1.38	0.25	0.30	100
South	2012–13	33.57	1.10	23.20	79.93	13.23	3.76	0.45	1.14	1.50	100
South	2016–17	33.91	1.04	21.47	78.74	13.59	3.74	0.58	1.28	2.08	100
West	2012–13	9.33	11.78	27.49	66.21	25.87	4.96	0.39	1.95	0.62	100
West	2016–17	8.47	14.75	21.84	60.70	29.98	5.47	0.46	2.72	0.67	100

Note:The Central region includes MP and Chhattisgarh; East includes Assam, Orissa, West Bengal, Bihar and Jharkhand; North includes UP, Haryana, Punjab, Rajasthan and Uttarakhand.

The pattern of changes across regions for each crop indicates the changes in the contribution of different regions to crop area (Table III.12).

There is a sharp reduction in the share of Northern region in wheat area and the gains are registered in the West. The pattern of area under rice remains fairly stable.

The Southern region shows increased share in national area under coarse cereals although in the aggregate, area under coarse grains may increase only marginally. Maize production trends offset the decline in area under other coarse cereals. There is a reduction in the share of West in coarse cereal production. Both West and South register gains in their share of maize area with Central, East and North showing decline.

There is a sharp decline in the share of Central region in the share of area under gram, with West and South registering increased shares. In the case of Tur, decline in area share of north is a gain for South. However, in pulses as a whole, the changes across regions are small. The pulses other than gram and Tur are offsetting the changes in these two pulses.

Among the oilseeds, the churn is in the Central, South and Western regions. Share of Central region is declining and South and West are gaining. In the case of groundnut, South is declining and West is gaining.

The extrapolation of the current trends indicate that regional composition of output may see some significant changes which may be in response to emergence of suitable crop varieties and also the changing agro-economic parameters such as availability of water and other inputs.

Table III.12: Composition of Area Under Food Commodities across Regions: % of Area Within a Crop

Year	2012–13	2016–17	2012–13	2016–17	2012–13	2016–17	2012–13	2016–17	2012–13	2016–17	2012–13 or 2016–17
Commodity											
Foodgrain	14.7	14.8	18.3	17.7	38.2	38.5	15.2	15.1	13.6	13.8	100.0
Rice	12.5	12.3	38.8	37.4	24.2	24.7	18.8	19.8	5.6	5.9	100.0
Wheat	15.6	15.9	8.6	7.9	64.6	61.8	0.9	0.8	10.2	13.6	100.0
Coarse grain	7.3	6.6	4.6	5.0	40.8	43.1	20.8	20.6	26.5	24.8	100.0
Maize	10.5	8.6	10.2	9.5	24.6	20.2	35.5	40.2	19.1	21.5	100.0
Gram	34.6	31.0	1.1	1.0	24.9	23.9	19.4	21.7	20.0	22.5	100.0
Tur	12.2	13.5	4.6	4.3	9.4	8.3	34.7	36.2	39.0	37.7	100.0
Pulses	24.6	24.8	9.5	10.8	28.5	29.3	20.1	19.2	17.3	15.9	100.0
Gnut	3.7	3.7	1.6	1.7	7.6	9.7	48.4	46.3	38.8	38.6	100.0
R&M	13.4	14.5	10.8	9.0	71.7	72.7	0.2	0.2	4.1	3.7	100.0
Soybean	50.5	42.9	0.0	0.0	7.9	7.1	4.4	6.3	37.2	43.7	100.0
Sugarcane	1.6	1.7	4.7	5.4	49.6	45.5	18.2	17.3	25.9	30.1	100.0
Potato	4.0	4.1	46.4	47.1	38.5	36.6	5.7	6.3	5.4	5.9	100.0
Onion	7.2	7.4	12.6	16.6	10.5	9.1	24.6	19.0	45.1	47.9	100.0

Note:The Central region includes MP and Chhattisgarh; East includes Assam, Orissa, West Bengal, Bihar, and Jharkhand; North includes UP, Haryana, Punjab, Rajasthan, and Uttarakhand.

In the case of potato and onion, East is projected to increase in area under these crops relative to the other regions. In the case of banana, South is seen to increase in importance relative to the West over the medium-term.

The extrapolation of the current trends indicate that regional composition of output may see some significant changes which may be in response to emergence of suitable crop varieties and also the changing agro-economic parameters such as availability of water and other inputs.

CHAPTER IV
Conclusions

An assessment of the emerging conditions for food production, demand and prices provides indicators that may help design measures by both the government and other stake holders to ensure that adequate food supplies are available to meet demand over the longer term.

This report examines the emerging scenario for food commodities over the medium-term of next five years with respect to production, demand, trade and prices. The report has taken into account the work of other agencies who have provided such an analysis both at the global level and also for India.

IV.1 Global Scenario

Review of the assessments of global trends suggests that world production of wheat and rice is expected to increase to meet the rising demand with the overall price situation easing from the recent high commodity prices. The slower increase in demand is an important factor in moderating price situation.

Livestock demand for feed is projected to increase at a lower rate, because of slower growth in demand in the developed economies. This may ease pressure on the prices of coarse grains.

There is expected to be increasing supply-demand gap in some commodities leading to higher prices or sustaining prevailing high prices. Vegetable oil demand is expected to be firm in the developing countries keeping up the pressure on prices to be at high levels. In the case of dairy sector and sugar also prices are expected to remain firm either because of rising costs in the case of dairy sector or production fluctuations in the case of sugar.

The high prices at the consumer or retail level are expected to continue in the medium term as high prices are needed to offset the increased input costs.

The higher share of production in emerging countries comes with an uncertainty of higher yield variability, thus likely to result in volatile prices in the future.

In spite of a slowdown in demand growth, consistent further investment in agriculture is needed to tackle yield stagnation, more frequent weather events, etc. in order to ensure an adequate supply response.

IV.2 Domestic Food Economy

The analysis of medium-term outlook for the food commodities in India identified the key defining parameters:

While there are opportunities to increase crop area under specific crops by shifting production of from one crop to another, the potential for increasing crop area either by increasing net sown area or cropping intensity is limited in the medium-term. This implies

that raising productivity per hectare is the only main instrument to increase production in the food sector.

The policy environment for agriculture is changing from input subsidies to more fiscally sustainable strategies. While prices of inputs such as fertliser, diesel, electricity, and pesticides rose at relatively moderate rates in the last 5–6 years, with the reduction in input subsidies on fuel and fertilisers, input prices are likely to increase at higher rates. In the case of labour, wage rates have increased at double digit rates per year in the last five years. Diversification of the economy is giving new opportunities for labour, raising the wage rates. The rise in wage rates may make further mechanisation of farming operations feasible if there are additional improvements in productivity as a consequence of mechanisation.

The MSP and procurement of grains by the government has provided incentives for raising production of rice and wheat. However, government has not been able to distribute all the grain it has procured at the MSP leading to large stocks. The Food Security Bill aims to provide grains at highly subsidised price essentially doubling the quantity distributed by the PDS now, or requiring the government to increase its procurement efforts to meet the demands of the enhanced distribution. If the resulting changes only mean that grain would be distributed through the subsidised channel rather than market, there may not be significant impact on production. However, if demand for grain increases because of the subsidy, production growth will also have to accelerate.

The expansion of subsidised food grain access on the one hand and likely reduction of input subsidies on the other, further increase the pressure to increase productivity of the sector. There have been a number of measures to expand supply of institutional credit and quality seeds. Increased supply of institutional credit, at subsidised interest rate, has helped the farmers to purchase productivity enhancing inputs. However, as we noted earlier, growing fiscal pressures make input subsidies difficult to sustain, especially in the context likely expansion of food subsidy. The need for improvements in productivity will remain the key for achieving adequate supply response to meet emerging demand.

IV.3 Emerging Supply-Demand Balances

The assessment of supply-demand scenario by the Working Group on Agriculture for the 12th Five Year Plan indicates that domestic supplies are likely to exceed demand in the case of cereals in the plan period ending in 2016–17. The projected domestic supply exceeds demand in the case of sugar also. The supply projection of pulses and oilseeds lags estimated demand even at the end of the projection period of 2016–17.

The additional analysis carried out in the report shows that growth in demand is likely to outpace production in the case of fruits, vegetables, and livestock products.

Production prospects of the major food commodities that included rice, wheat, coarse cereals and oilseeds examined within a framework of an econometric model showed that in the medium-term production of cereals, foodgrains and oilseeds is greater than upper limit of the range of estimates provided by the Working Group for the 12th Five Year Plan. Our projection of production of pulses in 2016–17 is lower than the upper limit of projections of the Working Group. The estimates of rice production by FAO are closer to our own projections than the projections of the Working Group but FAO projections are significantly lower than ours in the case of wheat. The projections from the present analysis seem to be more in line with the recent production trends in 2011–12 and 2012–13.

The rise in wage rates may make further mechanisation of farming operations feasible if there are additional improvements in productivity as a consequence of mechanization.

The need for improvements in productivity will remain the key for achieving adequate supply response to meet emerging demand.

The projections of the present analysis indicate large surplus of production relative to domestic demand in the case of cereals. The deficit in the case of pulses is similar to the case of Working Group projections and it is smaller in the case of oilseeds.

In the case of pulses, potato, onion, banana, sugarcane and milk we have projected production levels based on a review of the recent rates of growth of production. The rates used for projection over the medium term are: 2 per cent per year for pulses, and 7 per cent, 5 per cent, 5 per cent, 3 per cent and 3.75 per cent per year for potato, onion, banana, sugarcane and milk, respectively.

IV.4 Spatial Dimension

In an attempt to explore the implications of current trends in the allocation of cultivated areas to different crops, we have presented the contribution of five regions of the country to crop area under the selected food crops. We have also examined the importance of each major food crop to the total crop area under these crops in each region. The analysis is based on rates of change in crop area in the major states in the period 2000–01 to 2010–11.

The analysis points to rising share of horticulture crops such as potato, onion and banana in a number of regions, while the area under sugarcane and foodgrain declines. These changes are more prominent in the Central, Eastern and Southern regions. The changes in North and West are relatively small. The shifting patterns of crop areas, if the present trends continue also indicate the need for development of marketing and other infrastructure support for the changes in production pattern.

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ANNEXURES

Model Structure and Assumptions of Exogenous Variables: % Change YoY

For supply projections, we shall use a simultaneous equation model for the historical data period from 1980–81 to 2010–11. The set of equations include four simultaneous equations to estimate the parameters for the dependent variables. These four determined variables are area, yield, farm harvest price (in real terms), and quantity of exports (Annex Table A.1). Because some of the determined variables are determinants in other equations, we follow a simultaneous three stage least square (3 SLS) estimation system. The following set of simultaneous equations model shall be estimated:

(i) $\quad Y_{1t} \quad = \quad f\,(X_{11t}, X_{12t}, X_{13t}, X_{14t}, X_{15t}, X_{16t}, X_{17t}, Y_{1t-1})$

(ii) $\quad Y_{2t} \quad = \quad f\,(X_{11t}, X_{21t}, X_{14t}, X_{15t}, X_{16t}, X_{17t}, Y_{2t-1})$

(iii) $\quad Y_{3t} \quad = \quad f\,(X_{31t}, X_{32t}, X_{33t}, X_{34t}, X_{35t}, X_{17t}, Y_{3t-1})$

(iv) $\quad Y_{4t} \quad = \quad f\,(X_{11t}, X_{32t}, X_{33t}, X_{41t}, X_{35t}, X_{42t}, X_{34t}, X_{43t}, X_{17t}, Y_{4t-1})$

Where,

Y_{1t} Is area under a particular crop (acres);

Y_{2t} is production in physical terms;

Y_{3t} is real domestic price (farm harvest price);

Y_{4t} is volume of net exports;

X_{11t} is real domestic (farm harvest) price;

X_{12t} is real competing crop price;

X_{13t} is rainfall – annual, monsoon or winter months as applicable in different cases;

X_{14t} is percentage of area under irrigation;

X_{15t} is fertilizer use in kgs per hectare;

X_{16t} is real fertilizer price;

X_{17t} is time trend;

X_{31t} is real minimum support price;

X_{32t} is real world price or real unit value of exports;

X_{33t} is production in physical terms;

X_{34t} is real world income;

X_{35t} is policy dummy;

X_{41t} is openness in terms of share of Indian exports in the world exports commodity wise;

X_{42t} is volume of world trade in a particular commodity; and

X_{43t} is real effective exchange rate.

In addition to the above four equations, there are the following two identities in the model:

Production   =   Area * Yield rate

Real farm harvest price in $ =   Real farm harvest price in Rs ÷ Exchange rate

Table A.1: Assumptions of Exogenous Variables: % Change YoY

Commodity	Scenario	Competing crop price	Fertlizer use	MSP	Irrigated area	WPI	Exchange rate	World price $	Fertilizer price	World GDP deflator	World income $	Openness	World trade
Wheat	1	5.0	2.8	4.2	0.8	4.8	2.6	0.2	3.1	2.9	2.9	2.7	1.0
	2	8.9	4.8	7.2	1.5	7.7	10.2	-1.0	3.6	4.0	3.1	-2.1	0.5
Rice	1	3.8	3.0	4.3	0.3	4.8	1.9	-1.0	-3.9	2.9	2.9	2.7	-
	2	10.0	6.0	7.9	1.3	8.8	10.2	-1.3	0.0	4.0	3.1	-2.1	-
Kharif coarse cereals	1	3.8	1.9	5.4	0.2	4.8	1.9	-0.2	3.1	2.9	2.9	2.7	-0.4
	2	9.7	6.9	6.9	1.8	8.8	10.2	-1.2	3.8	4.0	3.1	-2.1	-0.4
Rabi coarse cereals	1	4.5	1.2	5.8	1.3	4.8	2.6	1.0	3.3	2.9	2.9	2.7	-
	2	8.2	5.2	7.1	1.9	7.7	10.2	0.6	3.6	4.0	3.1	-2.1	-
Kharif pulses	1	3.8	2.7	7.2	0.2	4.8	1.9	0.2	2.9	2.9	2.9	2.7	7.1
	2	8.7	7.5	9.7	6.5	8.8	10.2	1.1	3.9	4.0	3.1	-2.1	-26.6
Rabi pulses	1	4.2	3.5	7.0	3.4	4.8	2.6	0.5	2.9	2.9	2.9	2.7	7.1
	2	8.0	6.3	8.6	3.1	7.7	10.2	11.6	3.8	4.0	3.1	-2.1	-26.6
Kharif oilseed	1	3.7	1.8	4.3	0.9	4.8	1.9	0.8	2.9	2.9	2.9	2.7	5.0
	2	10.0	6.2	9.0	2.4	8.8	10.2	-2.3	3.9	4.0	3.1	-2.1	0.7
Rabi oilseed	1	5.0	3.1	7.6	0.2	4.8	2.6	3.3	3.1	2.9	2.9	2.7	2.4
	2	8.1	4.1	6.9	2.8	7.7	10.2	-0.3	3.8	4.0	3.1	-2.1	5.9

Note: * Fertiliser price has been specified at the crop level by aggregating state level N,P, K prices to the national level using area under the crop in the respective state as weights. The same procedure is used to estimate fertilizer consumption at the national level using crop area as weights.
** WPI of all commodities has been averaged from April–March for the rabi crops and Oct–September for kharif crops.