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Agricultural Production and Consumption Trends in India: The Past, Present and Future

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Agricultural Performance in the Last Three Decades

The widely held perception that the agricultural sector, broadly defined to include forestry and fishery, has not been part of India's growth transition in the recent past is corroborated by data. Agriculture has languished at a time when the trend rate of growth in the other sectors of the economy has been rising. The divergence in growth rates of overall and agricultural GDP has persisted and even widened after the year 2000 (Figure 1), though volatility in agricultural growth rates has fallen since then. The GDP growth rate of agriculture peaked in the 1980s (i.e. 1980–89) at above 4 per cent, while overall GDP grew at a rate of 5.6 per cent during the same time period. Growth rate in agricultural GDP came down to 3.4 per cent in the 1990s (i.e. 1990-99) and further to 2.7 per cent during the decade of 2000s (i.e. 2000-09). In comparison, the overall GDP jumped from 5.7 per cent in the 1990s to 7.4 per cent during the 2000s. Thus, while the overall economy accelerated, the agricultural sector decelerated. As a result, the gap between the growth of agriculture, including allied sectors, and that of the rest of the economy continues to widen. This has led to a steeper fall in the share of agriculture and allied sectors in the rest of the economy, although no major changes have taken place in the employment structure.

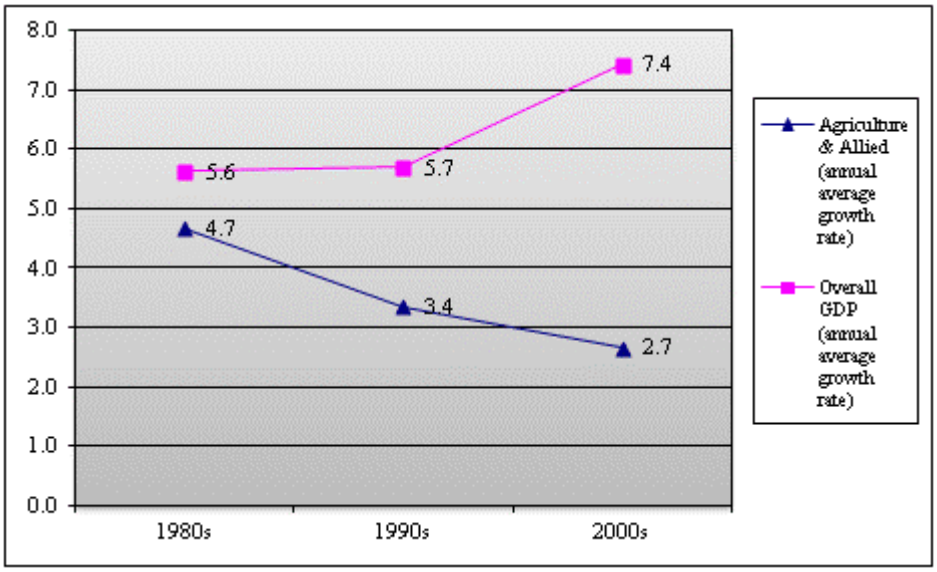


Figure 1: Trend of Agricultural and Overall GDP

[$] This paper is part of a larger study, "Assessment of Supply - Demand Balances of Foodgrains and other Food Items over the Medium Term Future". The project was submitted to the Ministry of Consumer Affairs, Food and Public Distribution, Government of India in the year 2010. This paper is based on the re-estimation of the demand and supply model with updated data up to 2012-13.

Growth Trends in Area, Production, and Productivity

Indian agriculture has made great strides in providing food security for its people. The foodgrains production has increased from 130 million tonnes in 1980–1 to above 250 million tonnes during 2013–14 (Table 1). However, production of foodgrains in the post-reform era has remained the subject of wide fluctuations. Production hovered around 200 million tonnes for almost a decade beginning from 1996–7 to 2005–6. Production peaked at 210 million tonnes in 1999–2000 and further increased to 213 million tonnes in 2001–2. However, a severe drought in 2002–3 caused a sharp fall in production to a new low of 175 million tonnes. The production recovery in the succeeding four years after drought was not spectacular. Due to the good harvest supported by a normal monsoon in the year 2007–8 and 2008–9, the country was able to achieve the 10th Plan target foodgrains production of above 230 million tonnes. Among different crops, the most inspiring increase appeared in the case of coarse cereals whose production increased from around 30 million tonnes in the mid-1990s to 40 million tonnes in 2007–8 and further to 42 million tonnes in 2011-12. Production of pulses remained stagnant to around 14 to 15 million tonnes, the level India had achieved around the late 1980s or early 1990s. However, a new peak of 18 million tonnes of pulses production was achieved in the year 2010-11 which might be the result of area expansion under Food Security Mission Pulse programme. In the case of oilseeds, the new peak achieved in 2010-11 is 32 million tonnes, the previous being 24 million tonnes achieved in 1996–7.

Deeper probing is needed, at the state level, to comprehend the factors responsible for the good or bad performance of different regions and crops during the last three decades. In the proceeding section, we will explore the trends in area, production, and yield in the major states for cereals, pulses, and oilseeds, and the factors influencing these trends. The performance of agriculture is analysed in terms of medium term growth of area (trend), production and productivity of cereals including wheat, rice and coarse grains, pulses, and oilseeds, during the 1980s (that is, from 1980–1 to 1989–90), the 1990s (1990–1 to 1999–2000), and the 2000s (2000–1 to 2009–10).[1] The whole period is also analysed for the pre-reform (1980–1 to 1994–5) and post reform period (1995–6 to 2009–10). Finally, growth rates have been presented for the entire period (1980–1 to 2009–10). The results are then discussed in the following paragraphs.

Tables 2 and 3 present the trends in area, production, and yield of foodgrains and pulses, respectively. It is evident from the statistics that foodgrains production increased at a rate of 2.7 per cent in the 1980s, which decelerated to 2.1 per cent in the 1990s and further came down to 1.8 per cent in the decade of 2000s. Growth rate was significant in the 1980s and 1990s, but was insignificant in 2000s. The pre-and post-liberalization periods make a better comparison of the aggregate thirty years' period as it divides the whole period (1980-81 to 2009-10) into approximately two halves. The foodgrains production increased at a significant rate of 2.8 per cent in the pre-liberalization period which came down to 1.2 per cent in the post-liberalization, although significant, but less than that of population growth rate.

Only Gujarat, Haryana, Punjab, Andhra Pradesh, Odisha and West Bengal observed significant positive growth rate in production in the post-liberalization period, while Kerala observed significant negative growth rate during the same time. In comparison, in the pre-liberalization period, all the major states observed significant and positive growth rates in the production of foodgrains. Even among the states that observed positive and significant growth rates in the post-liberalization period, only in Gujarat, Andhra Pradesh and Odisha was the growth rate higher in the post-liberalization period as compared to the pre-liberalization period. In all other states, the trend of growth rate was lower in the post-liberalization as compared to the pre-liberalization period. Decline in the production

[1] Data for area, production, and yield for state level has been used up to 2009–10, using the last two years' data as advanced estimates. Here, the area implies the total area cropped and yield implies the total production per acre.

growth rate could be an outcome either of decline in area or decline in the yield growth rate, or of both. The area trends of foodgrains present a very dismal picture, not only for the post-liberalization but for the pre-liberalization period as well. During the entire period of 1980–1 to 2009–10, the area under foodgrains observed a significant but negative trend in the growth rate at –0.2 per cent per annum. Thus, a shift in cropping pattern is taking place from foodgrains to non-foodgrains since the beginning of the 1980s. This change is visible in almost all the states as there is hardly any state that has observed any significant positive growth rate in area under foodgrains during both the pre as well as post-liberalization periods. Therefore, decline in production in the post-liberalization in comparison to the pre-liberalization period was not caused by the decline in area, but the sole reason was decline in the yield rate of foodgrains production. This is evident from the trend growth of yield. During the pre-liberalization period, foodgrains yield increased at 3 per cent per annum. In comparison, in the post-liberalization period, the yield growth rate was only 1 per cent. Almost all the major states observed significant and positive growth rate in yield in the pre-liberalization period while in the post-liberalization period; only Uttar Pradesh, Gujarat, Punjab, Haryana, Odisha, Andhra Pradesh, West Bengal, and Kerala observed a significantly positive growth rate. Even in these states, positive growth rate in yield was lower in the post-liberalization period compared to pre-liberalization period except for the state of Gujarat. The trends are further analysed for foodgrains crops in order to grasp the underlying changes occurring in area, production, and yield in these crops.

Looking at the trends in area, production, and yield in wheat, rice, coarse cereals, and pulses. There has been a declining trend of acreage for most of these crops during the post-liberalization period. Area growth rate was insignificant in the post-liberalization period in rice and pulses, while it was significant and negative in coarse cereals. In comparison, the area growth was significant and positive in wheat and rice in the pre-liberalization period, while it was insignificant in pulses and significant with a negative sign in coarse cereals during that period. State wise, only Punjab and West Bengal observed a significant positive growth in rice, while in the case of wheat, significant positive growth occurred in the traditional wheat producing states of Punjab, Haryana, and Uttar Pradesh. In pulses, significant growth in area expansion occurred in Andhra Pradesh, Karnataka, and Maharashtra, while none of the states experienced expansion in area under coarse cereals in the post-liberalization period. In the post-liberalization period, area and yield growth of wheat was mostly significant in the states where it was significant in the pre-liberalization period but its magnitude was less in the post-liberalization except the state of Gujarat. In rice, growth in area in the post-liberalization period was positive and significant only in Punjab while yield growth was positive and significant in several other states but the volume of growth was higher only in Punjab during the post-liberalisation period. In coarse cereals, hardly any state had positive and significant growth in area in the post-liberalization period like rice while the volume of yield growth rate was higher in most of the states compared to the pre-liberalization period. In production of pulses, area growth was positive and significant in Andhra Pradesh and Karnataka during the post-liberalization period, while yield growth was higher only in Andhra Pradesh. In the case of oilseeds, both area and yield growth decelerated in the post-liberalization period compared to pre-liberalization across almost all the states. Thus, among foodgrains and oilseed crops, the silver lining in the post-liberalization was provided by coarse cereals, whereby significant and positive growth in yield was observed in Uttar Pradesh, Andhra Pradesh, Rajasthan, Karnataka, Tamil Nadu, Haryana, Odisha, Madhya Pradesh, Punjab, and Bihar in the post-liberalization period.

Thus, given the lower growth trends in area and yield, the trends in production were also lower in the post-liberalization period as compared to the pre-liberalization period. Production of wheat grew at a rate of 1.3 per cent in the post-liberalization period as compared to 3.7 per cent in the pre-liberalization period. Production of rice grew by 1.1 per cent in the post-liberalization period

compared to 3.5 per cent in the pre-liberalization period. In pulses, growth rate in the post-liberalization period was insignificant (0.8 per cent) compared to 1.3 per cent, a significant growth during the pre-liberalization period. Only in coarse cereals was the production growth rate significant and higher (1.6) per cent in the post-liberalization period as compared to insignificant (0.5 per cent) growth rate during the pre-liberalization period.

In oilseeds production, India formulated an integrated policy under the Technology Mission on Oilseeds in 1986. From less than 11 million tonnes during 1985–6, the country attained an all-time record oilseed production of 24 million tonnes in 1996–7. It ushered in an era of the yellow revolution. The mission later slowed down and oilseed production dropped to less than 15 million tonnes during the drought year 2002–3. There was a slight recovery thereafter in the succeeding years and oilseeds production has increased to 34 million tonnes during the current year (2011-12). The growth statistics presented in Table 4 clearly indicate that significant expansion in area under oilseeds during the 1980s, a slowdown in the 1990s, but recovery during the 2000s. The growth rate in area under oilseeds during the pre-reform period was 3.2 per cent and significant, while it turned insignificant during the post-reform period. Almost all the major oilseed-growing states had significant and positive growth rate in the pre-liberalization period. In comparison, the growth rate in area was significant and positive only in Maharashtra, Madhya Pradesh and West Bengal in the post-liberalization period. The major states, for example, Rajasthan, Haryana, Karnataka and Andhra Pradesh that had major expansion in area under oilseeds during the pre-liberalization period went on to observe an insignificant or even negative growth in area during the post-liberalization period.

Unlike area, yield growth rate was observed positive during all the three decades, i.e. 1980s, 1990s and 2000s. During the pre-liberalization period, yield growth rate was significant and its magnitude was 2.8 per cent. In the post-liberalization period, yield growth rate declined to 1.3 per cent. State wise, yield growth rate was found to be positive and significant in Uttar Pradesh, Tamil Nadu, Rajasthan and West Bengal during the post-liberalization period whereas, it was significant and positive in Uttar Pradesh, Haryana, Andhra Pradesh, Tamil Nadu, Rajasthan, Madhya Pradesh, Maharashtra, and West Bengal during the pre-liberalization period. Accordingly, production growth rate was above 5 per cent in the 1980s; it came down to 2.3 per cent in the 1990s and again increased to 5 per cent during the 2000s. Comparing both pre- and post-liberalization periods, oilseeds production grew at a significant rate of 6 per cent in the pre-liberalization period, which accounts for the golden period of the Technology Mission. The Mission completely collapsed in the post-liberalization period when growth in production turned insignificant and the magnitude of growth rate came down to less than two per cent.

Thus, trends in area clearly indicate constraints in availability of land for agriculture. Due to competing pressure on land, demand for the non-agriculture sector and rapid urbanization witnessed in the recent years, the possible increase in aggregate supply of land for the purpose of agriculture cannot be easily foreseen. Vigorous efforts are needed to convert fallow and wasteland for cultivation and adequately compensate for high productivity land getting diverted from the agricultural sector to other uses. There was a sharp decline in the growth rate of productivity of almost all the crops in the decade of post-liberalization. The productivity growth of rice and wheat, the anchors of the green revolution in the past, decelerated to less than 1.3 per cent per annum, respectively, from around 3 per cent per annum in the previous decade. The productivity of pluses during the same period in the absence of any technological breakthrough remained almost at the same level without any significant growth rate. Among coarse cereals, only maize and bajra registered a significant positive productivity growth from 1995–96 to 2006–07.

Trends in Input Usage

Indian agriculture is at a crossroad as area as well as productivity of major crops has either declined or stagnated since the mid-1990s. The constraints that the agricultural sector is facing are numerous, including imbalanced use of fertilizers, soil-nutrient deficiency, depleting water resources, problems of land degradation, agrarian distress, agricultural risks, spatial and temporal climatic aberrations, etc. In this section, we shall analyse the holding size, cropping pattern, and trends in input usage during the last two and a half decades so as to understand the reasons for the slowdown in agricultural productivity and to chalk out the future strategy.

The average size of land holdings in India is less than one and a half hectares. Not only is the size of holdings small but they are also declining further incessantly. The average size of holdings was 1.7 hectares in 1985–86, which came down to 1.4 hectares in 1995–96, and further to 1.3 hectares in 2000–1. The size of land holdings was around 0.5 hectares in Bihar and half of that size (0.24 hectares) in Kerala during 2000–1. The size of land holdings is declining because of fragmentation caused by inheritance and also due to land ceiling acts and, in some cases, family disputes. Out of India's 116 million farmers, around 60 per cent have less than one hectare and together they account for 17 per cent of the land. The share of medium to large farmers (above 4 hectares) is very small at just over 7 per cent of all holdings, but these farmers account for around 40 per cent of the land. The implication is that many of the very small farms are subsistence holdings, with low investment and little productivity growth. Small-sized holdings are often over manned, resulting in disguised unemployment and low productivity of labour. Adoption of modern agricultural practices and use of technology is greatly hampered, leading to high costs in the case of small land holdings. However, there is a silver lining as the trend of falling holding size is reversed in agriculturally advanced states of Punjab and Haryana, where the process of consolidation has already started and is likely to be followed by Uttar Pradesh, Tamil Nadu, and other fast developing states.

India has a wide range of soil and climatic conditions and cropping patterns vary widely from region to region, and, to a lesser extent, from year to year. Among foodgrains, there was no much change in the percentage of area (to gross cropped area) under wheat, rice, and pulses during the last two and a half-decade at the all-India level. Wheat and rice area averaged around 13 and 23 per cent, respectively, while pulses occupied 12 per cent of the gross cropped area since the 1980s. There was a slight decline in the area under pulses (around 1.5 per cent) from the 1980s to 2000s, while major decline took place in the area under coarse cereals during this period. Area under coarse cereals came down from 22.5 per cent in the 1980s to 16 per cent during the 2000s. At the aggregate, area under foodgrains came down from 72 per cent in the 1980s to 64 per cent during the first seven years of 2000s. Oilseeds area increased from 11 per cent in the 1980s to 13.7 per cent in the 1990s, thanks to the Technology Mission, as mentioned earlier. However, the mission later slowed down, leading to a fall in area under oilseeds which came down slightly to 12.6 per cent in 2000s. No major change was observed in the share of different states in the total area of foodgrains during the last twenty five years. In oilseeds, on the other hand, few states like Madhya Pradesh and Rajasthan observed an increase in their share, while Uttar Pradesh and few other minor states observed a fall in their area share across India.

Thus, the proportion of area under rice and wheat (in the *kharif* and *rabi* seasons) together remained around 35 per cent of the total cropped area in the country during the last twenty five years. This accounts for more than half of the total area under foodgrains. No other (*kharif* and *rabi* crop) combinations accounted for this much area. The reason for the domination of wheat and rice in the cropping pattern is obviously that of higher returns from these two crops in comparison to any other cereal as well as non-cereal crops. The value of net margin (value of output – cost of production) on an average was around ₹ 3 to 5 thousand per hectare in wheat and rice, although the value turns out negative in many states. In comparison, the value of net margin was negative in most coarse cereals,

pulses, as well as oilseeds.[2] The range of positive margins in the rest of the crops was far less than that of wheat and rice, putting forth an explanation for the dominance of the latter in the cropping pattern. Both, the value of output as well as the cost of production were increasing over a period of time. However, in some cases, increase in cost overruns that of revenue leading to negative trends in the net margins over time.

Irrigation facilities in India are inadequate, as has been revealed by the fact that only 58.5 per cent of the land was irrigated in 2004–05, which results in farmers still being dependent on rainfall. A good monsoon results in a robust growth for the economy as a whole, while a poor monsoon leads to sluggish growth. Out of the total cropped area in the country, around 89 per cent area under wheat and 55 per cent area under rice was irrigated in 2004–05. The proportion of area of most other crops was much less irrigated. Among coarse cereals, barley had 64 per cent and maize had 21 per cent area irrigated while jowar and bajra had less than 10 per cent area irrigated. In the case of pulses, only 14 per cent of the area had assured irrigation, while 27 per cent of the area under oilseeds accounted for assured irrigation. At the aggregate, out of the total gross cropped area, only 42 per cent was irrigated, either by groundwater or surface water.

Table 5 presents the trend in growth rates of percentage of irrigated area under different crops in the major states for the period of the 1980s, 1990s, and the first five years of 2000s (up to 2005–06) and also for the pre- and post-liberalization periods, as defined above. The growth trends in percentage irrigated area were higher in the pre-liberalization period than in the post-liberalization among almost all the crops at the all-India level. The proportion of irrigated area of wheat increased by a trend growth rate of 1.5 per cent per annum during the pre-liberalization as compared to less than 0.5 per cent during the post-liberalization period. The respective figures for rice were 1.3 and 0.8 per cent, and for coarse cereals 1.6 and 1.4 per cent, respectively, during these two periods. Similarly, percentage of irrigated area of pulses grew by 2.8 per cent per annum during pre-liberalization, which came down to 1.4 per cent during the post-liberalization period. The situation was even worse in oilseeds, wherein increase in the percentage of irrigated area was negligible (insignificant) in the post-liberalization period as compared to above 5 per cent per annum increase during the pre-liberalization period.

Thus, a slowdown in the progress of irrigation among almost all the crops since the mid-1990s provides an eloquent explanation for the fall in productivity of these crops in the post-liberalization era. The slowdown was across the board, among all the states, in wheat, rice, pulses, and oilseeds. Only in the case of coarse cereals, a few states like Andhra Pradesh, Haryana, Madhya Pradesh, and Maharashtra observed higher growth in the percentage of irrigated area during the post-liberalization as compared to pre-liberalization period.[3] Consequent to the slowdown in irrigated area growth, the growth rate in cropping intensity was also almost negligible at the all-India level as well as in most of the states during the post-liberalization period (Table 6).

Fertilizer consumption varies widely between different states owing to the substantial differences in soil type, fertility status, crop, weather, rainfall, irrigation facilities, etc. Fertilizer consumption in

[2] The cost of production here is C2 which is a combination of material cost, labour cost including imputed value of family labour, rental value of owned land, and interest on fixed capital. If a farmer has to pay all the above costs, he would be left with a net loss. However, farmers still remain in operation because they do not account for some of the imputed costs while evaluating their net return. Farmers' net return in the given circumstances is the imputed values of own land and imputed value of own labour; see, for example, Kumar and Sarkar (2012).

[3] However, there is some reversal in the falling trends of irrigated area during the very recent period that is not accounted for the lack of availability of data at the state level. This will be seen in the trends presented for the public and private investment at the all-India level.

India has increased significantly in the last two and a half decades. Total NPK (N, P_2O_5 and K_2O) consumption increased around four-fold from 5.5 million tonnes in 1980–81 to 20.3 million tonnes in 2005–06. Per-hectare NPK consumption increased from 32 kg in 1980–81 to 113 kg in 2006–07. The consumption of fertilizers witnessed an impressive growth during 2004–05, 2005–06, and 2006–07, after witnessing a slow and uneven growth in the preceding four years. The nutrient consumption per hectare was the highest so far in 2006–07. State wise, Uttar Pradesh and Punjab had the maximum per hectare consumption of more than 200 kg of fertilizer while Odisha and Rajasthan used the lowest, less than 50 kg per hectare. It is interesting to note that agriculturally less advanced states like Bihar, Madhya Pradesh, Gujarat, and Andhra Pradesh have witnessed a huge increase in per hectare consumption of fertilizers during the last decade.

The trend of growth rate of consumption of total nutrients per hectare was positive and significant in most of the states during both the pre-and post-liberalization periods (Table 7). Comparing these two periods, per hectare consumption of fertilizer at the all-India level grew at a rate of 6 per cent per annum during the pre-liberalization period as compared to almost half of this growth during the post-liberalization period. However, some of the states, for example, Madhya Pradesh, Punjab, Uttar Pradesh, and Assam observed a higher growth in fertilizer consumption in the post-liberalization period as compared to the pre-liberalization period. The phenomenal increase in fertilizer consumption during the late 2000s is reflected by a higher growth in the 2000s as compared to the 1990s at the all-India as well as majority of the states. These current trends indicate that it is possible that with the given lagged effect of fertilizer consumption on productivity, most Indian states might observe higher yield in the near future.

In India, a multi-agency approach comprising cooperative banks, scheduled commercial banks, and regional rural banks (RRBs) has been followed for imparting credit to agricultural sector. Overall, farm credit is regulated by NABARD, which is the statutory apex agent for rural development in India. Over time, spectacular progress has been achieved in terms of scale and outreach of the institutional framework for agricultural credit. The number of offices of public sector banks increased rapidly from 8,262 in June 1969 to 68,355 by March 2005. The spread of institutional credit widened rapidly, in the 1970s and 1980s, leading to a decline in the role of non-institutional sources, notwithstanding some reversal in the trends observed particularly in the 1990s. The share of institutional credit, which was little over 31 per cent in 1971, increased more than two-fold to over 63 per cent in 1981 and further to over 66 per cent in 1991. However, 2004 NSSO Survey reveals that the share of non-institutional credit has taken a reverse swing that is a cause of concern.

According to the National Sample Survey (NSS), the outstanding loans per household (including non-institutional sources) increased from less than ₹ 2,000 in 1992 to more than ₹ 7,500 in 2002, at the all-India level. State wise, Kerala, Punjab, Haryana, Rajasthan, and Gujarat exceeded ₹ 10,000, whereas, West Bengal, Odisha, and Bihar remained less than ₹ 5,000 per household. The increasing trends in outstanding loans from institutional sources are indicated by the data in Table 8. The institutional loans increased by 13 per cent in the pre-liberalization period while they increased by more than 15 per cent in the post-liberalization period. Comparing the 1990s with the 2000s, the rate of increase was more than double in the latter period as compared to the former at the all-India level. State wise also, almost all the states observed significantly higher trend in growth in the post-liberalization period compared to the pre-liberalization period. Similar to increasing trends in the use of fertilizer and institutional loans, the share of tractor, power tillers, and the use of electricity in agriculture for lifting water and other purposes has also increased in the post-1990s.

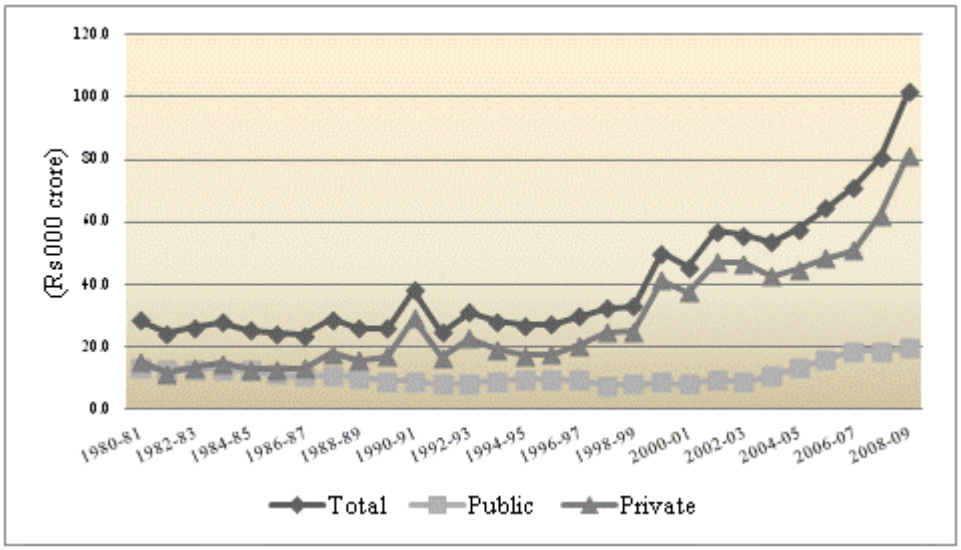


Figure 2—Public and Private Investment in Agriculture (at 1999–2000 prices)

Table 9 presents trends in the growth rate of public and private investment in agriculture at constant (1999–2000) prices. The trends in public investment were negative in both the 1980s as well as the 1990s, as can also be seen from Figure 2. However, public investment started turning positive in the late nineties and it increased rapidly in the 2000s, especially 2003–04 onwards. Public investment grew at an impressive trend growth rate of 12.8 per cent per annum during the 2000s (six years for which data is available). Private investment in agriculture was positive throughout this period but trends were insignificant during the 1990s as well as the first six years of 2000s. Trend growth rates in both public and private investment turn out much higher during the post-liberalization period as compared to pre-liberalization period (Table 9). As a result of increasing concern shown by all stakeholders towards the falling productivity in agriculture, a complete U-turn has taken place in the public investment in agriculture, which has set a positive incentive for the private investment as well. As a result, a rapid increase in public as well as private investment has occurred during the second half of the 2000s as is depicted by the above figure very clearly.

Thus, trend in growth rates in input usage, for example, use of fertilizer and pesticides, irrigation, etc., had a negative pace in the 1990s and early 2000s. However, a complete reversal has started in the last seven to eight years beginning with 2003–04. Positive trends have been observed in fertilizer use, credit, and public and private investment during the mid-2000s. These are encouraging signs for Indian agriculture and are expected to set a positive tempo for agricultural productivity.

Trends in Demand for Foodgrains and Edible Oils

Access to food demands affordability primarily depends upon the twin factors, namely income of the people and prices prevailing in the country (Nasurudeen et al., 2006). According to WHO (2003), the dietary consumption pattern is a complex process that is determined by many factors such as income, prices, individual preferences, beliefs, cultural traditions as well as geographical, environmental, social, and other economic factors. The available statistics on food consumption data through various rounds of NSS portrays a baffling picture on food and nutrition security in India.[4] On the one hand,

[4] For details on this issue, see a special section on 'Trends in Food Consumption and Nutrition – Food Security Concerns' published in *Indian Journal of Agricultural Economics*, Vol. 61(3), Conference Number, July–September, 2006, pp. 362–98.

per capita foodgrains consumption and total calorie intake are declining while, on the other hand, grain surpluses have reached peak levels in the recent past and the real per capita expenditure on food is on the rise among all income groups. There are numerous factors responsible for the falling per capita food consumption. The explanation provided for such a phenomenon in the literature centres around the theory of diversification in the food basket as well as changing income and lifestyle of the rural and urban masses. On the one hand, due to change in work nature, the requirement of calorie intake has declined over time and, on the other, the changes in the composition of diet have increased the cost of calories (Radhakrishna and Ravi 1991; Murty 1999). Convergence between rural and urban patterns of calorie consumption also provides an explanation to this phenomenon. The per capita calorie intake declined by 5.3 per cent in rural areas, whereas, it increased at 2.3 per cent in the urban areas for the period from 1972–73 to 1999–00 (Nasrudeen et al., 2006). Diversification of the Indian diet to include more high value commodities in the form of fruits, vegetables, dairy products, sugar, oil, eggs, fish and meat products, and, consequently, the fall in the required intake of calories in the form of cereals provides an explanation for this phenomenon (Ray 2005). Although, cereals and pulses were the main source of protein in both rural and urban areas in the previous rounds, the contribution of milk and milk products as source of protein is consistently increasing in the more recent rounds of NSS and the increase is observed much more in the urban areas. The contribution from meat, fish, and eggs to protein has increased slightly. The urban consumers also often prefer foods that offer variety and convenience rather than maximum calorie content (Delgado et al., 1999).[5]

This section analyses the dynamics of consumption trends for various foodgrains and edible oils. The database used for the purpose is NSS Unit Level Data consisting of large samples—quinquennial rounds 43, 50, 55, and 61 covering of the years 1987–88, 1993–94, 1999–2000, and 2004–5—and thin samples consisting of all other years that provided us a complete series of consumption and expenditure on all major food and non-food items for the period 1987–88 to 2006. As the dieting pattern differs among different regions owing to individual preferences, beliefs, cultural traditions, etc., we have divided the country into seven main regions, following the pattern followed by the NSS. These regions are North-Western India (comprising of Jammu and Kashmir, Himachal Pradesh, Delhi, and Chandigarh), North India (Haryana, Punjab, Uttar Pradesh, and Uttarakhand), South India (Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, Goa, Andaman and Nicobar, Lakshadweep, and Puducherry), East India (Bihar, Jharkhand, West Bengal, and Odisha); West India (Rajasthan, Gujarat, Maharashtra, Dadra and Nagar Haveli, and Daman and Diu); Central India (Madhya Pradesh and Chhattisgarh); North-East India (Assam, Arunachal Pradesh, Manipur, Mizoram, Nagaland, Meghalaya, Sikkim, and Tripura).

Table 10 presents trend growth rate in the per capita monthly consumption of food items, viz., rice, wheat, coarse cereals, pulses, and edible oils for rural and urban areas in the seven regions and for All-India. As has been mentioned earlier, with rising income and changing tastes, diversification in the Indian diet is taking place. Consumption of cereal for all-India rural came down by more than 2 kg from around 14.5 kg to around 12 kg per capita per month between 1987 and 2004. The fall in consumption was higher in the case of coarse cereals as compared to the superior cereals of rice and wheat in rural areas. The consumption of rice and wheat came down from 7 and 5 kg in 1987 to 6.5 and 4 kg, respectively, in 2004. In comparison to this, consumption of coarse cereals in rural areas came down from 2.5 kg to 1.3 kg during the same time period. In urban areas, consumption of total cereals came down from 11.3 kg in 1987 to 9.9 kg in 2004. Thus, decline in urban areas was slightly

[5] There is, however, an opposite view in other quarters that argues that consumption of cereals is declining due to fall in real purchasing power of a vast section, reduction in state intervention, increasing stocks of foodgrains along with starvation, and failure of the public distribution system; see, for example, Patnaik, 2003, 2004; Sen and Himanshu, 2004; Ray and Lancaster, 2005; and Meenakshi and Vishwanathan, 2003.

less than that of rural areas. In urban areas, rice consumption declined from 5.5 kg to 4.9 kg, wheat consumption declined from 5 kg to 4.6 kg and that of coarse cereals declined from 0.9 kg to 0.4 kg during the above-mentioned period. Decline in consumption of pulses was slightly less from 0.9 to 0.7 kg in rural areas and from 1 kg to 0.8 kg in the urban areas during 1987 to 2004. In comparison, consumption of edible oils increased from 0.3 to 0.5 kg in the rural and from 0.5 to 0.7 kg in the urban areas during the same time period as mentioned above. Thus, a clear trend away from cereals and pulses and towards high value crops, like edible oils, is observed from the above analysis.

Looking at the consumption pattern in different regions in rural India, it can be seen from the data that rice was the staple diet in the east, north-east, and the southern part of the country, while wheat was the staple diet in the north. Wheat and rice both were consumed in almost same proportion in north-west and central India while coarse cereals were eaten in large quantity along with wheat in Western India. The consumption pattern of cereals in the urban areas was more or less the same as that of rural areas, excepting for the fact that the divide between rice and wheat was less pronounced in the urban areas as compared to rural areas as discussed above. Table 10 provides the trend growth rates of consumption of foodgrains and edible oils. We have a time series of NSS data for 20 years for the period 1987–88 to 2005–06. In consonance with the production trends, consumption data has been divided into two periods, pre-liberalization (1987–88 to 1995–96) which constitutes 9 observations; and post-liberalization (1996–97 to 2005–06) constituting 11 observations.[6] Finally trend growth rates are calculated for the entire period of 20 years.

The decline in consumption of cereals was dominant not only in the post-liberalization period (1996–2006) but also in the pre-liberalization period (1987–2005) and both in rural as well as in urban areas. At the all-India level, negative trends in consumption were observed for rice, wheat, and coarse cereals during both the pre- and post-liberalization periods and for both rural as well as for urban areas. In most of the cases, these negative trends were significant. In the case of pulses, negative trends in consumption were observed for rural as well as urban areas during the pre-liberalization period. However, consumption trends for pulses reversed during the post-liberalization period, although trends remained insignificant in the latter period. Edible oil consumption trends were positive but insignificant during the pre-liberalization period, both in rural as well as urban areas. These trends (for edible oils) became significant and their volume also increased during the post-liberalization period for both rural and urban areas.

Among the seven regions, rice and coarse cereal consumption trends were not found to be positive and significant in any regions in the rural as well as urban areas during both the periods. However, wheat consumption trends were observed positive and significant in rural areas in central India during the pre-liberalization and south and north-east India in the post-liberalization period. Among urban areas, trends in wheat consumption were positive in a few regions but they were insignificant during both the periods. Similarly, in the case of pulses, consumption trends were positive and significant only in the north-east in the rural areas during pre-liberalization and in south India in urban area during the post-liberalization period. Thus, the shift of calories from cereals and pulses towards edible oils, fats, and high value products is clearly visible from the trends presented by the survey data. The decline in consumption of foodgrains and shift towards edible oil and other high value commodities, including fruits, vegetables, and animal products, was widespread in all regions and in all areas of rural and urban India and among all the sections of the society.

[6] There is a repetition of consumption data for one year during 2004, for which data is available from both small and large samples (60th and 61st rounds of NSS survey). For the sake of continuity, we have reported the period as 1996 to 2006, indicating 11 observations for this period.

Food Security in India - Future Prospects

Using the demand (expenditure) and supply elasticities from Parmod Kumar (2013) and using the actual population numbers and per capita consumption of 2009-10 (66th Round of National Sample Survey), the demand estimates are worked out for the year 2009-10. For the future period of 2010-11 to 2020-21, three scenarios, viz., baseline scenario (8.9 percent), high growth (12 percent) and low growth (6 percent) are presented in the Box 1 below. The aggregate demand for foodgrains is projected to increase from 194 million tonnes from the baseline (2009-10) to 243 million tonnes by the end of 12th Five Year Plan and 255 million tonnes by the end of 2020-21 if the economy grows at 8.9 percent per annum growth rate. However, if the economy spur on 12 percent per annum growth rate, the demand for foodgrains by 2020-21 would be less, 247 million tonnes because of the rapid diversification of consumption basket from foodgrains to high value food items that would take place at a much higher per capita income. On the opposite, if economic growth slows down to 6 percent per annum, aggregate demand for foodgrains would approach 250 million tonnes by 2016-17 and will exceed 264 million tonnes by the end of 2020-21.

Box 1: Aggregate demand (direct + indirect) projections for foodgrains and Oilseeds - All India - aggregate
(Million tonnes)

	Rice	Wheat	Other Cereals	Total Cereals	Pulses	Foodgrains	Edible Oil	Oilseeds (28 per cent Oils from Oilseed)
Actual demand								
2009-10	77.12	76.16	27.33	180.61	13.73	194.34	9.76	34.9
Baseline (growth rate of NNP at 8.9 per cent per annum)								
2010-11	91.83	88.03	39.80	219.67	18.26	237.93	10.32	36.9
2011-12	93.18	89.14	37.40	219.72	17.27	236.99	10.90	38.9
2012-13	90.71	75.99	33.94	200.64	18.74	219.38	11.49	41.0
2013-14	92.69	85.58	37.52	215.79	19.14	234.93	12.05	43.1
2014-15	93.12	86.50	38.28	217.90	19.57	237.47	12.69	45.3
2015-16	93.57	87.45	39.09	220.12	20.01	240.13	13.36	47.7
2016-17	94.05	88.45	39.95	222.44	20.47	242.91	14.07	50.2
2017-18	94.54	89.49	40.85	224.88	20.93	245.82	14.81	52.9
2018-19	95.06	90.57	41.81	227.44	21.42	248.86	15.59	55.7
2019-20	95.60	91.69	42.82	230.12	21.91	252.03	16.41	58.6
2020-21	96.17	92.85	43.88	232.91	22.42	255.33	17.28	61.7
High growth (growth rate of NNP at 12 per cent per annum)								
2010-11	91.38	87.65	39.56	218.58	18.37	236.95	10.53	37.6
2011-12	92.27	88.38	36.93	217.59	17.50	235.09	11.36	40.6
2012-13	89.36	74.86	33.28	197.51	19.10	216.61	12.22	43.6
2013-14	90.92	84.10	36.70	211.72	19.63	231.35	13.07	46.7
2014-15	90.93	84.68	37.31	212.91	20.21	233.12	14.05	50.2
2015-16	90.97	85.30	37.98	214.25	20.81	235.06	15.09	53.9
2016-17	91.04	85.96	38.73	215.73	21.44	237.17	16.22	57.9
2017-18	91.14	86.68	39.54	217.35	22.09	239.45	17.43	62.2
2018-19	91.27	87.45	40.41	219.12	22.77	241.90	18.72	66.9
2019-20	91.43	88.27	41.35	221.04	23.48	244.52	20.12	71.9
2020-21	91.62	89.14	42.35	223.11	24.22	247.33	21.62	77.2
Low growth (growth rate of NNP at 6 per cent per annum)								
2010-11	92.26	88.39	40.03	220.68	18.16	238.84	10.12	36.1
2011-12	94.03	89.86	37.85	221.74	17.06	238.79	10.49	37.5
2012-13	91.98	77.06	34.59	203.64	18.42	222.05	10.84	38.7
2013-14	94.38	86.99	38.37	219.74	18.70	238.44	11.16	39.9
2014-15	95.23	88.26	39.31	222.80	19.00	241.80	11.53	41.2
2015-16	96.10	89.56	40.29	225.95	19.32	245.27	11.91	42.5
2016-17	96.99	90.90	41.31	229.19	19.64	248.83	12.30	43.9

2017-18	97.89	92.28	42.37	232.54	19.96	252.50	12.71	45.4
2018-19	98.82	93.69	43.47	235.99	20.29	256.28	13.14	46.9
2019-20	99.78	95.15	44.61	239.54	20.63	260.17	13.58	48.5
2020-21	100.75	96.65	45.80	243.20	20.98	264.18	14.03	50.1

Note: Oilseeds demand has been calculated from the edible oils using a recovery rate of 28 percent from oilseeds to edible oils (see for details, Planning Commission, 2008)

In the case of superior cereals, aggregate demand of wheat would come closer to that of rice because of increased demand of wheat as feed for animal use. The aggregate demand for these two cereals is expected to be around 90 to 100 million tonnes each by the end of 2020-21 depending on different growth scenarios. In the case of coarse cereals, aggregate demand is expected to increase whereas for human consumption their demand was expected to either remain constant or decline by 2020-21. The aggregate demand of coarse cereals can increase from 27 million tonnes in the baseline to 42 million tonnes in 2020-21 in the high growth scenario and 46 million tonnes in the low growth scenario. Similarly, aggregate demand for pulses is expected to increase from 14 million tonnes in the baseline scenario and would go up to 20 to 24 million tonnes depending upon various growth scenarios. Lastly, the oilseed demand would increase at a much faster rate as compared to foodgrains demand and could increase from 35 million tonnes of baseline scenario up to 50 to 77 million tonnes by 2020-21 among different growth scenarios. Against the case of foodgrains in which case human demand is expected to decline if the economy grows at a faster rate, the demand for oilseeds will increase at a higher rate in consonance with the higher growth rate of per capita income.

For supply projections, this paper uses area, production and export elasticities from Parmod Kumar (2013). The actual and projected area, production and exports using two scenarios, i.e., if the Indian agriculture grows at a historical period growth rate of 1980-81 to 1994-95, termed as period I and if the it grows at period 1995-96 to 2012-13, termed as period II, are presented in Box 2. The production of foodgrains is expected to grow from the present peak of 259 million tonnes during the period of 2011-12 to touch 284 million tonnes by the end of 12th Five Year Plan and further to reach 295 million tonnes in 2020-21 if the agricultural grows at a rate of 1980-81 to 1994-95 (period I) in input usage during the projected period. We can anticipate more bright scenario whereby input usage is managed to grow at the trend growth of period II, which can also be likely the case given the rising public and private investment in agriculture, increasing use of fertilizer and higher credit availability to the farmers during the recent years and given a time lag for their effect on the productivity in agriculture. In the optimistic scenario (of period II) the foodgrains production can touch up to 305 million tonnes by the end of 2020-21. Area under foodgrains is expected to either remain stagnant at 125-128 million hectares in the optimistic scenario or decline slightly in the alternate scenario during the projected period. Exports were most volatile as their quantum observed a huge increase with the opening up of the Indian economy in the mid 1990s. If the opening up process continues at a faster rate in the medium run, foodgrains exports would increase rapidly, while lack of reforms may slow down the exports process. If the globalization process continues at post liberalization speed, the exports of foodgrains would increase from around 12 million tonnes in 2011-12 to 28 million tonnes by the end of 2020-21. In the event of slow-down in globalization process, the exports of foodgrains would peak only at the present level of 12-13 million tonnes by the end of 2020-21.

Looking at the commodity composition, the rise in foodgrain production would mainly come from increase in the production of rice and wheat. The production of rice would increase from about 105 million tonnes at present to around 130 million tonnes by the end of 2020-21, while wheat production would increase from 95 million tonnes at present to 103 million tonnes by the end of 2020-21. The production of coarse cereals would increase from the present level of 42 million tonnes to approximately 44 to 57 million tonnes by the end of 2020-21 while pulses production would remain constant at the present level of 15-18 million tonnes. Oilseeds production on the other hand, is

expected to increase from the present 30 million tonnes to 46-50 million tonnes by the end of 2020-21. Regarding area under different crops, wheat and rice are expected either to maintain their present level or undergo minor expansion. Pulses, on the other hand, will have minor area contraction. Coarse cereals' area will expand a little bit if the agriculture grows according to growth of period II (post liberalization) trends while it will contract if the growth path is in accordance with the period I (pre liberalization) trends. Oilseeds will have expansion in their area in both the cases of pre and post liberalization growth situations. In the case of exports, rice and coarse cereals will have major share in the rapid increase in exports of foodgrains if the liberalization process of the Indian economy continues at rapid pace. Coarse grains will have a major surplus from human consumption given the trends of demand of foodgrains.

Box 2: Aggregate supply projections for foodgrains and oilseeds - All India– aggregate

(Production and Exports in Million tonnes and Area in Million hectares)

		2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Period I (1980-81 to 1994-95)											
Rice	Area	44.0	42.2	44.3	44.4	44.5	44.4	44.4	44.3	44.2	44.1
	Production	105.3	105.2	112.3	113.8	116.8	119.8	122.7	125.7	128.6	131.6
	Export	7.2	10.1	6.7	6.8	7.0	7.1	7.2	7.3	7.5	7.6
Wheat	Area	29.9	29.7	29.5	29.5	29.6	29.7	29.7	29.6	29.4	29.3
	Production	94.9	93.5	95.5	97.2	99.6	103.3	103.8	103.6	103.3	103.0
	Export	0.7	6.5	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.7
Other Cereals	Area	26.4	24.6	25.4	25.2	24.8	24.2	23.4	22.7	21.8	21.0
	Production	42.0	40.0	43.5	43.9	44.8	45.0	45.1	45.0	44.7	44.4
	Export	4.0	5.2	5.7	5.3	4.9	4.5	4.1	3.7	3.3	3.0
Pulses	Area	24.5	23.4	23.2	22.7	22.2	21.9	21.6	21.4	21.1	20.9
	Production	17.1	18.3	16.4	15.9	15.8	15.6	15.6	15.5	15.5	15.5
	Export	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Foodgrains	Area	124.8	119.8	122.5	121.8	121.1	120.2	119.1	117.9	116.6	115.3
	Production	259.3	257.1	267.7	270.9	277.0	283.7	287.1	289.8	292.2	294.5
	Export	11.9	21.7	12.5	12.3	12.1	11.8	11.6	11.4	11.3	11.3
Oilseeds	Area	26.3	26.5	29.6	30.3	31.0	31.7	32.5	33.3	34.4	35.4
	Production	29.8	30.9	37.2	37.4	39.1	40.8	42.7	44.7	48.3	50.2
	Export	1.3	1.0	1.3	1.2	1.2	1.1	1.0	1.0	0.9	0.9
Period II (1995-96 to 2012-13)											
Rice	Area	44.0	42.2	45.0	45.5	45.9	46.3	46.6	46.9	47.2	47.5
	Production	105.3	105.2	111.4	112.8	115.6	118.3	121.1	123.9	126.6	129.4
	Export	7.2	10.1	7.7	8.4	9.1	9.7	10.4	11.0	11.7	12.3
Wheat	Area	29.9	29.7	29.8	29.9	30.0	30.1	30.2	30.4	30.5	30.6
	Production	94.9	93.5	93.6	94.6	96.0	97.4	98.9	100.3	101.8	103.4
	Export	0.7	6.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other Cereals	Area	26.4	24.6	26.6	27.2	27.7	28.1	28.4	28.6	28.8	28.9
	Production	42.0	40.0	44.0	45.7	47.9	49.8	51.6	53.3	55.0	56.6
	Export	4.0	5.2	6.3	6.6	7.3	8.2	9.4	10.9	12.8	15.1
Pulses	Area	24.5	23.4	23.1	22.7	22.3	22.1	21.9	21.7	21.6	21.5
	Production	17.1	18.3	16.4	15.9	15.8	15.7	15.7	15.7	15.7	15.8
	Export	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Foodgrains	Area	124.8	119.8	124.6	125.2	125.9	126.5	127.1	127.6	128.1	128.5
	Production	259.3	257.1	265.4	269.1	275.3	281.3	287.3	293.2	299.2	305.2
	Export	11.9	21.7	14.1	15.2	16.5	18.0	19.8	22.0	24.5	27.5
Oilseeds	Area	26.3	26.5	29.3	29.8	30.3	30.7	31.1	31.6	32.0	32.4

	Production	29.8	30.9	36.6	36.5	38.0	39.5	41.0	42.6	44.3	46.0
	Export	1.3	1.0	1.7	1.9	2.0	2.2	2.4	2.6	2.8	3.0

By combining the demand and supply projections, we can assess the likely gaps in the food demand and supply for India in the medium term future. In the following section, we try to see the probable situation of food security in the scenario of closed economy without allowing for exports and in the scenario when we open exports of foodgrains (and oilseeds). Our results show that whether India will have manageable foodgrains demand in the medium term by the end of 12th Five Year Plan and in the long term by the end of 2020-21 will depend critically on what happens on the international trade scenario especially that of India's exports of rice and coarse grains. In the closed economy scenario by the end of 12th Plan as well as by 2020-21 (Box 3), the picture looks affirmative form both the optimistic (high demand and supply situation) as well as pessimistic (low demand and supply) scenario as in both the cases available supply exceeds that of demand. However, when we include likely exports of foodgrains in aggregate demand during this period, the balance sheet becomes slightly narrow in both the low and high demand supply scenarios. However even in the face of open economy, aggregate supply will still exceed that of demand and overall balances would remain in surplus in low and high demand supply scenarios. In the latter scenario of high demand supply in the face of open trade, demand would come closer to supply and the food security will be challenged although overall it still remains surplus by around 10 million tonnes.

Box 3: Net balances of supply and demand of foodgrains and Oilseeds

(Million tonnes)

		Rice	Wheat	Other cereals	Total cereals	Pulses	Foodgrains	Oilseeds
Without adjusting for exports								
2011-12	Low	13.0	6.5	5.1	24.6	0.0	24.6	-7.7
2011-12	High	11.3	5.0	4.2	20.5	-0.4	20.1	-10.8
2012-13	Low	15.9	18.6	6.8	41.3	-0.1	41.2	-7.8
2012-13	High	13.3	16.5	5.4	35.2	-0.8	34.4	-12.7
2013-14	Low	20.4	9.5	6.8	36.8	-2.3	35.0	-3.3
2013-14	High	17.9	8.5	5.7	32.1	-3.2	28.3	-9.5
2014-15	Low	21.8	10.0	6.6	38.4	-3.1	37.1	-4.7
2014-15	High	18.6	9.0	6.4	34.0	-4.3	27.9	-12.8
2015-16	Low	24.6	10.7	6.8	42.1	-3.5	41.7	-4.5
2015-16	High	20.7	10.1	7.6	38.4	-5.0	30.2	-14.8
2016-17	Low	27.3	11.4	6.3	45.1	-4.0	45.9	-4.4
2016-17	High	22.8	12.4	8.5	43.7	-5.7	33.1	-17.1
2017-18	Low	30.0	12.2	5.5	47.7	-4.4	49.8	-4.4
2017-18	High	24.8	11.5	9.2	45.5	-6.4	32.6	-19.5
2018-19	Low	32.6	12.9	4.5	50.0	-4.8	50.3	-4.3
2018-19	High	26.8	9.9	9.8	46.6	-7.1	34.5	-22.2
2019-20	Low	35.2	13.6	3.4	52.2	-5.1	57.5	-4.2
2019-20	High	28.8	8.2	10.4	47.4	-7.7	29.1	-23.6
2020-21	Low	37.8	13.9	2.1	53.8	-5.5	50.4	-4.1
2020-21	High	30.8	6.7	10.8	48.4	-8.5	37.8	-27.0
After making adjustments for exports								
2011-12	Low	5.9	5.8	1.1	12.7	0.0	12.7	-9.0
2011-12	High	4.1	4.3	0.1	8.5	-0.4	8.1	-12.1
2012-13	Low	5.8	12.2	1.6	19.5	-0.1	19.5	-8.7
2012-13	High	3.1	10.0	0.3	13.4	-0.8	12.6	-13.6
2013-14	Low	13.8	9.4	1.1	24.3	-2.3	22.5	-4.6
2013-14	High	10.2	8.4	-0.7	18.0	-3.2	14.3	-11.3

2014-15	Low	15.0	9.8	1.3	26.1	-3.1	24.9	-5.9
2014-15	High	10.2	8.9	-0.2	18.8	-4.3	12.7	-14.7
2015-16	Low	17.6	10.5	1.9	30.0	-3.5	29.7	-5.7
2015-16	High	11.6	10.0	0.4	22.0	-5.1	13.8	-16.9
2016-17	Low	20.2	11.2	1.8	33.2	-4.0	34.1	-5.5
2016-17	High	13.1	12.3	0.3	25.7	-5.7	15.1	-19.3
2017-18	Low	22.7	11.9	1.5	36.1	-4.4	38.2	-5.4
2017-18	High	14.5	11.4	-0.1	25.7	-6.4	12.8	-21.9
2018-19	Low	25.2	12.5	0.9	38.6	-4.8	38.9	-5.2
2018-19	High	15.8	9.8	-1.0	24.6	-7.1	12.5	-24.8
2019-20	Low	27.7	13.0	0.1	40.8	-5.1	46.2	-5.1
2019-20	High	17.2	8.1	-2.4	22.9	-7.7	4.6	-26.5
2020-21	Low	30.2	13.2	-0.9	42.5	-5.5	39.2	-4.9
2020-21	High	18.5	6.6	-4.3	20.9	-8.5	10.2	-30.1

In the lower demand and supply scenario with open trade, supply will exceed demand and there would be huge net surplus of around 40 million tonnes in 2020-21. In the high demand and supply scenario, however, the surplus will be reduced to around only 10 million tonnes in 2020-21. The crops among foodgrains that will have adverse balances would be pulses, which will continue in shortage in all scenarios (of low as well as high demand and supply) because of its short supply compared to increasing demand for human consumption. Like in the case of pulses, balances of oilseeds are also already adverse as part of the demand at present is being met by imports. The demand-supply balances will further turn adverse and in the given circumstances we are expected to continue import a huge amount of oilseeds/edible oils.

The Policy Implications for Food Security

The fluctuations in foodgrain balances could be the result of change in either demand or supply. Although, in the long run, production and consumption of foodgrains both move on a stable path, however, in the short run foodgrain production is subject to higher fluctuations given the agriculture's dependence on weather and rainfall, as compared to their human consumption. The short run fluctuations in production cause ripples in food security as have been experienced widely by many countries during the recent past. In India, although long run food balances appear to remain in surplus, however, short run fluctuations in production (and in export) can be a major cause of worry. The paper observes that higher exports of foodgrains may turn food balances negative. The appropriate policy to deal with such a situation should not be imposing restrictions on exports that might turn counter-productive in the long run. We need to enhance productivity of food crops to raise the overall level of foodgrain production to turn our agriculture merely self-sufficient into net exporter. We need to lay emphasis on productivity improvement, public investment in irrigation, infrastructure development, and efficient use of water and plant nutrition. We also need to put in resources for research and development (Kumar 1998; Shenngen Fan et al 1999; Evenson et al. 1999).

To meet the projected higher supply of foodgrains and oilseeds depicted in Box 2, targeted yield level that commensurate with the post liberalization trends is presented in Box 4 and Figure 1 below. It is evident from the data that if we have to maintain our post liberalization trends in productivity our yield of rice should increase from 21 quintals per hectare at present to 30 quintals per hectare by 2020-21. Similarly, wheat yield will have to increase from 26 quintals at present up to 36 quintals per hectare by 2020. The overall foodgrains productivity should touch 25 quintals per hectare in 2020-21, up from 17 quintals per hectare at present. On the other hand, if we continue to grow at the low we would be able to achieve only 24, 35 and 21 quintals per hectare yield, respectively for rice, wheat and total foodgrains by 2020-21. To achieve the higher growth in yield mentioned above, our input use like irrigation, fertilizer use etc., will have to increase at a much faster rate (Figures 2 to 4). Figure 5

depicts the desired rate of growth of use in fertilizer, irrigation and minimum support price for different crops. For instance, fertilizer use per hectare needs to be increased by around 5 percent per annum to achieve the above yield level. However, due to fertilizer policy followed by the government in the past, use of nitrogen fertilizers have increased over other nutrients. Phosphorus deficiency is now the most widespread soil fertility problem in both irrigated and un-irrigated plots in the country. Correcting the distortion in relative prices of primary fertilizers by removing the remaining subsidies could help correct the imbalances in the use of the primary plant nutrients: nitrogen, phosphorus, and potash. The most disquieting feature in Indian agriculture today is the decline in real investment in irrigation, which can be traced to a paucity of financial resources caused largely by the rise in subsidies. The irrigation expansion has to be much higher than what we have been able to achieve during the post liberalization period. It is essential to explore the options for cost-effective expansion of irrigated area. Scaling down the input subsidies provided for water, electricity, and fertilizer would augment the resources available for investment in irrigation, rural roads, and prevention of land degradation. It would also promote more efficient allocation of resources and provide incentives for development of cost-reducing innovations.

Further, to provide appropriate incentives to the farmers, there is also need to continue with enhancement in their farm harvest prices by means of increasing minimum support prices in the future or by providing them other incentives. However, the scope for influencing long-run productivity growth through manipulation of crop prices is limited. Reforms of trade and macroeconomic policies are needed to encourage long-term investment and technological change in the agriculture sector. The increasing complexity of production environments demands efficient information dissemination and training in the use of modern technologies. For this, an appropriate extension service needs to be created to stimulate and encourage both top-down and bottom-up flows of information between farmers, extension workers and research scientists to promote generation, adoption and evaluation of location-specific farm technologies. Resource productivity can be further enhanced by creating infrastructure in less developed areas by managing infrastructure better and by introducing new technologies.

Box 4: Target yield levels (quintals per hectare) to meet the future demand

	Actual			Period II		Period I	
	Te 1986	Te 1996	Te 2006	2012	2020	2012	2020
Rice	14.8	18.6	20.7	22.4	24.4	24.5	30.1
Wheat	19.4	25.7	26.4	31.2	35.1	33.5	36.2
Coarse cereals	7.1	9.8	11.7	12.4	13.3	14.8	18.9
Pulses	5.3	6.0	6.0	6.3	6.5	6.3	6.7
Foodgrains	11.5	15.5	17.1	19.1	21.1	21.1	25.0
Oilseeds	6.2	8.7	9.4	11.0	13.0	11.5	13.9

Figure 1: The desired yield in the medium term future

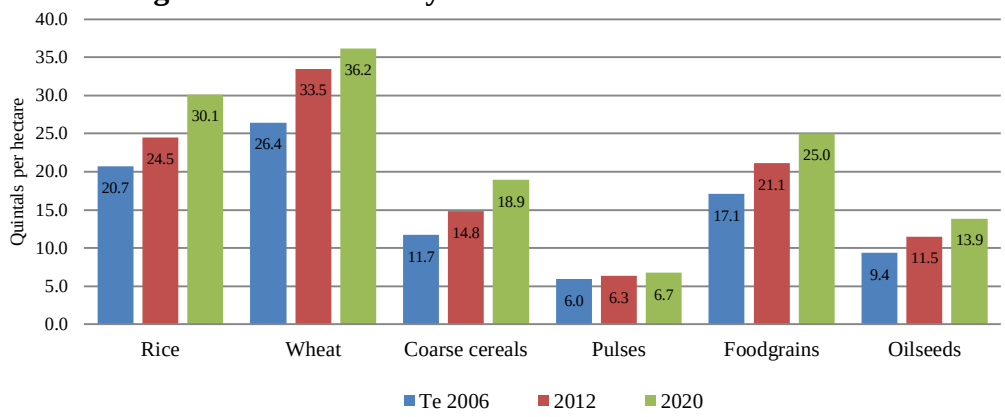


Figure 2: The desired use of fertilizer by 2020-21

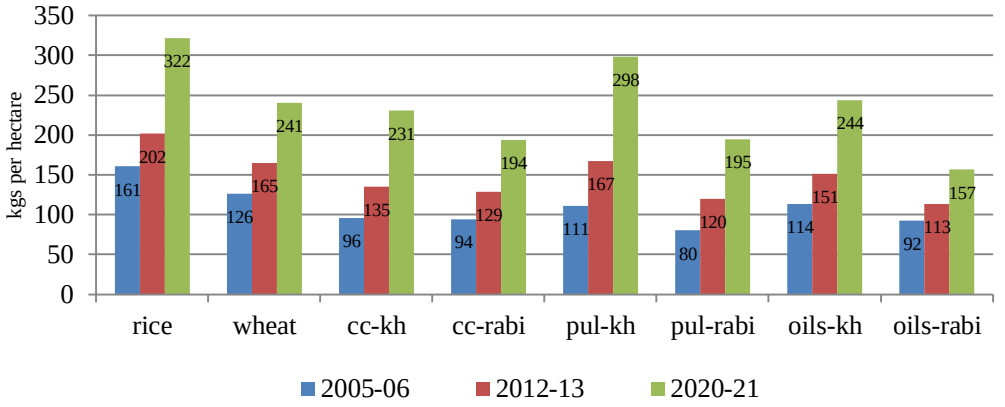


Figure 3: The expected minimum support price by 2020-21

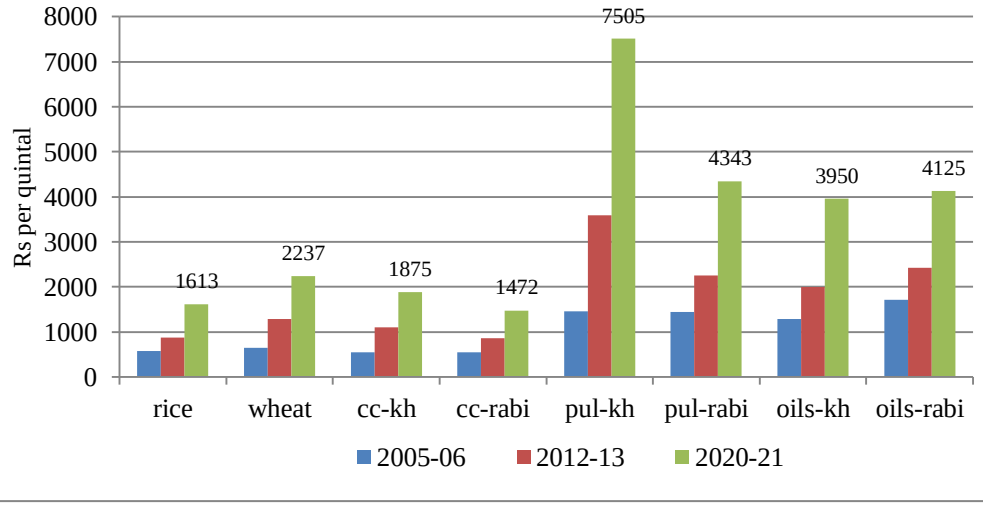


Figure 4: The desired expansion in irrigated area under different crops

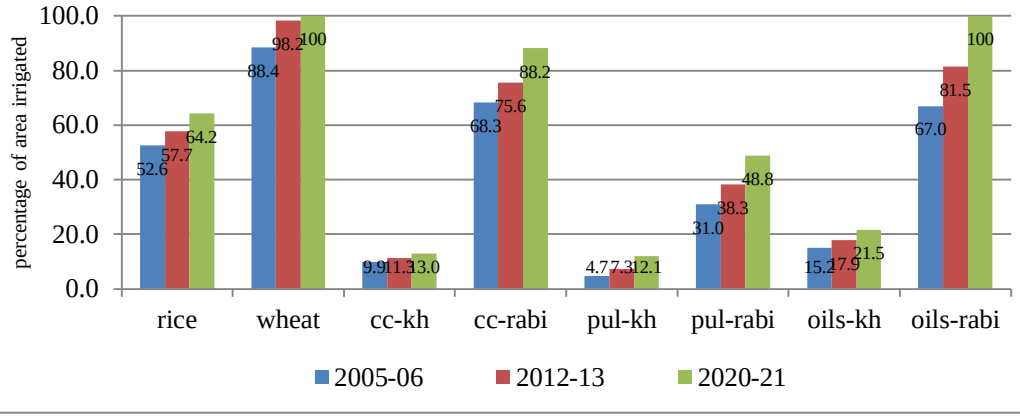
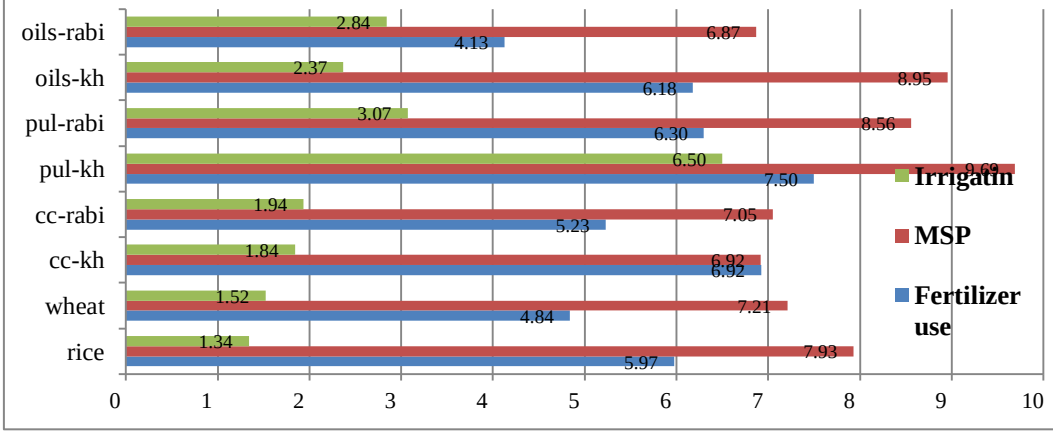


Figure 5: The desired growth rate in input usage upto 2020-21 (percent per annum)



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Tables – India

Table 1: Production of Important Crops During the Selected Period (Million Tonnes)

Year	Foodgrains	Rice	Wheat	Coarse Cereals	Pulses	Oilseeds	Cotton#	Sugarcane
1980–81	129.59	53.63	36.31	29.02	10.63	9.37	7.01	154.25
1985–86	150.44	63.83	47.05	26.20	13.36	10.83	8.73	170.65
1990–91	176.39	74.29	55.14	32.70	14.26	18.61	9.84	241.05
1995–96	180.42	76.98	62.10	29.03	12.31	22.11	12.86	281.10
1996–97	199.42	81.74	69.35	34.10	14.24	24.38	14.23	277.56
2000–01	196.81	87.70	69.68	31.08	11.08	18.40	9.52	295.96
2001–02	212.85	93.34	72.77	33.38	13.37	20.66	10.00	297.21
2002–03	174.77	71.82	65.76	26.07	11.13	14.84	8.62	287.38
2003–04	213.19	88.53	72.16	37.60	14.91	25.19	13.73	233.86
2004–05	198.36	83.13	68.64	33.46	13.13	24.35	16.43	237.08
2005–06	208.60	91.79	69.35	34.07	13.39	27.98	18.50	281.17
2006–07	217.28	93.36	75.81	33.92	14.20	24.29	22.63	355.52
2007–08	230.78	96.69	78.57	40.75	14.76	29.76	25.88	348.19
2008-09	234.47	99.18	80.68	40.04	14.57	27.72	22.28	285.03
2009-10	218.11	89.09	80.80	33.55	14.66	24.88	24.02	292.30
2010-11	244.78	95.98	86.87	43.68	18.24	32.48	33.00	342.38
2011-12##	250.42	102.74	88.31	42.08	17.28	30.53	34.09	347.86

Note: # million bales of 170 kg., each;
4th advanced estimates

Table 2: Trend Growth Rate of Foodgrains (per cent per annum)

State	1980's	1990s	2000s	Pre	Post	Total
Area						
Uttar Pradesh	0.00	0.30**	–0.34	–1.90*	–0.01	0.08***
Gujarat	–1.20	–1.90**	2.95**	–0.70	0.74	–0.58***
Bihar	–0.10	–0.10	0.00	–0.50***	–0.13	–0.25*
Haryana	–0.80	1.40**	0.98**	–0.30	0.67*	0.46*
Andhra Pradesh	–2.10**	–0.60	0.15	–1.90*	0.01	–0.80*
Karnataka	0.80	0.50	0.78	–0.10	0.57**	0.11
Tamil Nadu	–0.20	–1.00	–0.64	–0.90**	–1.25	–1.49*
Punjab	1.40*	0.90*	0.47*	1.30*	0.79*	0.91*
Rajasthan	–1.50	0.30	2.22	–0.30	0.44	0.10
Madhya Pradesh	–0.60**	0.20	0.33	–0.30***	–0.31	–0.24*
Maharashtra	0.20	–0.50	–0.72	–0.20	–0.73**	–0.53*
Odisha	0.40	–2.70*	0.50	–0.90***	–0.07	–1.12*
Assam	0.50	0.20	–0.96	0.60*	–0.55**	0.09
West Bengal	0.80**	0.50**	–0.28	0.70*	–0.24	0.29*
Kerala	–4.10*	–5.30*	–5.00*	–3.60*	–5.28*	–4.65*
All India	–0.20	–0.10	0.29	–0.30**	–0.04	–0.19*
Production						
Uttar Pradesh	3.60*	2.50*	0.52	3.20*	0.70	2.03*
Gujarat	–4.50	1.70	8.25**	–0.10	3.26***	1.56**
Bihar	3.60**	3.50**	–0.44	2.40*	–0.31	1.59*
Haryana	4.00*	3.40*	2.32*	4.30*	2.50*	3.28*
Andhra Pradesh	0.90	1.60	3.35	1.10***	2.76*	1.80*
Karnataka	0.90	3.30*	3.94	1.90*	2.02	2.05*
Tamil Nadu	3.80**	1.00	1.22	3.10*	–0.95	0.08
Punjab	4.40*	2.20*	1.17*	3.90*	1.85*	2.49*
Rajasthan	0.80	3.50	3.70	2.20	1.87	2.58*
Madhya Pradesh	2.10**	2.00**	3.05	2.80*	0.62	1.43*
Maharashtra	1.60	1.00	2.75**	2.00***	0.42	0.85**

Odisha	2.80	–3.10***	4.79	2.00**	2.38***	0.54
Assam	1.00	1.10**	–0.33	2.40*	0.49	1.57*
West Bengal	6.10*	2.50*	0.74	4.90*	1.36*	2.85*
Kerala	–3.00*	–4.80*	–3.08*	–2.00*	–3.35*	–3.14*
All India	2.70*	2.10*	1.80	2.80*	1.23*	1.87*
Yield						
Uttar Pradesh	3.60*	2.20*	0.86	3.20*	0.71**	1.96*
Gujarat	–3.30	3.60**	5.30**	0.50	2.52**	2.13*
Bihar	3.70*	3.60*	–0.44	2.90*	–0.17	1.84*
Haryana	4.80*	1.90*	1.34*	4.60*	1.83*	2.82*
Andhra Pradesh	3.00*	2.20*	3.20**	3.10*	2.75*	2.60*
Karnataka	0.20	2.80*	3.16	2.10*	1.45	1.94*
Tamil Nadu	3.90*	2.00***	1.86	4.00*	0.29	1.57*
Punjab	3.00*	1.30*	0.70**	2.60*	1.07*	1.58*
Rajasthan	2.20	3.20***	1.48	2.60**	1.43	2.48*
Madhya Pradesh	2.60*	1.70**	2.72***	3.10*	0.93	1.67*
Maharashtra	1.40	1.50	3.47*	2.20**	1.15	1.38*
Odisha	2.40	–0.40	4.30***	3.00*	2.45**	1.65*
Assam	0.50	0.90*	0.64	1.90*	1.05**	1.49*
West Bengal	5.30*	2.00*	1.02*	4.30*	1.60*	2.56*
Kerala	1.10*	0.60	1.92*	1.60*	1.93*	1.51*
All India	2.90*	2.10*	1.52**	3.00*	1.27*	2.06*

Note: 1980's period is 1980–89, 1990's period is 1990–99, 2000's period is 2000–09, pre–reform period is 1980–94 and post–reform period is 1995–2009.

* Significant at 1 per cent; ** significant at 5 per cent and *** Significant at 10 per cent level.

Table 3: Trend Growth Rate of Pulses (per cent per annum)

State	**1980s**	**1990s**	**2000s**	**Pre**	**Post**	**Total**
Area						
Uttar Pradesh	0.30	–1.00*	–1.57	–0.10	0.28	–0.13
Gujarat	1.70	–1.70***	2.13	2.70*	–0.29	0.46
Bihar	–1.00***	–2.90*	2.09***	–2.00*	0.63	–1.39*
Andhra Pradesh	0.60	–0.10	–0.43	1.10*	1.59**	1.31*
Karnataka	1.20**	1.30	2.29**	0.40	2.62*	1.38*
Rajasthan	–3.70	0.90	4.45	–0.50	–0.16	0.09
Madhya Pradesh	–0.60	0.60	1.81***	0.00	0.67	0.36*
Maharashtra	2.10*	1.00***	–0.09	1.90*	0.33	0.92*
Rest of states	0.50	–6.40*	0.06	–2.60*	–1.44*	–3.43*
All India	–0.10	–0.60	1.15**	–0.10	0.28	–0.13
Yield						
Uttar Pradesh	0.00	0.00	–1.09	0.30	–0.75	–0.27***
Gujarat	–1.70	1.50	7.82*	0.70	1.83	1.01***
Bihar	1.70*	1.10	–0.86	1.80*	–0.19	0.64*
Andhra Pradesh	4.40*	0.40	4.89*	2.30*	4.54*	2.57*
Karnataka	–0.80	1.40	2.42	0.50	1.06	0.94*
Rajasthan	–0.70	2.30	–1.05	0.20	–2.71	–0.39
Madhya Pradesh	2.10**	2.00**	2.87***	2.60*	1.01	1.48*
Maharashtra	4.80*	3.60	3.15**	3.00*	1.77***	1.97*
Rest of states	1.80***	–0.90	–0.38	1.30*	–0.34	0.02
All India	1.60**	1.30***	1.52**	1.40*	0.52	0.77*
Production						
Uttar Pradesh	0.40	–1.00	–2.66**	0.10	–1.73**	–0.88*
Gujarat	0.00	–0.20	9.95**	3.40	1.54	1.48***
Bihar	0.70	–1.70	1.23	–0.20	0.44	–0.75*
Andhra Pradesh	5.00*	0.30	4.45*	3.40*	6.13*	3.88*
Karnataka	0.30	2.80	4.72***	0.90	3.69*	2.33*
Rajasthan	–4.40	3.20	3.39	–0.30	–2.87	–0.30
Madhya Pradesh	1.50	2.60*	4.68**	2.60*	1.68	1.84*

Maharashtra	6.90*	4.60	3.06	4.90*	2.10	2.90*
Rest of states	2.30***	–7.40*	–0.33	–1.30	–1.78**	–3.40*
All India	1.50	0.70	2.67**	1.30*	0.80	0.64*

Note: 1980's period is 1980–89, 1990's period is 1990–99, 2000's period is 2000–09, pre-reform period is 1980–94 and post-reform period is 1995–2009.

* Significant at 1 per cent; ** significant at 5 per cent and *** Significant at 10 per cent level.

Table 4: Trend Growth Rate of Oilseeds (per cent per annum)

State	1980s	1990s	2000s	Pre	Post	Total
Area						
Uttar Pradesh	–9.60*	–1.20**	–0.68	–5.70*	–2.78*	–3.27*
Gujarat	–1.80	0.10	0.31	1.30	0.08	0.76**
Haryana	7.10**	–1.40	0.69	8.80*	0.04	3.29*
Andhra Pradesh	5.00*	–2.60*	–1.01	4.40*	–1.38**	0.49
Karnataka	7.60*	–3.30**	1.70	6.20*	–0.29	1.12**
Tamil Nadu	2.40**	–3.40*	–3.99*	2.00*	–5.21*	–2.56*
Rajasthan	8.20*	2.80*	6.25**	8.80*	1.34	4.26*
Madhya Pradesh	6.50*	4.70*	2.72*	7.40*	1.06**	4.33*
Maharashtra	3.40*	0.40	6.46*	2.40*	3.66*	1.95*
West Bengal	5.80*	–1.00**	2.06*	4.20*	2.94*	2.38*
Rest of states	2.70*	–5.10*	0.35	–0.50	–1.55**	–2.25*
All–India	2.40*	0.20	2.42**	3.20*	0.45	1.35*
Production						
Uttar Pradesh	–5.20**	–1.50	0.06	–0.40	1.72	–2.38*
Gujarat	–2.60	4.40	5.61	2.20	2.42	3.07*
Haryana	13.20*	–1.50	2.38	14.10*	1.72	5.76*
Andhra Pradesh	7.30*	–4.50***	1.40	6.10*	–1.06	0.95
Karnataka	8.70*	–2.00	0.43	6.40*	–1.87	0.82
Tamil Nadu	4.70**	–0.10	–2.32	5.50*	–3.85*	–0.03
Rajasthan	14.90*	5.30*	9.52**	13.30*	3.94***	7.31*
Madhya Pradesh	11.60*	7.50*	7.56*	12.80*	2.43***	7.31*
Maharashtra	4.00	5.40***	6.20**	4.40*	4.61*	4.45*
West Bengal	13.00*	–1.90*	3.17**	8.40*	4.86*	4.41*
Rest of states	4.10*	–6.60*	1.86***	–0.30	–0.91	–2.38*
All India	5.20*	2.30**	5.02**	6.00*	1.72	3.28*
Yield						
Uttar Pradesh	4.40*	–0.40	0.74	5.20*	1.27***	2.38*
Gujarat	–0.80	4.30	5.29	0.90	2.34	2.31**
Haryana	6.10*	0.00	1.69	5.40*	1.69	2.47*
Andhra Pradesh	2.40	–1.90	2.42	1.70**	0.33	0.45
Karnataka	1.00	1.30	–1.27	0.20	–1.57***	–0.29
Tamil Nadu	2.30***	3.30*	1.67	3.40*	1.35***	2.53*
Rajasthan	6.70*	2.50**	3.27***	4.50*	2.60*	3.05*
Madhya Pradesh	5.10*	2.80*	4.84*	5.40*	1.37	2.98*
Maharashtra	0.60	5.00**	–0.26	2.00***	0.95	2.50*
West Bengal	7.20*	–0.90	1.11	4.30*	1.91*	2.03*
Rest of states	1.40	–1.40***	1.51***	0.20	0.64	–0.13
All India	2.90**	2.10*	2.60***	2.80*	1.27***	1.93*

Note: 1980's period is 1980–89, 1990's period is 1990–99, 2000's period is 2000–09, pre-reform period is 1980–94 and post-reform period is 1995–2009.

* Significant at 1 per cent; ** significant at 5 per cent and *** Significant at 10 per cent level.

Table 5: Trend Growth Rate of Irrigated Area under Different Crops (per cent per annum)

State	1980s	1990s	2000s	Pre	Post	Total
Total foodgrains						
Andhra Pradesh	2.57*	1.36*	–0.03	1.97*	–0.84	1.04*
Bihar	2.25*	1.83*	–0.69**	2.01*	0.19	1.50*
Gujarat	1.70	4.24*	0.55	2.90*	–0.18	2.57*
Haryana	2.44**	1.18*	0.12	1.89*	1.31*	1.44*
Karnataka	1.97**	1.91*	1.21	2.45*	0.28	1.68*
Madhya Pradesh	5.40*	5.23*	4.37*	6.48*	1.42**	4.80*
Maharashtra	0.05	2.95*	0.86	1.38*	1.25**	1.79*
Odisha	2.28*	3.42*	3.23	3.10*	1.07	2.57*
Punjab	0.88*	–0.15	–0.11	0.67*	0.21	0.38*
Rajasthan	–0.07	4.21*	–3.68	0.75	–0.10	1.39*
Tamil Nadu	–2.50*	2.05*	–0.51	0.11	–0.80	0.65*
Uttar Pradesh	2.52*	1.83*	1.01***	2.55*	0.82*	1.86*
Rest of states	0.45	0.70	2.03	0.43	3.35*	1.43*
All India	1.81*	2.22*	0.61	2.13*	0.92*	1.85*
Oilseeds						
Andhra Pradesh	1.28	0.57	1.34	1.87*	–1.29	0.69*
Gujarat	2.59	2.05**	–1.90	2.32*	–1.95*	1.13*
Haryana	6.68*	2.07**	–2.45*	2.10***	1.18	1.57*
Karnataka	7.93*	1.30	–2.78*	5.80*	0.83	3.05*
Madhya Pradesh	4.21**	–2.07	16.33**	5.31*	–1.41	1.47**
Maharashtra	1.09	0.02	–4.81**	6.76*	–4.58*	2.99*
Rajasthan	6.47*	1.09	4.68*	3.94*	1.94	2.62*
Tamil Nadu	1.01	4.81*	2.61	2.68*	5.65*	4.20*
Uttar Pradesh	16.25*	1.92	2.56*	13.78*	4.80*	8.35*
West Bengal	3.00	4.41**	–0.84	2.60*	–2.30	2.03*
Rest of states	6.83*	7.80*	7.97*	6.90*	1.77	5.57*
All-India	5.99*	1.40**	3.68*	5.10*	0.73	2.94*

Note: 1980's period is 1980–89, 1990's period is 1990–99, 2000's period is 2000–07, pre-reform period is 1980–94 and post-reform period is 1995–2007.

* Significant at 1 per cent; ** significant at 5 per cent and *** Significant at 10 per cent level.

Table 6: Trend Growth Rate in Cropping Intensity (per cent per annum)

State	1980s	1990s	2000s	Pre	Post	Total
Andhra Pradesh	0.39*	0.65	0.11	0.13	–0.27***	0.28*
Assam	0.95*	0.63*	–1.26	0.73*	–0.09	0.53*
Bihar	0.34	0.55***	0.63	–0.03	–0.01	0.15**
Gujarat	0.00	–0.34	0.32	0.14	0.04	–0.08
Haryana	0.38	0.56**	1.09	0.70*	0.88*	0.72*
Karnataka	0.68*	2.16	–0.37	–0.51	0.15	0.37
Kerala	0.14	–0.33***	–0.41	0.27*	0.38	0.13*
Madhya Pradesh	0.20***	1.48*	2.22	0.55*	–0.30	0.64*
Maharashtra	0.45*	0.81**	0.75	0.65*	0.81*	0.76*
Odisha	0.65***	–1.27*	2.08	0.66*	–0.11	–0.05
Punjab	1.04*	0.72*	0.29	0.90*	–0.03	0.68*
Rajasthan	–0.10	1.17*	0.67	0.19***	–0.05	0.43*
Tamil Nadu	–0.14	–0.31***	–2.21	0.14	–0.32	–0.09
Uttar Pradesh	0.27**	–0.04	1.11**	0.27*	0.44**	0.22*
West Bengal	2.26*	1.25*	1.71	1.36*	1.02*	1.18*
All–India	0.39*	0.49*	0.46	0.44*	0.18	0.40*

Note: 1980's period is 1980–89, 1990's period is 1990–99, 2000's period is 2000–07, pre-reform period is 1980–94 and post-reform period is 1995–2007.

Table 7: Growth rate in Consumption of Fertilizer per Unit Cropped Area (per cent per annum)

State	1980s	1990s	2000s	Pre	Post	Total
Andhra Pradesh	9.99	3.58	5.44	7.47	2.71	4.71
	(7.7)	(4.5)	(2.0)	(9.4)	(2.5)	(11.6)
Karnataka	7.92	4.49	2.46	5.74	3.34	4.56
	(7.7)	(3.3)	(0.8)	(7.9)	(2.8)	(13.7)
Kerala	9.83	–1.41	2.80	5.80	0.44	2.03
	(15.4)	–(1.3)	(3.9)	(5.8)	(0.7)	(4.3)
Tamil Nadu	6.78	2.55	5.75	4.55	3.10	2.97
	(5.6)	(1.9)	(1.8)	(6.3)	(2.3)	(8.1)
Gujarat	5.90	3.86	9.30	5.82	3.74	4.38
	(3.9)	(3.1)	(5.2)	(7.7)	(2.9)	(12.3)
Madhya Pradesh	13.70	3.98	22.54	10.41	12.63	8.60
	(17.9)	(4.0)	(5.3)	(12.4)	(6.0)	(15.2)
Maharashtra	8.84	3.89	4.52	8.19	2.41	5.20
	(7.3)	(3.3)	(2.1)	(10.7)	(2.5)	(12.3)
Rajasthan	9.76	6.70	4.64	9.92	1.49	6.56
	(7.5)	(7.7)	(1.8)	(17.2)	(1.4)	(13.5)
Haryana	10.00	4.14	2.71	8.00	3.08	5.32
	(11.8)	(8.6)	(3.8)	(14.5)	(11.3)	(16.8)
Punjab	3.19	0.89	4.72	2.10	2.28	1.52
	(5.3)	(2.2)	(9.6)	(6.1)	(5.1)	(10.0)
Uttar Pradesh	5.38	4.37	15.00	4.37	8.87	5.40
	(4.6)	(9.2)	(4.9)	(7.9)	(6.5)	(14.3)
Assam	9.19	12.44	6.83	8.58	13.69	11.81
	(7.0)	(5.3)	(5.0)	(9.1)	(11.2)	(25.0)
Bihar	15.15	6.68	14.98	9.51	8.36	7.66
	(7.3)	(10.7)	(5.3)	(7.0)	(6.1)	(14.9)
Odisha	7.23	7.52	3.23	5.42	4.75	5.52
	(2.4)	(7.0)	(2.8)	(4.0)	(5.4)	(12.6)
West Bengal	10.56	4.45	2.85	7.58	2.58	5.09
	(9.4)	(5.3)	(2.7)	(9.2)	(4.6)	(13.7)
All-India	7.65	3.73	4.36	5.94	2.84	4.23
	(11.3)	(6.0)	(4.1)	(11.7)	(5.2)	(17.0)

Note: 1980's period is 1980–89, 1990's period is 1990–99, 2000's period is 2000–06, pre-reform period is 1980–94 and post-reform period is 1995–2006.

* Significant at 1 per cent; ** significant at 5 per cent and *** Significant at 10 per cent level.

Table 8: Growth Rate of Loan Outstanding – Institutional (₹ Per hectare)

State	1980s	1990s	2000s	Pre	Post	Total
Andhra Pradesh	17.11*	11.28*	21.98*	13.58*	14.69*	12.80*
Bihar	16.06*	5.17*	16.99**	15.73*	9.10*	11.37*
Gujarat	16.51*	7.99*	18.23*	14.54*	15.33*	12.55*
Haryana	15.57*	7.67*	22.56*	11.13*	18.34*	11.08*
Himachal Pradesh	15.97*	7.34*	31.86*	11.93*	22.02*	11.97*
Karnataka	18.75*	14.49*	22.45*	13.08*	16.68*	13.65*
Kerala	15.66*	11.19*	16.84*	12.06*	14.68*	11.96*
Madhya Pradesh	19.16*	10.73*	20.68*	15.23*	16.30*	13.86*
Maharashtra	14.50*	12.49*	22.79*	11.97*	16.40*	13.07*
Odisha	18.32*	9.66*	16.13*	12.04*	11.79*	10.69*
Punjab	10.66**	9.34*	18.22*	8.37*	16.54*	9.97*
Rajasthan	17.83*	11.30*	16.68***	13.47*	20.55*	13.58*
Tamil Nadu	16.42*	10.09*	27.26*	14.32*	14.11*	13.15*

Uttar Pradesh	14.07*	8.55*	20.99*	14.06*	17.78*	13.24*
West Bengal	18.33*	4.72*	28.43*	12.90*	17.73*	11.07*
India	16.57*	9.49*	20.98*	13.41*	15.37*	12.42*

Note: 1980's period is 1980–89, 1990's period is 1990–99, 2000's period is 2000–05, pre-reform period is 1980–94 and post-reform period is 1995–2005.

* Significant at 1 per cent; ** significant at 5 per cent and *** Significant at 10 per cent level.

Table 9: Trend Growth Rate in Public and Private Investment (constant prices)

	1980s	1990s	2000s	Pre	Post	Total
Total	–0.26	3.01	5.82*	0.81	8.56*	3.79*
Public	–3.88*	–0.22	12.82*	–3.56*	4.74*	–0.76
Private	2.47***	4.03	2.99	3.61*	10.15*	5.66*

Note: 1980's period is 1980–89, 1990's period is 1990–99, 2000's period is 2000–06, pre-reform period is 1980–94 and post-reform period is 1995–2006.

* Significant at 1 per cent; ** significant at 5 per cent and *** Significant at 10 per cent level.

Table 10: Growth Rate of Per Capita Consumption of Foodgrains and Edible Oils

	Rural			Urban		
Region / year	1987–1995.	1996–2006	1987–2006	1987–1995.	1996–2006	1987–2006
Rice						
North India	0.26	–0.76**	–0.25**	–1.39	–0.09	–0.06
North–western India	–10.03*	0.68	0.13	–6.17**	–1.71	0.35
South India	0.22	–0.59**	–0.20***	–0.24	–0.96*	–0.65*
East India	–0.31	–0.85**	–0.94*	–0.69	–0.94**	–0.69*
West India	–0.50	0.61	0.20	0.60	–0.52	–0.07
Central India	–0.39	0.37	–0.80**	–1.24	–1.55**	–0.73**
North-east India	–1.79*	0.23	–0.45*	–1.67**	0.22	–0.56*
All India	0.00	–0.39***	–0.44*	–0.68*	–1.17*	–0.72*
Wheat						
North India	–2.46*	–0.76**	–1.30*	–0.73***	–0.69**	–0.77*
North–western India	2.16	–0.59	–1.35*	0.62	0.05	–0.67**
South India	1.70	2.49*	1.37*	0.64	0.56	0.15
East India	–2.53**	–0.71**	–0.81*	–0.22	–0.81**	–0.46*
West India	–0.96	0.09	–0.03	–0.95**	–0.63***	–0.40*
Central India	2.43***	–1.27	–0.42	–0.21	0.02	–0.53**
North-east India	3.16	3.17**	1.78***	3.43	–0.01	0.73
All India	–1.60*	–0.39	–0.63*	–0.42	–0.23	–0.35*
Coarse Cereals						
North India	–5.51	–7.60**	–7.12*	–0.48	3.83	–3.37
North–western India	–1.64	–7.39*	–7.21*	–8.00	–7.11	–10.47*
South India	–4.38**	–4.46*	–5.41*	–1.47	–0.62	–2.48*
East India	–5.77	–2.33	–5.54*	–14.50***	0.64	–3.64
West India	–2.04*	–2.09**	–2.73*	–3.90	–1.08	–3.41*
Central India	–10.99***	1.94	–5.07*	–13.50***	1.74	–3.95
North-east India	–11.51*	–10.67*	–8.86*	–17.51	–25.40	–13.63**
All India	–4.10*	–2.81**	–4.32*	–2.69	–0.68	–2.99*
Total Pulses						
North India	–3.70***	0.01	–1.48*	–3.21**	0.07	–0.71**
North–western India	–0.82	0.54	–0.78***	2.08	–0.85	–2.89***

South India	–1.31***	1.36	0.20	–2.02	1.47**	–0.06
East India	–5.03*	0.88	–0.99**	–2.87**	0.35	–0.69**
West India	–3.03***	0.32	–0.82**	–3.62*	0.49	–0.58
Central India	–2.78	0.50	–2.07*	–3.78*	0.22	–1.53*
North-east India	–4.36**	2.48***	–0.13	–4.36*	0.48	0.48
All India	–3.28*	0.64	–0.92**	–2.27	0.54	–0.90**
Total Edible Oils						
North India	2.95	1.13**	0.63	0.43	0.59***	1.05*
North–western India	1.40	1.51**	2.15*	–1.59	0.69	0.23
South India	0.52	2.51*	2.41*	0.75	1.56**	1.92*
East India	1.84	3.28**	2.46*	–0.56	1.58*	1.82*
West India	0.50	1.86**	2.08*	–0.56	0.84***	1.05*
Central India	2.79*	0.90***	1.56*	–0.23	1.58*	1.09*
North-east India	–0.04	1.90	1.22	0.89	–0.90	1.92
All-India	1.52	1.99*	1.72*	0.61	1.07***	1.07*

* Significant at 1 per cent; ** significant at 5 per cent and *** Significant at 10 per cent level.