Institute of Chinese Studies
ICS
中国研究所 DELHI
Working Paper
Paper 2013/12/3
http://www.icsin.org/

# Food and Feed in a Resource Constrained System: Revisiting China's Agrarian Questions

**Sriram Natrajan**
**Independent Researcher**



Institute of Chinese Studies
ICS
中国研究所 DELHI

# ABOUT THE AUTHOR

**Sriram Natrajan** is an independent researcher based in Bangkok. He is currently a Consultant on Food Balance Sheets and Food Security to the Food and Agricultural Organization – Regional Office for Asia and the Pacific, Bangkok. He received his Doctoral degree from the Centre for Economic Studies and Planning, Jawaharlal Nehru University in 2012 for his thesis "Agrarian Change and Rural Transformation: China's Development Experience since 1965". In 2013, he designed, coordinated and lectured a Masters level course – "India, ASEAN and the ASEAN Economic community-2015" – at the Institute of Southeast Asian Studies, Chulalongkorn University, Bangkok. His research interests include, Dynamics of Agrarian Transition in Asia, Food Security in Developing Economies and Indian Ocean Studies. He has worked as a Research Economist and as a Consultant at the International Labour Office, Geneva (1999-2004). For over a decade he has been associated with the Institute of Chinese Studies, Delhi.

**First published in 2013**
by the Institute of Chinese Studies,
8/17 Sri Ram Road,
Civil Lines,
Delhi 110 054, India
Ph.: +91-11-23938202; Fax: +91-11-23992166
Email: info@icsin.org
Website: www.icsin.org

Digitally printed at Sapna Photostat,
Munirka Phase-II, New Delhi

## Introduction

The 'Agrarian Question' in China is still in a process of unfolding after undergoing two major transitions one in the middle of the twentieth century (socialization) and another in the early 1980s (reforms). Not only does agriculture still retain importance as regards employment, its strategic contribution as a provider of wage goods is greatly enhanced owing to the never-shrinking demands on its productive potential. While institutional and technological innovations during various periods were significant in maintaining a stable or even increasing per capita availability of food thereby fulfilling the productive role, changes in the composition of food in recent decades has brought to fore the familiar contradiction between food and feed in a resource constrained system. Changes in consumption patterns brought about by rapid economic growth and therefore incomes is likely to impact the ongoing 'transition' in China's agriculture in the coming decades.

An examination of the long term trend in food production in China reveals that the sudden spurt in output expansion during the early 1980s forms part of the trend of the earlier decade rather than a completely new break from the past and attributed to institutional changes of the late 1970s. The argument that introduction of a few elements of market institutions predominantly explain the spurt is inadequate for two reasons. First, ownership of land did not undergo any change. Rural land or more precisely farmland continues to be collectively owned although operational and management rights underwent a significant shift with the household responsibility systems officially introduced during 1979-80. A similar downward delegation of responsibility to the level of the Production Team was effected in the early 1960s following the complexities of managing large scale communes. This along with other factors in combination led to disastrous consequences at the end of the 1950s.

Secondly, there are reasons to suggest a significant divergence between officially reported and actual production in the farming sector. Foremost among these relates to the reduced capabilities of the statistical system in the 1960s and early 1970s to collect and report data consistently. A large part of the data published after reforms for this period are estimates based on recollections. Other parameters such as moderate weather, rapid build-up of agricultural capital – irrigation and water control by means of labour intensive methods-the expansion farm inputs and sown areas in that period and above all the introduction of higher-yielding crop varieties support the thesis that output levels could have been far higher than the estimates officially prepared and presented more than a decade later. An additional factor that favours such a line of reasoning is the widely accepted view that under a regime of compulsory state procurement, farm output is more likely to be under reported.

A significant development in China's agriculture since the mid-1990s has been a sluggish expansion or even stagnation in grain production per capita. Coinciding with this trend are changes in the composition of food consumption which is reflected on the production side by a diversification of crops driven by commercialization. With an intensification of broader and deeper changes in the form of market mechanisms increasingly determining economic outcomes, a more critical underlying development has been widening disparities in personal incomes as well as within and across sectors and regions. The resulting changes in the quantum and composition of food availability across various income groups reveal a clear and consistent divergence. This last issue is examined more closely by comparing rural and urban consumption bundles since 2000. The significant finding is that nutritional entitlements appear to be steadily declining for the rural population in the past decade.

This paper examines the following three related issues that are likely to emerge as important in the coming decade for China's food and agriculture:

1. On the production side, domestic supplies of food have begun to decline on a per capita basis in the last decade leading to a dependence on external sources. This dependence though small in proportion to domestic needs is high relative to global trading volumes. Given the strategic nature of agriculture and food in China this development requires close attention and analysis.
2. Changes in the composition of food consumed have a corollary in the diversification of food produced. In other words, with increases in average incomes the diversification of consumption choices has a direct impact on choices in production. But since increases in income are not uniform across income groups/classes, consumption bundles of some classes alter the bundle of food available for other income groups. This has serious implications with regard to food security especially for the vulnerable income groups.
3. The dynamics of changes in urban diets suggest a profound disconnect with rural production possibilities. More fundamentally however, this dynamics directly impacts rural consumption levels. Grappling with this disconnect will be an emerging agrarian challenge in China.

The paper is organized in five sections. Section 1 examines the slowing down since the mid-eighties and ultimately a stagnation or sluggish growth beginning in the mid-nineties in China's grain production. The paradoxical trend in grain trade during this period is elaborated as part of the discussion.

Section 2 delves in to the reasons for these empirically observed changes. These, it is argued, comprise a combination of many dynamic factors viz. cropping patterns, weather, market intervention and above all changes in food consumption patterns emerging from shifts in income distributions.

Section 3 looks closely at the changes in the composition of food consumption that ultimately determine and direct changes in the pattern of food production. While growth in income disparities – both across and within sectors, regions as well as in the rural and urban space – largely account for these changes in consumption, the declining role of the Chinese state in ensuring adequate food availability for all income classes promoted an erosion of food entitlements for the bottom half of the population.

The nutritional dimension in this context is the focus of discussion in Section 4. An important theoretical contribution of the mid-1980s, largely ignored in the literature but of utmost relevance for Developing country policy formulation with regard to food security, (Yotopoulos (1985)), is also discussed in this section.

Section 5 is an empirical exercise on food consumption in rural and urban China since the mid-1990s. Using survey data annually assembled in the China Statistical Yearbooks, the exercise estimates the proximate per capita consumption levels of an elaborate list of food items that account for over 90% of nutrition. The results are in the least alarming for a nation aspiring to acquire a status beyond middle-income. Rural nutritive entitlements have eroded considerably since the mid-1990s and in the past decade the situation has deteriorated to an extent that minimum adequate nutritional levels for a majority of rural Chinese is beyond reach.

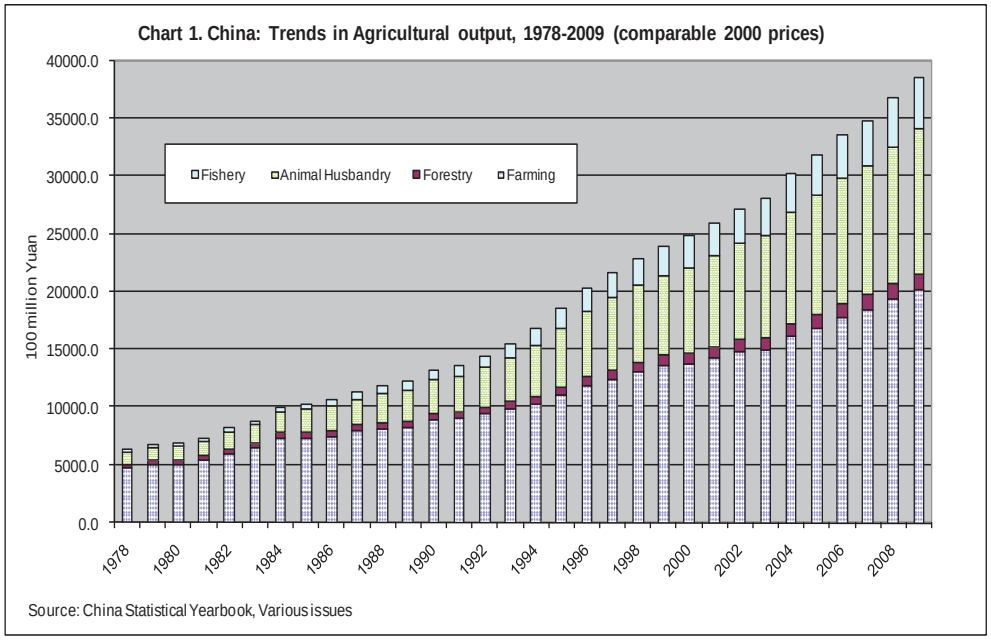
The paper ends with some concluding remarks highlighting an urgent need for immediate and effective policy intervention.

## 1. Stagnation in China's Grain Sector since the 1990s

The post-reform performance of agriculture was impressive in the first phase until 1984. The devolution of production decisions to the level of the household combined with large increases in procurement prices brought about a sudden 'explosion' of production in all the agricultural sub-sectors in the initial phase of reforms. The rates of growth were higher in animal husbandry and fisheries (as also forestry) than in grain production. While the rapid growth in non-grain food production came about with the expansion in the

number and size of local markets, that of grain production resulted from large increases in procurement prices[1]. Per capita grain production was one-fifth higher by 1992 at 380 Kg. compared to 318.7 Kg. in 1978[2].

| **Table 1 China: Growth rates in the Agricultural Sector, 1978-2009** | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| | 1978-84 | 1985-92 | 1993-2009 | 1985-2009 | 1978-2009 |
| **Agriculture** | 7.2 | 4.7 | 5.4 | 5.9 | 5.96 |
| **Farming** | 6.9 | 3.7 | 4.3 | 4.3 | 4.51 |
| **Forestry** | 8.4 | 2.4 | 4.4 | 4.6 | 4.81 |
| **Animal Husbandry** | 8.6 | 7.2 | 6.9 | 8.0 | 8.37 |
| **Fishery** | 7.6 | 11.1 | 7.3 | 9.7 | 10.65 |
| Source: CSY, various years, comparable 2000 prices | | | | | |




[1] Between 1979 and 1981 the total additional income to the farming sector from procurement price increases was estimated at Yuan 46.3 billion equal to 10.5% of total gross output value of farming for those years[1]. Over the period 1978 to 1994, agriculture grew at an annual rate of 7.2%. During the initial phase of reform (1978-84) gross value of agricultural output (GVAO) rose by 40%. The performance of agriculture in the six years from 1978 -84 was repeatedly quoted by several commentators to demonstrate the 'liberating' power of the market - As Field (1993) puts it " Gross value increased as much in the six years from 1978 to 1984 as it did in the twenty years from 1957 to 1978".

[2] These figures are in terms of the definition of grain used in China that include soyabeans and tubers in dry weight equivalent. A more detailed exercise on the availability of food and nutrition in post-reform China is taken up in a later chapter.

| **Table 2. China: Production of Cereals, Grain and Population, 1978-2009*** | | | |
|---|---|---|---|
| | Cereals | Grain | Population |
| | 10,000 metric tons | | Millions |
| 1978-79 | 23511.9 | 31844.3 | 969.0 |
| 1980-82 | 24357.6 | 33336.0 | 1001.4 |
| 1983-85 | 29226.9 | 39123.2 | 1044.1 |
| 1986-88 | 29635.0 | 39619.0 | 1092.8 |
| 1989-91 | 32803.4 | 42969.3 | 1142.9 |
| 1992-94 | 34227.9 | 44808.2 | 1185.1 |
| 1995-97 | 37425.2 | 48844.1 | 1223.8 |
| 1998-00 | 37473.1 | 49428.5 | 1257.6 |
| 2001-03 | 33401.3 | 44679.6 | 1284.4 |
| 2004-06 | 37118.7 | 48384.5 | 1307.3 |
| 2007-09 | | 52037.8 | 1314.4 |
| **Growth rates, compound (%)** | | | |
| | Cereals | Grain | Population |
| 1978-9 to 1986-88 | 2.94 | 2.77 | 1.51 |
| 1986-88 to 1995-97 | 2.63 | 2.35 | 1.27 |
| 1995-97 to 2004-06 | -0.09 | -0.11 | 0.74 |
| OVERALL<br>1978-79 to 2007-09 | n.a. | 1.53 | 1.08 |
| Grain includes tubers at 1/5$^{th}$ weight, pulses and soyabeans. 3-year averages except first period 1978-79, Source: CSY, various years | | | |

Rural real incomes during 1978-91 grew at an average rate of 7.5% p.a. with the major spurt at 13.4% concentrated in the period 1978-84[3]. However, the pace of growth of the first phase did not continue after 1985. In particular grain production growth slowed down while animal produce (and fisheries) continued on an expansionary path for the rest of the period. Animal husbandry and fishery sectors grew the fastest at over 8% and 10.5% annually between 1978 and 2009. (**Chart 1 and Table 1)**. These differential growth rates are reflected in their shares in total gross output value of the primary sector – farming declined by 24 percentage

[3] The growth of real expenditure in current terms, of rural residents was also impressive - 8.4% p.a. in 1978-84 falling to 3.0% p.a. in the next six years and 6.5% p.a. for the entire period 1978-91. Improvements in housing in terms of increases in area was at a rate of 6.6% p.a. during 1978-91 (These data are from sample surveys conducted by the State Statistical Bureau).

points (from 76% in 1978) where as animal husbandry and fisheries together rising from 20% in 1978 to over 43% by 2009.

Population growth slowed down from the mid-1980s and fell sharply below 1 percent annual rate from the mid-1990s onwards **(Table 2)**. While the food grains growth rate was well above the population growth rate up to the mid 1990s, entailing rising output per capita, thereafter grain output became completely stagnant and in fact registered a small decline comparing the terminal triennium 2004-06 to the initial triennium 1995-97 (larger decline is observed in the intermediate period) so despite the decelerating population growth rate, per capita grain output declined over this decade quite significantly. Paradoxically, much larger net imports of food grains took place up to the mid-1990s when domestic production was rising, thus taking per head supply above domestic output, than later on when the output situation worsened.

Net imports of various components of food grains compiled in **Table 3** shows that wheat and maize have been the major cereals in total trade in food grains. The table further reveals that wheat has rarely been net exported (except in 2003 and 2007 amounting to low volumes of 0.7 and 1.7 million tons respectively) while in the case of maize the maximum exported was in 2003 amounting to over 11 million tons owing to a high production levels in 2002 and 2003 with a corresponding fall in feed demand in those years. The large imports of wheat over the period until 1995 were aimed at increasing availability for northern China which is prone to frequent droughts and inadequate irrigation (relative to southern China).

The importance of grain imports at least until 1996 may appear insignificant if viewed as a share of domestic supply (never exceeded 6.6% in any year) but in terms of global trade in grains the quantum of imports assume greater importance. Though, there were wide year to year variations in net grain imports, when examined over a period the significance of grain imports emerges more clearly. For the period 1978-1996, cumulative net grain imports were close to 259 million Mt, averaging 13.6 million Mt per year. This amounts to about 90% of net grain imports for the entire period 1978-2007[4].

[4] Brown's (1995) thesis concerning China's impending inability to meet food requirements and greater dependence on global grain markets emerged precisely in this context of China's increasing imports of grain. The argument here is based on the emerging combination of declines in cultivated and sown areas potentially limiting or even contracting grain production and increases in population and incomes leading to expanding demand for grains as food as well as increasing consumption of animal products leading to additional grain demand as feed. According to Brown's estimates, by 2030, grain production would decline from 341 million MT in 1990 to 272 million MT, whereas consumption would increase to 479 million MT assuming no increase in per capita consumption (from the levels in early 1990s) requiring grain imports of over 200 million MT in 2030. In a scenario where China's per capita consumption in 2030 equals Taiwan's levels of the late 1990s of 400 kgs per capita, the import demand would be of the order of 370 million MT.

| Table 3. China: Net Imports of Food Grains, 1978-2009 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Volume of Net Imports, million met. tons | | | | Share in Food Grains % | | |
| | Food grains | All Cereals | Wheat | Maize | cereals | wheat | Maize |
| 1978 | 11.4 | 11.4 | 8.5 | 3.2 | 99.7 | 74.4 | 27.9 |
| 1979 | 15.5 | 15.5 | 9.6 | 5.6 | 100.1 | 61.9 | 36.4 |
| 1980 | 16.3 | 16.4 | 11.8 | 4.6 | 100.8 | 72.6 | 28.2 |
| 1981 | 18.2 | 18.5 | 13.8 | 3.5 | 101.5 | 75.8 | 19.0 |
| 1982 | 20.1 | 20.2 | 14.7 | 4.4 | 100.8 | 73.5 | 21.9 |
| 1983 | 18.4 | 18.5 | 12.2 | 5.9 | 100.4 | 66.0 | 31.8 |
| 1984 | 13.5 | 13.5 | 11.0 | 2.3 | 100.2 | 81.7 | 17.2 |
| 1985 | 3.5 | 3.4 | 6.4 | -2.9 | 97.3 | 182.7 | -82.8 |
| 1986 | 5.3 | 5.8 | 7.3 | -1.6 | 109.4 | 138.0 | -30.6 |
| 1987 | 17.0 | 17.4 | 14.9 | 1.8 | 102.3 | 87.5 | 10.4 |
| 1988 | 16.2 | 16.6 | 15.8 | 0.8 | 102.8 | 97.9 | 5.2 |
| 1989 | 18.3 | 18.2 | 16.2 | 1.1 | 99.5 | 88.4 | 6.0 |
| 1990 | 16.4 | 16.5 | 13.7 | 2.2 | 101.0 | 83.8 | 13.3 |
| 1991 | 11.2 | 11.8 | 13.6 | -2.1 | 105.4 | 121.6 | -19.1 |
| 1992 | 6.3 | 6.9 | 11.7 | -4.8 | 109.7 | 187.0 | -76.7 |
| 1993 | 0.9 | 1.3 | 7.2 | -5.5 | 151.8 | 807.8 | -621.9 |
| 1994 | 5.0 | 6.1 | 8.2 | -3.1 | 122.4 | 164.3 | -62.8 |
| 1995 | 27.7 | 28.1 | 12.6 | 11.9 | 101.5 | 45.5 | 42.9 |
| 1996 | 17.4 | 17.3 | 8.7 | 6.2 | 99.1 | 50.0 | 35.8 |
| 1997 | 3.6 | 3.3 | 2.5 | -0.8 | 92.8 | 69.2 | -23.3 |
| 1998 | 2.2 | 1.9 | 2.5 | 0.5 | 86.0 | 116.9 | 22.4 |
| 1999 | 3.0 | 2.9 | 1.7 | 0.7 | 96.1 | 55.7 | 23.5 |
| 2000 | -3.5 | -3.9 | 2.1 | -5.5 | 110.2 | -60.1 | 157.4 |
| 2001 | 2.7 | 1.5 | 1.2 | -0.7 | 56.0 | 45.2 | -27.3 |
| 2002 | -4.1 | -5.1 | 1.0 | -6.6 | 124.2 | -23.7 | 163.4 |
| 2003 | -11.6 | -12.9 | -0.7 | -11.4 | 111.5 | 6.1 | 98.3 |
| 2004 | 14.2 | 11.6 | 7.4 | 2.5 | 82.1 | 51.9 | 17.5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2005 | 5.3 | 3.0 | 4.3 | -3.8 | 57.2 | 81.6 | -71.3 |
| 2006 | 7.7 | 4.0 | 0.1 | 1.9 | 52.1 | 1.8 | 24.1 |
| 2007 | 0.3 | -2.7 | -1.7 | -0.9 | -943.3 | -583.9 | -321.5 |
| 2008 | 5.7 | 4.5 | 0.9 | 3.4 | 79 | 15.5 | 59.9 |
| 2009 | 11.8 | 7.7 | 2.0 | 4.2 | 64.8 | 17.2 | 35.6 |
| Total (1978-2009) | 295.9 | 279.5 | 241.3 | 9.0 | 94.4 | 81.5 | 5.6 |
| Source: FAO-SUA Database | | | | | | | |

When production became stagnant after the mid-1990s instead of rising to compensate and maintain domestic supply, net imports also declined and net exports actually occurred in a period of especially low output during 2001-03. Instead of moderating falling per head output, trade thus aggravated the situation and heavy drawing down of stocks could not prevent the lowest per capita supply being registered in over two decades during 2001-03. Further, even out of stagnant output, a progressively higher share of grain supply was being diverted to indirect use, mainly animal feed leading to a gradual shrinking of grain available for direct consumption. The ramifications of changes in the composition of food arising from increased incomes is examined later in this paper.

Numerous projections of China's future grain demand and consumption have been made estimates, based on varying assumptions with regard to changes in production (supply side) and consumption (demand side)[5]. All the projections estimate growing demand for both food and feed using different projected values of income elasticities of demand for various animal products. These projections also vary on the predictions regarding production increases bases on various assumptions about decline or reclamation of cultivable land, changes in yields, inputs and irrigation infrastructure. But one crucial factor that would determine future demand for food and feed arises from changes in income distribution and therefore in elasticities of demand for grain directly as food and indirectly as feed by different income classes. Though this factor can neither be predicted nor projected with any degree of accuracy, it would be an important determinant of the quantum of grains that would be available for consumption by different income classes.

[5] Brown(1995) Rosegrant et al (1995), USDA/ERS (1994, 1997), Mitchell and Ingco (for the World Bank) (1993), Simpson et al (1994), OECD (1995), FAO (1995), Nyberg (1997) etc. See Zhang (2004), Fan and Agcaoili-Sombilla (1997) and Huang and Rozelle (1998) for a summary and evaluation of some of these projections.

## 2. Accounting for stagnation of grain production since the mid-nineties

The relatively very low endowments of arable and cultivable land in China has has historically induced (land augmenting) technical and technological innovations to enhance productivity while at the same time balancing the distribution of cultivated land across various crops-grain and non-grain. Further, a complex sequencing of crop-mix on multiple sown areas is a feature that takes into account both the need to expand total output of all crops while at the same time keeping in check the degradation of soil that ensures longer-term sustainability. The overall objective of such a highly developed system of agricultural practice has more to do with securing adequate or expanded food supplies than increasing variables such as total factor productivity or value added.

Reductions to cultivated area may result from a variety of factors that include weather or diversion away from farming either for household use or public infrastructure or rural industry. The additions to cultivated areas may either result from bringing into cultivation fallow land in a particular year or reclamation of new land or recording previously undeclared land. Following rural reforms of the late seventies and early eighties, the already land starved economy witnessed large reductions in arable area, as a direct consequence of rural industrialization and infrastructure development. The impact of such reductions assume as much significance for food security as the shift in area away from food crops towards non-food high value crops that reforms effectively promoted.

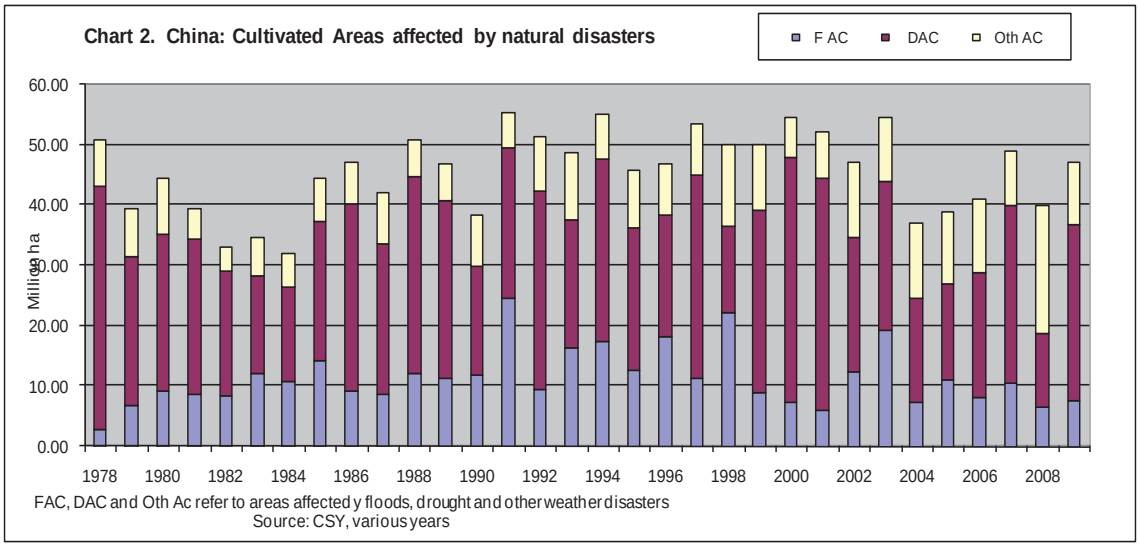
Cultivated area amounted to around 100 million ha according to the China Statistical Yearbooks, the FAO and the UDSA datasets on China's Agricultural Statistics. The estimates by the FAO and the USDA (which is a compilation of annually published official data), of total cultivated area (or arable area) vary considerably between 1983 and 1996. The FAO series seems to have been revised upwards in 1983 (by 13.7 million ha) and the USDA series in 1997 (by over 35 million ha) after which the two series converge. These upward revisions account for a significant share of the total additions to cultivated area which for the period 1978-2008 was 22.2 million ha and 15.9 million ha respectively.

The trend however begins to decline after the mid 1990s from a peak of slightly over 130 million ha to around 120 million ha. Wu and Wang (2000) observed that official estimates of arable land may be understated by up to 40% due partly to unregistered land. Satellite imagery projections conducted between 1980 and 1996, place estimates at between 131.1 and 139.6 million ha[6]. This has serious implications for analytical exercises

[6] Smil (1999) Table 1, pp 418

concerning estimates of productivity. Besides this, the permanent feature in Chinese agriculture relating to weather and the costs – both financial and direct impact on output –annually incurred to mitigate the same would render such exercises more complex[7].

The effect on agricultural production of weather induced factors that seriously disrupted the general trend prior to the mid-1960s was already moderated by the time reforms were initiated. But extreme weather as an important determinant of agricultural production in individual years continued to remain significant. Further, as in the earlier period, the effect of frequent policy shifts on economic performance gave rise to distinctly discernible phases (or cycles) in the latter period. In fact, policy shifts became more frequent and intense in post-reform China due to rapid diversification in all sectors and a corresponding loss of control by the government over the economy owing to continued decentralization of authority as well as the withdrawal of the state from many spheres of production and distribution. These influences altered or aggravated some of the basic conditions in agriculture.




It is reasonable therefore to conclude that favourable weather conditions - a steep fall in total areas affected - during the initial phase of reforms (until 1984) was a significant additional factor behind rapid expansion in production[8].

Besides the loss of arable area due to weather induced factors, additional losses emerged due to diversion of cultivable land for non-agricultural purposes. The already land starved economy witnessed large reductions

[7] Further, the effect on agricultural output and its composition under the 'reformed' institutional structure flows not only from prices which are determined not by the market alone but also from government policy (on the supply side) and the evolving distribution of income (on the demand side).

[8] The same reasoning applies also for the decade starting in the early 1990s. This however requires a more detailed analysis.

in arable area after 1978 as a direct consequence of rural industrialization and infrastructure development. Cumulative losses due to diversion of land for capital construction, village collective construction and individual peasant construction over the period 1984-1995 amounted to over 2.56 million ha accounting for 58% of the cumulative reduction in cultivated area. More serious however, was the quantum of land diverted away from farming for purposes other than the three mentioned above. The total diversion was of the order of over 10 million ha during 1984-95[9]. The impact of such reductions assume as much significance for food security as the shift in area away from food crops towards non-food high value crops that reforms effectively promoted.

Total sown area (TSA) declined from the pre-reform period and continued up to 1984 before gradually rising until 1990 to reach almost 150 million ha. The next peak is recorded for the year 1998 - 146.4 million ha. Data on total sown area, multiple cropping index (MCI) and irrigated areas are presented in **Table 4**. In the first phase of reforms (1978-84) the net reduction in TSA was of the order of 4.85 million ha. But between 1985 and 1998 the net addition was almost 12.75 million ha but this was followed by a net fall of 4.2 million ha during 1999 to 2006. Despite reductions in TSA in 12 out of the 32 years there was a net addition over the period to the extent of 10.16 million ha or about 7%. MCI (expressed as a ratio of sown area to cultivated area) estimated with FAO and USDA series on cultivated areas show divergence during 1983-1996 conforming exactly with the years in which the series were revised. For the periods 1978-82 and 1997-2003 they are almost identical but the indices in the latter period (using both the series) are significantly lower-beginning with almost 1.5 and falling to 1.2.[10]. But clearly in both periods MCI was falling.

Trends in irrigated areas during the period 1978-2009 show a reduction in the first phase of reforms falling by close to a million ha (or 2%) between 1979 and 1985. Nickum (1995) attributes this to three factors; normal capacity reduction due to aging of reservoirs and infrastructure, declines in pump irrigated areas due to inoperability or technical reasons, irrigated land diverted to non-agricultural uses. In the next five years however, there was a recovery of close to 3.37 million ha with the major increase occurring in 1990 (2.5 million ha). During 1986-2009, irrigated area grew at an annual average rate of over 12%. The corresponding net addition over the same period was over 15 million ha.

[9] These figures are from China Statistical Yearbook 1996.

[10] Since the trends in the value of the MCI result from the combined effect of variations in both cultivated and sown areas, a reduction in the former increases the value of MCI if there is a less than proportionate fall in the latter. For the period 1983-1996, the divergence in the two series (USDA and FAO) is purely statistical. Therefore, comparing the periods before and after this period it can be inferred that MCI was gradually falling.

| Table 4. China: Total Sown Areas, Multiple Cropping Indices and Irrigated Areas 1978-2009 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Total Sown Area | | Multiple Cropping | | Irrigated Area (IA) | | %Share of IA in Cultivated | %Share of |
| | TSA | Change | MCI-USDA | MCI- | Total | Mechanical | | |
| 1978 | 148477 | | 1.49 | 1.48 | 44965 | 24895 | 45.2 | 55.4 |
| 1979 | 146379 | -2097 | 1.47 | 1.46 | 45003 | 25321 | 45.3 | 56.3 |
| 1980 | 145157 | -1222 | 1.46 | 1.45 | 44888 | 25315 | 45.1 | 56.4 |
| 1981 | 144755 | -403 | 1.46 | 1.43 | 44574 | 25231 | 44.9 | 56.6 |
| 1982 | 143993 | -761 | 1.45 | 1.42 | 44177 | 25145 | 44.6 | 56.9 |
| 1983 | 144221 | 228 | 1.46 | 1.26 | 44644 | 25265 | 45.3 | 56.6 |
| 1984 | 143626 | -595 | 1.46 | 1.24 | 44453 | 25062 | 45.2 | 56.4 |
| 1985 | 144204 | 578 | 1.47 | 1.15 | 44036 | 24629 | 45.0 | 55.9 |
| 1986 | 144957 | 753 | 1.50 | 1.14 | 44226 | 25032 | 45.7 | 56.6 |
| 1987 | 144869 | -88 | 1.51 | 1.12 | 44403 | 24825 | 46.1 | 55.9 |
| 1988 | 146554 | 1685 | 1.53 | 1.13 | 44376 | 26083 | 46.3 | 58.8 |
| 1989 | 148362 | 1808 | 1.55 | 1.13 | 44917 | 26107 | 46.9 | 58.1 |
| 1990 | 149586 | 1224 | 1.56 | 1.14 | 47403 | 27148 | 49.6 | 57.3 |
| 1991 | 149007 | -579 | 1.56 | 1.13 | 47822 | 27629 | 50.0 | 57.8 |
| 1992 | 147741 | -1266 | 1.54 | 1.12 | 48590 | 28283 | 50.8 | 58.2 |
| 1993 | 148241 | 500 | 1.55 | 1.13 | 48728 | 31625 | 51.1 | 64.9 |
| 1994 | 149879 | 1639 | 1.58 | 1.14 | 48759 | 31528 | 51.3 | 64.7 |
| 1995 | 152381 | 2501 | 1.61 | 1.15 | 49281 | 32205 | 51.9 | 65.3 |
| 1996 | 153969 | 1589 | 1.62 | 1.16 | 50381 | 32891 | 53.0 | 65.3 |
| 1997 | 155706 | 1737 | 1.20 | 1.19 | 51239 | 34370 | 39.4 | 67.1 |
| 1998 | 156373 | 667 | 1.20 | 1.18 | 52296 | 34716 | 40.3 | 66.4 |
| 1999 | 156300 | -73 | 1.21 | 1.18 | 53158 | 35639 | 41.0 | 67.0 |
| 2000 | 155708 | -592 | 1.21 | 1.18 | 53820 | 35954 | 41.7 | 66.8 |
| 2001 | 154636 | -1072 | 1.21 | 1.18 | 54249 | 36212 | 42.3 | 66.8 |
| 2002 | 152415 | -2221 | 1.19 | 1.17 | 54355 | 36213 | 42.6 | 66.6 |
| 2003 | 153553 | 1138 | 1.22 | 1.19 | 54014 | 36162 | 42.9 | 66.9 |
| 2004 | 153553 | 0 | 1.24 | 1.14 | 54478 | 36055 | 44.2 | 66.2 |
| 2005 | 155488 | 1935 | 1.27 | 1.19 | 55029 | 36715 | 44.9 | 66.7 |
| 2006 | 152149 | -3339 | 1.25 | 1.16 | 55750 | 37762 | 45.7 | 67.7 |
| 2007 | 153464 | 1315 | 1.26 | 1.25 | 56518 | 37762 | 46.4 | 66.8 |
| 2008 | 156266 | 2802 | 1.28 | 1.28 | 58472 | | 48.0 | |
| 2009 | 158639 | 2374 | | | 59261 | | | |
| MIA – Irrigation with mechanical power. Irrigated area as a share of Cultivated area uses the USDA series in Table 6.1c. Source: USDA, CSY (various years) | | | | | | | | |

The more significant and serious post reform developments relate to changes in the distribution of sown areas across various crops. **Table 5** compiles three year average shares of sown areas of various grain crops in total sown area. The area under grain crops (that includes besides all cereals, soyabeans and tubers) that stood at 81% of TSA during 1978-81 fell gradually over the next 3 decades to 69% during 2007-09. In absolute terms,

this amounted to a reduction by over 11.6 million ha **(Table 6)**. Among the grain crops however, corn and soya beans expanded their shares at the cost of other grains. The share of non-food crops also fell from around 10% to just 1.7% in 2009. Correspondingly, non-grain food crops in TSA rose dramatically from just over 9% to almost 30% in the same period. Among the non-grain food crops, as a share in TSA, between 1978 and 2009, area under fruit crops rose 7 times (from 1% to 7%), vegetable sown area expanded almost 4.5 times (2.5% to 11.6%) while oil crops more than doubled (4% to 8.6%). The share of non food crops changes marginally from 45 to 3.9%[11]**.**

| **Table 5. China: Composition of Total Sown Area 1978-2009 (proportions)-3-year averages** | | | | | |
|---|---|---|---|---|---|
| | **Rice** | **wheat** | **corn** | **soyabean** | **tubers** |
| 1978-79 | 0.232 | 0.197 | 0.134 | 0.048 | 0.079 |
| 1980-82 | 0.231 | 0.197 | 0.134 | 0.055 | 0.067 |
| 1983-85 | 0.228 | 0.203 | 0.127 | 0.052 | 0.062 |
| 1986-88 | 0.221 | 0.200 | 0.135 | 0.057 | 0.061 |
| 1989-91 | 0.220 | 0.205 | 0.142 | 0.055 | 0.061 |
| 1992-94 | 0.208 | 0.201 | 0.141 | 0.076 | 0.062 |
| 1995-97 | 0.203 | 0.192 | 0.154 | 0.071 | 0.063 |
| 1998-2000 | 0.197 | 0.182 | 0.158 | 0.076 | 0.066 |
| 2001-03 | 0.181 | 0.153 | 0.158 | 0.084 | 0.065 |
| 2004-06 | 0.187 | 0.148 | 0.174 | 0.082 | 0.058 |
| 2007-09 | 0.187 | 0.153 | 0.193 | 0.077 | 0.054 |
| | **Other grain** | **total grain** | **non-grainfood** | **total food** | **non-food** |
| 1978-79 | 0.122 | 0.812 | 0.091 | 0.903 | 0.097 |
| 1980-82 | 0.112 | 0.797 | 0.113 | 0.910 | 0.090 |
| 1983-85 | 0.104 | 0.777 | 0.130 | 0.907 | 0.093 |
| 1986-88 | 0.088 | 0.762 | 0.162 | 0.923 | 0.077 |
| 1989-91 | 0.073 | 0.756 | 0.171 | 0.927 | 0.073 |
| 1992-94 | 0.051 | 0.739 | 0.195 | 0.934 | 0.066 |
| 1995-97 | 0.043 | 0.726 | 0.224 | 0.950 | 0.050 |
| 1998-2000 | 0.036 | 0.716 | 0.251 | 0.967 | 0.033 |

[11] These are estimates from CSY various issues. A detailed examination of these trends in available in Natrajan (2011)

| | | | | | |
|---|---|---|---|---|---|
| 2001-03 | 0.030 | 0.672 | 0.287 | 0.959 | 0.041 |
| 2004-06 | 0.025 | 0.674 | 0.284 | 0.958 | 0.042 |
| 2007-09 | 0.022 | 0.686 | 0.287 | 0.974 | 0.026 |
| Source: CSY, various years | | | | | |

Complex interactive cumulative effects of agricultural price and non-price policies besides the expansion of markets for 'superior' food products directly translated into increased demand that were relatively outside the scope of these policies appear to explain the changes in the composition of sown areas discussed above[12].

The large declines in grain sown areas by the early 1990s brought about an important policy initiative almost identical to the local grain sufficiency policy of the 1960s and the 1970s in the form of the Governor grain responsibility system[13].

**Table 6. China: Changes in Sown areas of various crops 1978-2009 (various periods)**

**Grain Crops, 1000 ha**

| | **Rice** | **Wheat** | **Corn** | **Soyabean** | **Tubers** | **Oth.Grains** | **Total** |
|---|---|---|---|---|---|---|---|
| **1978-85** | -2351 | 35 | -2267 | 574 | -3224 | -4509 | -11742 |
| **1986-90** | 994 | 1535 | 3707 | -159 | 549 | -2007 | 4621 |
| **1991-94** | -2893 | -1773 | -249 | 5177 | 150 | -5333 | -4922 |
| **1995-98** | 1042 | 793 | 4087 | -1065 | 730 | -343 | 5243 |
| **1999-2003** | -4706 | -7777 | -1171 | 1228 | -298 | -1653 | -14377 |
| **2003-2009** | 3119 | 2294 | 7114 | -950 | -1066 | -936 | 9575 |
| **1978-2009** | -4794 | -4892 | 11221 | 4805 | -3160 | -14782 | -11602 |

**Non-Grain Crops, 1000 ha**

| | **Cotton** | **Oilcrops** | **Sugar Crops** | **Tobacco** | **Vegetables** | **Tea** | **Fruit** |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| **1978-85** | 274 | 5578 | 421 | 529 | 1017 | 31 | 1080 |
| **1986-90** | 447 | -900 | 384 | 280 | 1585 | 16 | 2443 |
| **1991-94** | -60 | 1181 | 76 | -103 | 2583 | 74 | 2085 |
| **1995-98** | -1069 | 838 | 230 | -129 | 3372 | -78 | 1271 |
| **1999-2003** | 651 | 2071 | -327 | -97 | 5661 | 150 | 902 |
| **2003-2009** | -159 | -1338 | 226 | 128 | 461 | 641 | 1703 |
| **1978-2009** | 85 | 7430 | 1010 | 608 | 14678 | 835 | 9484 |

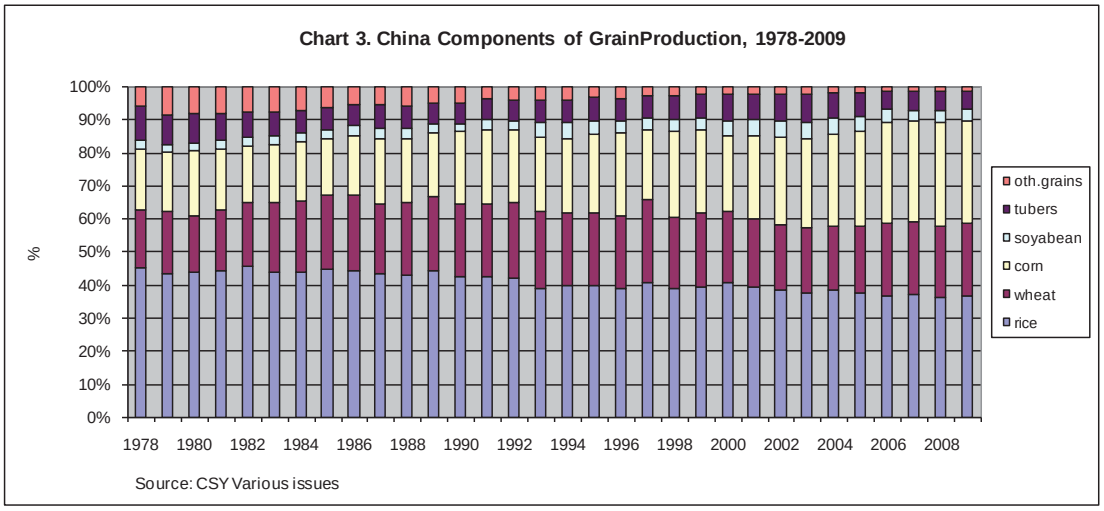
Source: CSY, various issues

[12] The overall procurement price index for agricultural and sideline products rose at an annual average rate of over 7% between 1978 and 1992.

[13] This is discussed in detail in Natrajan (2011) (chapter 5 section 5.1)

Important shifts occurred among grain crops too. Though, rice continues to be the major grain crop both in terms of acreage and proportion of output, the share of wheat and corn increased significantly. In 1978 the shares of the three crops rice, wheat and corn (by weight) in total grain output were 45%, 17.5% and 18.4% respectively. **Chart 3** depicts the trends in the shares of all the grain crops. The share of rice consistently fell over the entire period to account for 36.8% in 2009 while wheat share was marginally higher (21%) but the share of corn rose by 12 percentage points to almost 31%. While minor grains and coarse grains (excepting corn) together fell from an already low figure of 6% just 1.4% in 1978 and 2009 respectively, that of tubers was halved (10.4% to5.6%) and that of soyabeans marginally increased from 2.5% to 3.6%.

It is clear that the shift towards production of commercial crops was very rapid but at the cost of grain production. After 1985 when the growth in grain production began to taper the government introduced measures to reverse the trend[14]. But as the data shows, the effect was the opposite to what was desired officially.



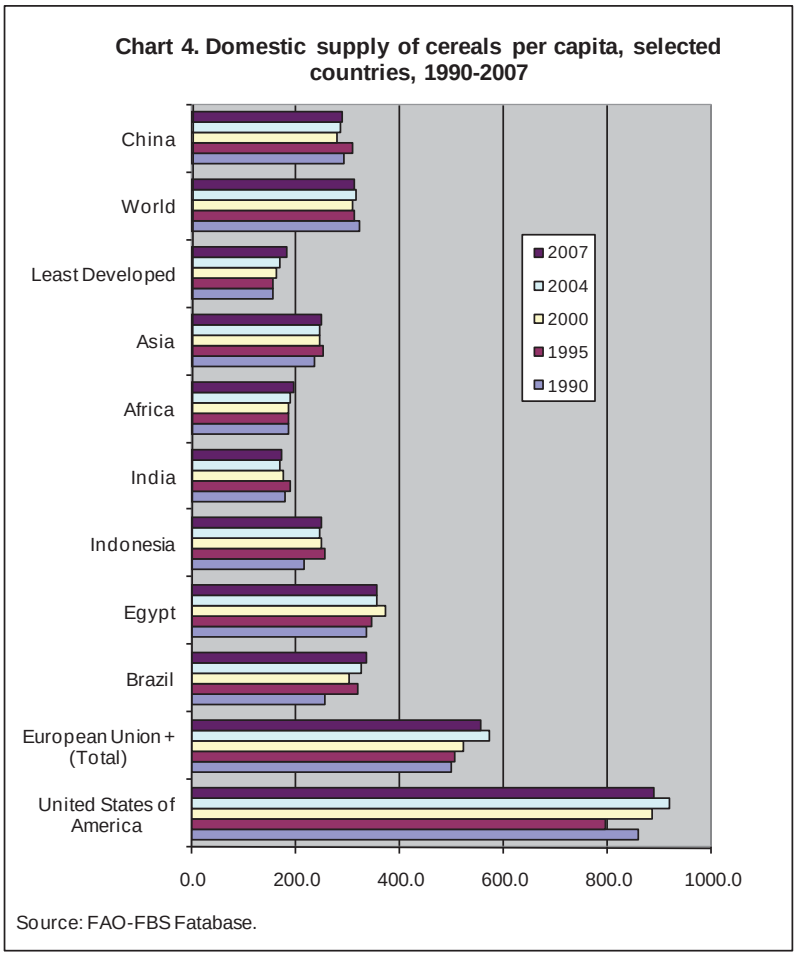

| Table 7. China; Per capita output of meat and aquatic products, 1978-2009 (kgs) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Meat products** | | | **Aquatic products** | | | |
| | Meat-total | pork | poultry | total | freshwaer | marine | other |
| 1978-79 | 13 | 10 | 2 | 6 | 1 | 3 | 1 |
| 1980-84 | 16 | 13 | 2 | 6 | 2 | 3 | 1 |
| 1985-89 | 22 | 18 | 2 | 10 | 4 | 4 | 3 |
| 1990-94 | 32 | 24 | 5 | 16 | 6 | 5 | 5 |

[14] For example, a special tax was levied on producers of high-value crops such as fruit and a grain development fund was established.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1995-99 | 44 | 30 | 8 | 29 | 11 | 8 | 10 |
| 2000-04 | 52 | 34 | 10 | 34 | 13 | 8 | 12 |
| 2005-09 | 53 | 35 | 10 | 33 | 13 | 8 | 12 |
| **Indices** | | | | | | | |
| | **Meat products** | | | **Aquatic products** | | | |
| | Meat-total | pork | poultry | total | freshwtaer | marine | other |
| 1978-79 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1980-84 | 128.5 | 131.5 | 110.5 | 110.0 | 142.4 | 95.7 | 115.2 |
| 1985-89 | 177.9 | 180.0 | 154.5 | 182.7 | 306.4 | 115.3 | 234.0 |
| 1990-94 | 250.7 | 235.6 | 284.3 | 284.1 | 473.4 | 169.1 | 391.7 |
| 1995-99 | 346.6 | 292.9 | 507.9 | 509.4 | 889.3 | 266.0 | 756.0 |
| 2000-04 | 414.2 | 337.4 | 640.4 | 591.1 | 1079.0 | 264.8 | 941.6 |
| 2005-09 | 421.5 | 343.3 | 647.8 | 590.0 | 1088.9 | 258.0 | 944.0 |
| **Change over periods (%)** | | | | | | | |
| | **Meat products** | | | **Aquatic products** | | | |
| | Meat-total | pork | poultry | total | freshwater | marine | other |
| 1978/79-1980-84 | 28.5 | 31.5 | 10.5 | 10.0 | 42.4 | -4.3 | 15.2 |
| 1980/84-1985/89 | 38.4 | 36.9 | 39.8 | 66.1 | 115.2 | 20.5 | 103.1 |
| 1990/94-1995/99 | 41.0 | 30.9 | 84.0 | 55.5 | 54.5 | 46.7 | 67.4 |
| 1990/94-1995/99 | 38.2 | 24.3 | 78.6 | 79.3 | 87.9 | 57.3 | 93.0 |
| 1995/99-2000/4 | 19.5 | 15.2 | 26.1 | 16.0 | 21.3 | -0.5 | 24.6 |
| 2000/04-2005/09 | 1.8 | 1.7 | 1.1 | -0.2 | 0.9 | -2.5 | 0.3 |
| 5 year averages except for 1978-9; Source: FAO-FBS Database and CSY various years | | | | | | | |

## 3. Changing Composition and Availability of Food

It has been observed from the FAO-FBS (Food Balance Sheets of the FAO) – which has been recorded on a comparable basis since the 1960s - that in developing countries as per capita average income rises, as a rule the per capita demand for grains also rises quite sharply since in addition to being directly consumed, much more grain is used as feed for raising the output of animal products, and also more grain is processed. In short there is a positive income elasticity of demand for grain.




What is true of a country which raises its per head income over time, is also true cross-sectionally, of countries which have widely different levels of income at any given point of time. Looking at countries at different levels of per capita income in 2007 **(Chart 4)** we see that the highest grain consumption per head in the world (nearly 900 kg. annually) is in the richest country USA followed by Western European countries (500 kg. to 650 kg.) and the lowest per head grain consumption is in the South Asian, African and the least developed countries, ranging between 175 kg to 200 kg. per head. Middle income countries like Mexico record intermediate figures of around 350-400 kg. per head. This pattern has been constant for the last few decades, only the grain consumption numbers have risen over time (except in both China and India in the last 15 years, despite rise in their per capita income). Further, the richer the country the higher is the observed share of its grain consumption which is indirect, with USA and India constituting the extremes. Only one-eighth of US grain consumption is direct and the bulk, nearly 88 percent is indirect, while only one-eighth of India's grain consumption is indirect while the bulk is direct. By 2007 China's grain consumption per capita was about the world average level and nearly half was indirectly consumed.

| **Table 8. Comparison of Cereal production and utilization in selected countries and Regions, 2007** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | millions | 1000 metric tons | | | | | |
| | Population - | Production ) | Net Imports | DS* | Feed | Food | other uses |
| European Union | 493.5 | 261015 | 959 | 275029 | 168316 | 61710 | 45021 |
| United States of America | 308.7 | 412169 | -96574 | 274560 | 162027 | 34450 | 78088 |
| Brazil | 190.1 | 65758 | -1140 | 64118 | 33179 | 21695 | 9244 |
| Egypt | 80.1 | 19275 | 9292 | 28632 | 7099 | 18476 | 3077 |
| Indonesia | 224.7 | 51412 | 7493 | 56031 | 6102 | 39368 | 10562 |
| India | 1164.7 | 212344 | -7196 | 202884 | 7950 | 177682 | 17254 |
| Africa | 962.7 | 130802 | 53214 | 188864 | 26480 | 138687 | 23753 |
| Asia | 3963.8 | 944389 | 66559 | 987498 | 225697 | 619473 | 142531 |
| Least Developed Countries | 771.1 | 125892 | 19377 | 140428 | 10677 | 105525 | 24259 |
| World | 6590.5 | 2121320 | -21440 | 2066740 | 74587 | 966236 | 355253 |
| **Kgs per capita per year** | | | | | | | |
| | | **food** | **feed** | **other** | **DS*** | | |
| United States of America | | 111.6 | 524.9 | 253.0 | 889.5 | | |
| Brazil | | 114.1 | 174.5 | 48.6 | 337.2 | | |
| European Union | | 125.1 | 341.1 | 91.2 | 557.4 | | |
| Least Developed Countries | | 136.9 | 13.8 | 31.5 | 182.2 | | |
| Africa | | 144.1 | 27.5 | 24.7 | 196.3 | | |
| China | | 152.5 | 89.9 | 46.7 | 289.1 | | |
| India | | 152.6 | 6.8 | 14.8 | 174.2 | | |
| Asia | | 156.3 | 56.9 | 36.0 | 249.2 | | |
| Indonesia | | 175.2 | 27.2 | 47.0 | 249.4 | | |

| | | | | | |
|---|---|---|---|---|---|
| Egypt | 230.8 | 88.7 | 38.4 | 357.9 | |
| World | 146.6 | 113.2 | 53.9 | 313.7 | |
| *DS – domestic supply: Source: Patnaik (2011) and FAO-SUA | | | | | |

In this context it is important to mention that there is a widely-held but clearly incorrect idea that the consumption demand for grain is negatively related to income, namely there is a negative income-elasticity of demand for grain. It is argued that as their income rises consumers diversify away from consuming grain which becomes an inferior good, to vegetables, fruit and animal products. Thus, according to this view, when per head grain output is declining and is not compensated by imports so that per head grain supply (total including both direct and indirect) is also falling, there is nothing surprising or alarming about it since it merely reflects diversification of diets to higher value foods as people get better off.

The fallacy in the above argument is rectified by examining data for 2007 in **Table 8**. In the advanced industrial countries such as the USA and in the EU, whereas direct consumption of grain was at about 110 kgs per capita, much lower than India and China (around 150 kgs). However, the total consumption (or demand) was close to 900 kgs in the USA and over 550 kgs in the EU where as the corresponding figures for India and China were about 289 kgs and 174 kgs respectively.

In China, corresponding to the 0.5% increase in total food grain production per capita, trend annual growth rates in the various components of animal food products were at the minimum of 5.7% for pork, close to 10% for poultry and over 12% in the case of beef resulting in a combined meat output growth of nearly 7% p.a. during 1978-2007. In the absence of significant increases in net imports of either food grains or feed, and assuming minimum grain to meat conversion rates this would imply a net decline in the availability of food grains for direct consumption.

The official view in this regard has been to interpret the changing composition of food – increasing meat consumption and corresponding decline in direct consumption of food grains – as an attainment of 'nutritional prosperity' signaling the onset of a prosperous stage in overall economic development. Official statistical representation of prosperity (or at the least nutritional well being) has taken the form of a annual data series on Engel's coefficient for both rural and urban China[15]. Expressed as a ratio of total living (consumption)

[15] Engel's law states that as household income increases beyond a certain level, the share of food expenditure begins to fall even though the absolute expenditure on food may increase. Just as for an individual, for a society too with increases in per capita GDP, Engel's law begins to operate and such a stage has been interpreted as the onset of 'prosperity'.

expenditure, the share of food declined from 67.7% in 1978 to 41% in 2009 for rural China while the corresponding decline for Urban residents was from 57.5% to 36.5% in the respective years.

This can be interpreted in two ways. Income growth far outstripped the share that is required to meet food expenditure and leaving an increasing share for other expenditure which corresponds to the basic idea of Engel's law. The other inference that can be drawn is that expenditure to meet needs other than food had become overwhelmingly high resulting in compressing food expenditures substantially. The former would represent improvements in food consumption and nutrition only if the reducing share in total expenditures also expanded the absolute quantity of food consumed while for the latter to be accepted it would suffice if the relative decline of food expenditure also reduced food availability. These inferences however are conditional upon other factors such as concerning food supplies, changes in behavioual parameters besides the initial level and composition of food consumed. More important in this regard are changes in the distribution of income between different classes and their effect on the volume of food consumption and its composition.

From **Table 9**, we can observe the trends in both the components of total demand for the main categories of food grains – cereals and starchy roots (tubers)[16]. As regards total food grains available together as food and feed, the per capita availability steadily fell from 1984 onwards from 292 kgs to 279 kgs in 1994. During 1995-99, though direct consumption was below the all time high of 1984, indirect consumption was 90kgs on average rising from 70kgs per capita on average during 1991-94.

**Table 9. China: Production, Domestic Supply and Utilization of Food Grains*, 1978-2009 (3 year averages except 1978-79 ) million tons**

| | Population | Production | Net Imports | Domestic Supply | Food | Feed | Other uses* |
|---|---|---|---|---|---|---|---|
| 1978-79 | 969.0 | 273.0 | 13.5 | 280.8 | 204.4 | 50.2 | 26.2 |
| 1980-82 | 1001.4 | 278.5 | 18.2 | 300.3 | 218.9 | 53.9 | 27.5 |
| 1983-85 | 1044.1 | 327.3 | 11.8 | 336.9 | 243.5 | 61.4 | 32.0 |
| 1986-88 | 1092.8 | 329.8 | 12.8 | 343.5 | 245.8 | 61.8 | 35.9 |
| 1989-91 | 1142.9 | 360.8 | 15.3 | 371.8 | 254.7 | 76.4 | 40.8 |
| 1992-94 | 1185.1 | 377.3 | 4.0 | 386.4 | 257.9 | 83.5 | 44.9 |

[16] The quantum of total pulses (both as food and as feed) available was already at a low level of about 6 kgs in 1978 and fell to less than 2.5 kgs per capita.). See Table 7.1c

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1995-97 | 1223.8 | 413.0 | 16.2 | 424.8 | 259.8 | 113.7 | 51.4 |
| 1998-00 | 1257.6 | 417.0 | 0.5 | 415.0 | 258.7 | 109.7 | 46.6 |
| 2001-03 | 1284.4 | 376.5 | -4.3 | 383.3 | 238.6 | 101.1 | 43.6 |
| 2004-06 | 1307.3 | 409.7 | 9.1 | 419.4 | 226.8 | 130.1 | 62.5 |
| 2007-09 | 1314.4 | 420.9 | 4.4 | 420.6 | 224.8 | 131.3 | 64.5 |
| | Per capita, Kg | | | | Share in domestic supply | | |
| | Production | DomesticSupply | Food | Feed | Food | Feed | Indirect* |
| 1978-79 | 281.7 | 290.6 | 207.8 | 51.0 | 71.5 | 17.5 | 28.5 |
| 1980-82 | 278.1 | 300.2 | 215.0 | 52.9 | 71.6 | 17.6 | 28.4 |
| 1983-85 | 313.5 | 323.0 | 229.5 | 57.9 | 71.1 | 17.9 | 28.9 |
| 1986-88 | 301.8 | 313.9 | 221.4 | 55.7 | 70.5 | 17.7 | 29.5 |
| 1989-91 | 315.7 | 323.9 | 219.4 | 65.7 | 67.7 | 20.3 | 32.3 |
| 1992-94 | 318.3 | 324.2 | 214.6 | 69.5 | 66.2 | 21.4 | 33.8 |
| 1995-97 | 337.5 | 345.5 | 209.9 | 91.9 | 60.7 | 26.6 | 39.3 |
| 1998-00 | 331.6 | 328.5 | 203.4 | 86.3 | 61.9 | 26.3 | 38.1 |
| 2001-03 | 293.1 | 296.5 | 183.3 | 77.7 | 61.8 | 26.2 | 38.2 |
| 2004-06 | 313.4 | 317.8 | 171.9 | 98.6 | 54.1 | 31.0 | 45.9 |
| 2007-09 | 320.2 | 316.7 | 169.3 | 98.9 | 53.5 | 31.2 | 46.5 |

Food grains refer to cereals, starchy roots at $1/5^{th}$ weight and pulses

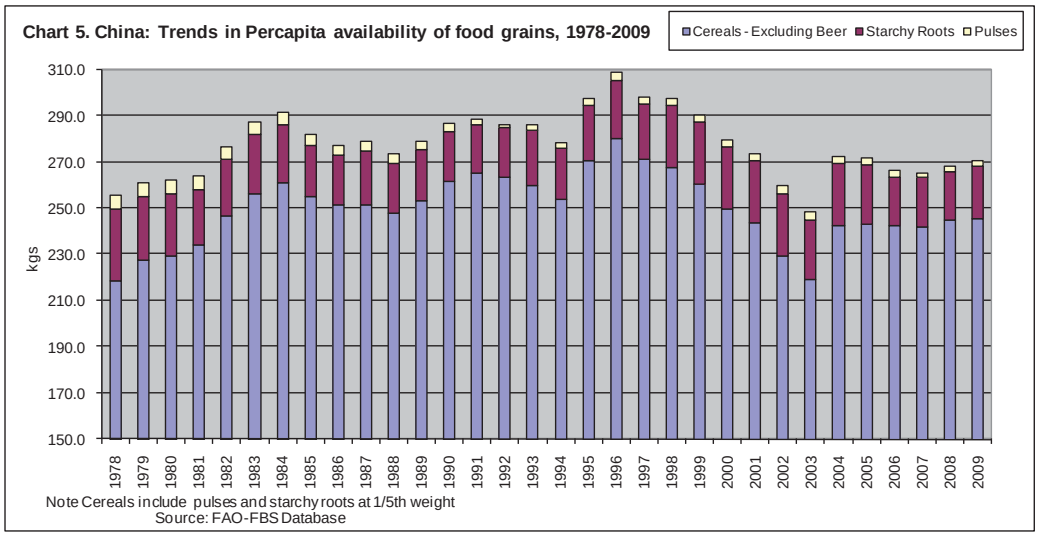
Indirect includes allocations towards seed, waste in processing and other uses (food and non-food manufacture).

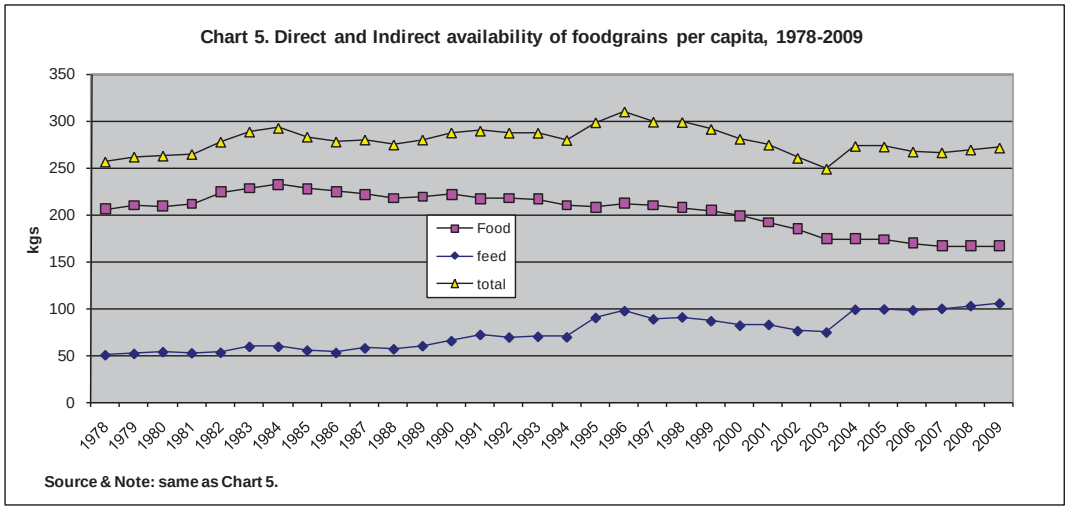
Source: FAO-FBS Database

Beyond 1996, the decline continued until 2003 reaching the lowest for the entire period before recovering and falling again during 2004-07. These are easily inferred from **Chart 5**, mapping the total availability of the three components of food grains for 1978-2007 and **Chart 6** representing the same figures by direct and indirect components of total availability.

Indirect consumption of grain in the form of animal feed rose from roughly 18 percent of domestic supply in the mid-1980s to over 26 percent by the mid-1990s in the rising output phase, and continued to rise further to nearly 31.5% percent by 2007 even in the phase of stagnant output. Over the entire period 1978-79 to 2007-09 grain output grew at 1.53%.

Another significant trend is also evident as regards the composition of cereals. Both rice and maize availability for direct consumption fell steadily though slowly after 1984 until 2007, but the total decline together was not compensated by the increases observed for wheat over the same period. Thus, total direct cereal consumption fell from a high in 1984 of 213 kgs to 152.5 kgs in 2007 – levels that were seen in 1970. The trends in tuber availability per capita for both direct and indirect consumption shows a mixed trend though a general decline is evident from the early years of reform to the last years of the period under consideration.




A significant amount of grain was diverted from direct consumption towards production of animal products which as examined in the previous chapter revealed enormous increases in per capita terms. Besides, animal

products, there were also impressive increases in the availability of vegetables, fruits and vegetable oils besides modest increases in sugar. The next section examines the trends in the non-grain food sector.

Diversification of food production during 1978-2009, entailed a rapid expansion of sown areas to vegetables and fruits and given the slower expansion in total sown area meant a net reduction of areas under tubers and grain crops with the exception of maize. The increase in maize areas however, as seen in **Table 5,** was almost entirely directed at increasing the availability as feed.

The enormous increase in areas under vegetables and fruits besides maize was compensated for by large declines in areas under rice, wheat and tubers. The reduction in wheat areas and the consequent slow growth over the entire period at 1.7% p.a. was made up by net imports as discussed in the previous section. The availability of vegetables and fruits per capita in 2007 was respectively 5 and 9 times the 1978 values, whereas in the case of alcoholic beverages it was 7 times. While in the case of total meat the expansion was almost 5 times relative to 1978, pork availability was close to 4 times in 2007. While the increases in vegetable and fruit production were a result of a trade-off against food grains through decreases in sown area in the latter, the increase in meat production comes about by an increase in the claim on food grain supplies as feed.

The latter relationship is such that for every kilogram increase in meat production the additional food grain required depends on the grain to meat conversion ratios (or rates). Given that meat production increased much more rapidly than domestic supplies of food grains in the entire period, at constant conversion rates this is possible only by a commensurate reduction in the proportion of food grains available for uses other than feed or more importantly directly as food. It was already seen that there was a net decline in per capita availability of grains for direct consumption. The growth rate of total domestic supply of food grains during 1978-2007 was 1.28% p.a., while that of total direct food was just 0.28%.

It must however, be clarified here that feed demands by other livestock sectors such as (sheep)wool production, bovine milk production besides fisheries (that marginally require grain based products) and draught animals are not taken into account in these estimates. Including the claimants other than meat producing animals would reduce the conversion ratios even further for the entire period. In an integrated agricultural systems grain is an important part of feed though not the only component. The ecological conditions and environmental parameters of China provide a larger set of feed types – grasslands, fodder crops besides many varieties of plant species – that substantially reduce feed grain demand. In addition, the traditional practice of utilizing crop residues as part of livestock feed has been fundamental and an expansion

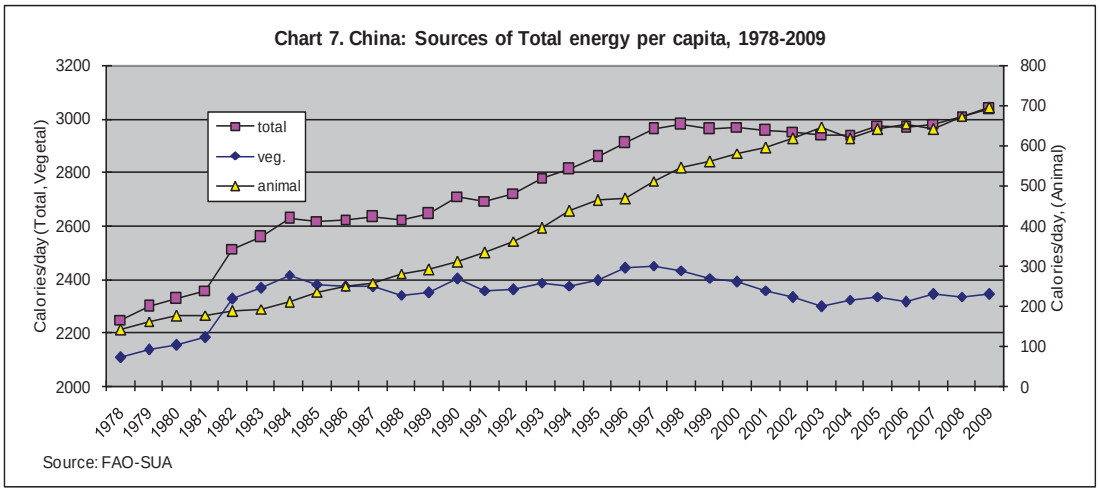
of farm output by itself creates possibilities for expanding livestock. However, the emergence of specialized production units as well as modern commercial livestock production complexes in post-reform China did lay claim to a growing proportion of grain for feed. The fundamental issue of the trade-off between food and feed in post-reform Chinese agriculture and the issues concerning access to food under conditions of an increasing unequal distribution of income is taken up for discussion below.

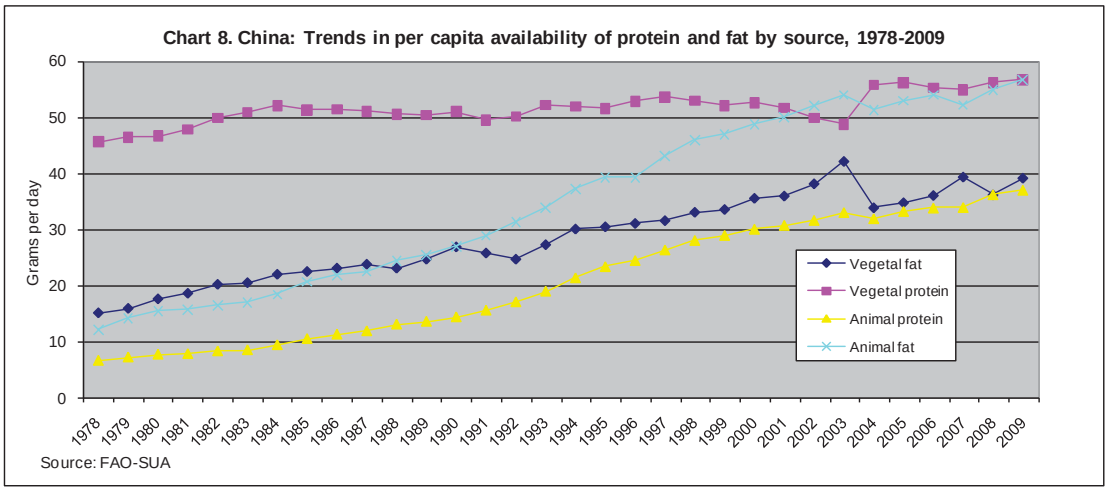
## 4. Trends in Nutrition under a Regime of Food vs. Feed

Changes in the composition of diet brought about by variations in the direct and indirect components of food grain demand translates into changes in the availability of the three components of nutrition – energy (calories), protein and fat. Further, an increase/decrease in the availability of other items of food such as vegetables, fruits directly alters the supply of micronutrients in the form of various types of vitamins that are vital to reduce the incidence of morbidity. The decline in the availability of food grains per capita and the consequent increase in the quantities of animal products therefore had a significant effect on the per capita nutritional profile revealed in **Charts 7.4 and 7.5** for the period 1978-2007. Total energy supply per capita increased rapidly from 2247 k cal to 2624 between 1978 and 1984 and grew at a slower pace until 1998 to attain a peak level of close to 3000 Kcal but subsequently fell until 2004. The increase thereafter was marginal.

In effect, from 1998 onwards until 2007 there was almost a stagnation explained by a more a rapid decline in energy supply from vegetal sources but only a gradual increase from animal sources. But vegetal sources remained predominant as regards energy supply, though there was a gradual decline in their share from close to 94% in 1978 to about 79% on average during the 2000s **(Table T7.3).**

As regards protein and fat availability, the share of vegetal sources fell more rapidly though they still accounted for an average of 62.5% during 2004-07 falling from over 87% in 1978. The shares of vegetal and animal sources in total fat availability per capita were reversed over the entire period – from roughly 55% and 45% in 1978. Table 7.3a presents the share of vegetal sources of energy by various components and Table 7.3b, the shares of fat and protein from these sources.




By 1978, even before formal reforms were initiated, the nutritional status on a per capita basis was already above the required or recommended levels in all three dimensions. Post-1978, the increase in protein and fat availability expanded much faster than that of energy supplies. Additionally the large increases in availabilities of vegetables and fruits point to vast improvements in micro nutrient availability too. This is consistent with observed empirical regularities over the long term in the case of industrialized countries explained by behavioural changes in consumption preferences following growth in incomes. But when growth in incomes is accompanied by changes in the distribution of income across groups, the per capita supplies of various food categories may not truly represent nutritional status of those groups.

### 4.1 The issue of Food versus Feed :A Theoretical Digression

One of the earliest theoretical elaboration and clarification in this regard is found in Yotopoulos (1985). The conventional formulation of demand for food as a function of population and income where an increase in

demand is proportional to that of population and less than proportional to changes in income due to the operation of Engels law, seeks to explain the growth of food demand mainly on population growth. The implication of this line of reasoning places population growth as the central cause for the emergence of food crises, famines or malnourishment. Yotopoulos points to three fallacies that underlie the conventional formulation arising from problems of aggregation. First, food as an aggregate category is actually a set of commodities, thus the growth of food consumption is owing to differential growth in these commodities. Secondly, the combination of food commodities and their elasticities of demand change at different levels of income – therefore the income elasticities are different across income categories. Thirdly, since population is a non-homogenous variable, changes in food demand depend on which income classes grow in size and by what quantum.

**Figure 1** is a stylistic representation of the basic hypothesis with regard to changes in direct and indirect consumption of food grains that accompanies income growth in a growing economy. The direct demand rises initially with the growth in income per capita and after a point of saturation would fall at higher income levels. The indirect component of total demand rises more steeply as the consumption per capita of animal products rise so as to offset the fall in direct demand.

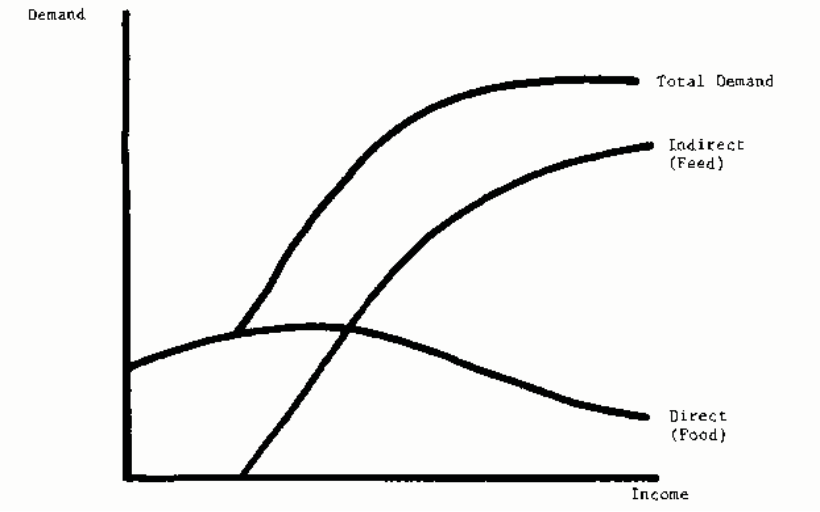



Figure 1. Total, direct and indirect demand for cereals
(Source: Yotopoulos PA, 1985 )

Without further background information on the nutritional content of animal products and the feed coefficients required to produce them, it may still not be very clear why in the Yotopoulos diagram, indirect demand increases much faster than direct demand declines, such that total demand rises steeply with rising income. Once we understand firstly, that animal products are weight for weight poor sources of energy

compared to grains, and second substantial weights of grain are required for conversion to animal products, the nature of the behaviour of total grain demand as income rises, becomes clearer. For illustrative purposes the energy and protein content of one kilogram of milk/ chicken, pork, and beef are compared below with the energy and protein content of the grain required as feed to produce these items, if that grain was directly consumed instead of being used as feed. The illustration is taken from Patnaik (2009).

**Table 10. Loss/Gain of Energy and Protein in converting feed grain to meat**

| | Energy (Kilocalories) | Protein (Grams) |
|---|---|---|
| 1 kg Chicken/Eggs gives | 1,090 | 259 |
| Requires 2kgs feed | 6900 | 200 |
| | | |
| 1 kg Pork gives | 1180 | 187 |
| Requires 3 kgs feed grain | 10,350 | 300 |
| | | |
| 1 Kg Beef gives | 1140 | 226 |
| Requires 7 kgs feed grain | 24150 | 700 |
| Source: Patnaik 2009 | | |

Though animal products like milk, eggs, meat are preferred by consumers as they get better off, the opportunity cost of consuming them in nutritional terms is very high. A kilogram of grain on average provides 3,450 kilocalories energy when directly consumed, and about 100 gms. protein. But a kilogram of eggs/ chicken provides only 1,090 kilocalories of energy – though a much higher protein intake. If a consumer who is getting better off, reduces one kilogram of grain directly consumed say over one week and substitutes it by eggs or chicken, but wishes to maintain the same energy intake as before, then 3.2 kg eggs/chicken would be required to maintain 3,450 calories, entailing a feedgrain demand of 6.4 kg. This feed grain if directly consumed as food, would have given 22,080 calories energy and 640 gms protein. Even if the well-to-do consumer puts up with halving his energy intake over the week in order to diversify his diet, the 1.6 kg. chicken/eggs consumed would still entail a derived grain demand of 3.2 kg., over three times higher than direct consumption of one kilogram grain in the initial state.

Thus if average incomes are rising (without much change in income distribution) then the rising feedgrain demand would indeed tend to far outweigh the fall in direct demand producing the steeply rising curve of total demand per capita depicted in the Yotopoulos diagram. The danger arises if in the process of growth income distribution itself becomes much more concentrated and grain output growth is insufficient. In such a

case diversification can take place within a falling per capita domestic supply entailing adverse nutritional outcomes for the majority[17].

In the final analysis, economic development and income growth that entails an expanding middle income classes has the potential to 'crowd-out' direct food consumption of the poor via higher income elasticities for indirect demand. The increasing role of markets in an integrated global economy, has a further potential to shift the 'crowding out' effect across countries and continents.

Revisiting **Chart 6**, it is clearly seen that after 1996 – with an all time peak in the per capita availability of total food grains of 309 kgs, there was a fall in all the three variables –total, direct and indirect availability – up to 2003 when the lowest total availability was recorded. The direct availability however had been declining since 1984 after reaching an all time peak of 233 kgs. As

During 1995 and 1996, net exports were to the tune of 27.7 and 17.4 million tons respectively and the sudden increase in total availability –of 18.6 kgs per capita in 1995 was accompanied by a reduction in direct availability by 1.6 kgs and 20.6 kgs per capita being diverted to feed. During 2004-07, while the additions to total availability per capita was 18.2 kgs, the additions to feed per capita was 23.5kgs the balance 5.3 kgs being the net reduction in per capita availability of direct food grain availability.

**5. Rural Urban differentials in Food Consumption and Nutrition**

In a context of rising income inequalities of various forms – inter-personal, inter-regional, intra-regional, rural urban, inter as well as intra rural and urban – a net decline in food grain availability for direct consumption can be of minimum concern only if the initial levels were so high as not to affect prescribed nutritional standards.

The evolution of the competition for food in general between the rural and the urban populations is taken up as an illustration of the issues discussed above. The intensity of the food versus feed problem emerges from data on per capita consumption of grain and meat in rural and urban areas. **Table 11** presents National Bureau of Statistics survey data on consumption of various foods in rural and urban areas. The rural data is denoted as 'consumption, whereas the urban data relates to purchases of various food items which implies that some food is consumed outside of home. Fuller et al (2000) examined the meat purchases data for urban residents

[17] Patnaik (2010) argues that such a process underlies the observed decline in Indian per capita domestic grain supply/ demand, and hence the observed decline from already low levels, in average calorie intake and protein intake over the economic reforms period, despite the fact that per capita income has been rising fast.

and consumption data for rural residents and estimated a shortfall of 40% between official reported meat production and total consumption. The consumption away from home according to their estimate could not amount to more than 10% of this shortfall and given inadequate storage facilities for meat in China, accumulation of stocks cannot account for the remainder of the shortfall. They conclude that meat production statistics are biased significantly upward. The FAO data used here is about 15% lower than official estimates. This problem however, does not affect a comparison of consumption figures of urban and rural residents.

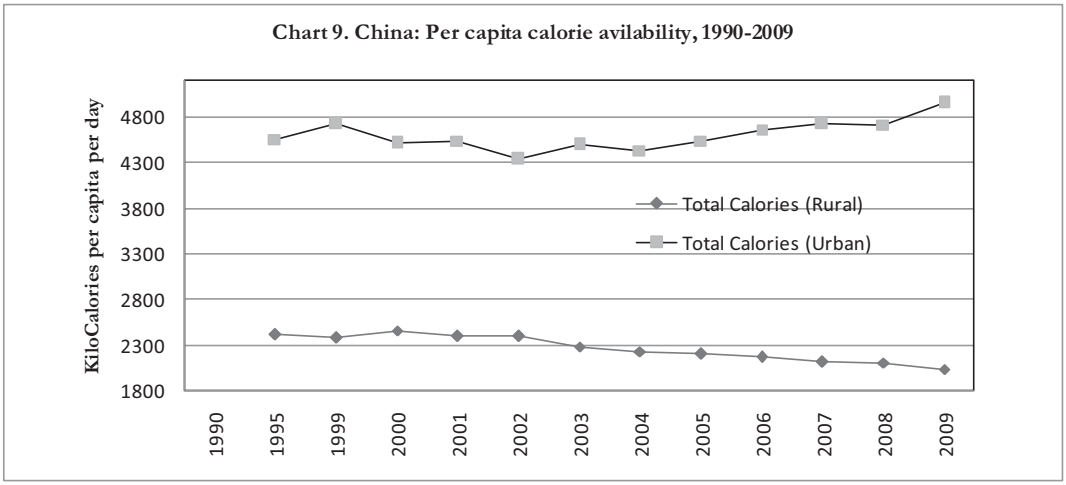
Data in **Table 11** appears consistent with the food balances statistics between direct consumption of grains and indirect consumption in the form of meat. The higher meat consumption by urban households is compensated for by a significantly smaller quantity of grain where as for the rural households the relatively lower meat consumption per capita is compensated for by significantly higher grain consumption per capita. The data in this table is however incomplete as the urban figures relate to only purchases of basic food items and understates total consumption that includes food consumed away from home. Thus the evidence is not convincing to accept such a line of thinking.

The ratio of rural to urban consumption of the items is provided in **Table 12** Clearly, rural residents have no advantage in consumption over urban residents in any of the food other than grain with consumption levels that are 2 to 3 times urban purchases over the period 1990-2009. As regards 'superior' or 'high-protein' food such as meat, milk and eggs the per capita rural consumption lags by wide margins except in the case of vegetables, edible oil and pork where the ratios are over 70% on average. In the case of fruits, the average is only 15% in the entire period though marginal improvements seem to have occurred during 2007-09.

A better understanding of relative levels of consumption is possible only if grain consumption for urban residents can be estimated. Official data provides grain production figures from which domestic supply to account for trade and the food component can be estimated using the ratios in FAO's supply and utilization accounts. This divided by the population gives the per capita supply of food grains according to the official definition that includes tubers (i/5$^{th}$ by weight), soyabeans and other minor grains. Since rural per capita consumption data is available for wheat and rice, consumption of other grains can be estimated as a residual. An alternate procedure would be to directly use FAO per capita supply figures for grain (including all the components according to the official definition) and deduct the rural per capita component weighted by rural population and estimate the urban per capita consumption for grain. The former procedure is used in the estimates here for grain and its components.

The latter procedure is used to estimate urban consumption per capita for all other food items in **Table 11** under rural consumption. **Table 13** is the result of such an exercise providing a more accurate estimate of urban consumption. The ratio of urban to rural consumption is calculated and presented in the same table. The results are striking, showing urban direct consumption levels of total grains, rice and wheat almost equal to the rural levels. Other grains account for a very small proportion of total grains and in this category the rural levels are higher. Except in the case of pork consumption, where the ratios of urban consumption is at the most 3 times rural levels (in just one year) but on average about 1.7 times the rural level, in all other components of superior food urban consumption levels are far higher – several times the rural levels. Clearly, at the aggregate level there has been a trade off between grain and meat – or food for feed – but in urban China though marginal reductions in per capita grain is seen from 2000 onwards but by 2007 it is higher than the rural levels in addition to much higher levels of meat, eggs, milk and fruit consumption .

A final exercise is also undertaken to estimate the changes in the calorific attainments with these sets of food consumption. Here the calorific equivalent per unit of a food item is drawn from the FAO data and used to estimate total calories for urban and rural residents and presented in **Chart 9** derived from **Table 14**.




The food items in the table account for 95% of total calorie supply per capita from all sources at the aggregate level (China as a whole) in 1990 and 1995. For 1999 and 2000 this figure is 93% and for the remaining years it amounts to 92%. Therefore, the estimates are fully representative of the nutritional status measured in terms of energy supply available for rural and urban China. Nutrition levels in rural China had already fallen to minimum recommended levels (of 2400 calories) until 2002. From 2003 onwards it has fallen below the norm and after 2005 it has further deteriorated to below 2200 calories per capita. Even after making a 7% adjustment for the food items not included in these estimates the level has clearly fallen below even 2200 calories per capita. Urban levels on the other hand, were double the rural levels until 2004 but since then the rural levels have fallen below half the urban levels. In many ways, the situation in the late 2000s, in terms of

level of rural nutrition is similar to 1978 only that this time the trend is declining whereas then it was on the rise.

**Concluding Remarks**

Rapid economic growth and increasing incomes following reforms marked an unprecedented transition in China's economic history. The transformations in agriculture have been equally striking. But as argued in this paper, in a reform environment where market mechanisms play a determining role, the differential growth of disposable incomes across the classes have also brought about an increasing wedge in food availability and nutrition. Changes in consumption patterns of the upper income classes have effectively determined changes in grain production patterns in such a manner as to result in a net loss of nutrition for the rest of the population. It may even be reasonable to suggest that these changes represent a major transitional phase in China's agriculture.

The decline in rural nutritional entitlements significantly below levels that are deleterious to human health resurrects the "san nong" problematic that was a central concern for the government until a few years ago. How and in what manner will this adverse developments impact the quest for a "harmonious society" is hard to predict.

It may however be pertinent for the government to address this issue with a renewed focus. Policy emphasis, simultaneously on two fronts are required in the coming decades if China seeks to avoid increasing pressures on food security. Since physical availability of food is not expanding commensurate with potential demand accompanying income growth, a primary emphasis on increasing food production is inevitable. Trade policy with regard to food also requires a reconfiguration. With severe limitations to augmenting the basic resource namely cultivable land, the feasible option may lie in reconfiguring crop diversification that is consistent with national needs rather than having market mechanisms determining the composition of food production.

A regime of enhanced agricultural support similar to that prevalent in Industrial economies is perhaps more if not equally relevant for China and other developing countries. This could take various forms viz. direct support to farming, subsidizing inputs, facilitating distribution of both inputs and produce, provision of storage and processing facilities that enable value addition near the production centres etc. Additionally, irrigation and water control as well as enhanced support to agricultural research and extension deserve attention.

At the consumption end, policy formulation aimed at safeguarding or even enhance entitlements to adequate food is perhaps equally important. Mere availability of adequate food at the aggregate level of the nation or province may not imply adequate actual consumption. State intervention in this sphere is crucial since the market is not capable of addressing deprivation or dis-entitlement problems.

**References:**


Brown, L.R., 1995, *Who Will Feed Chita? Wake up Cal[ for a Small Planet*, New York: W.W. Norton.

FAO, 1995, 'Global and Regional Food Demand and Supply Prospects', in Nurul Islam (ed.), *Population and Food in the Early Twenty-First Century*, Washington, DC: IFPRI.

Field, R.M (1993) "Trends in the Value of Agricultural Output, 1978-88" in Ash and Kueh (Eds.)(1993).

Huang, J.K. and S. Rozelle, (1998), *China's Grain Economy to the Twenty-First Century*, Beijing: China Agriculture Press.

Fan, S. and M. Agcaoili-Sombilla, 1997, 'Why Projections on China's Future Food Supply and Demand Differ', The *Australian Journal of Agricultural and Resource Economics*, Vo1.41, No.2, pp.169-90.

Mitchell, D., M. Ingco and R.C. Duncan, (1997), *The World Food Outlook*, Cambridge: Cambridge University Press.

Natrajan, Sriram, (2011), *Agrarian Change and Rural Transformation: China's Development Experience since 1965*, Doctoral Thesis submitted to Jawaharlal Nehru University, New Delhi.

Nickum, J.E. (1995) "Dam lies and other statistics: Taking the measure of irrigation in China, 1931-91", *East-West Center Occasional Papers (Environment Series)*, No. 18, January.

Nyberg, A., 1997, 'China Long-Term Food Security', *World Bank Report No.16469-CHA*, Washington D.C.: The World Bank.

OECD, (1995), *The Chinese Grain and Oilseed Sectors: Major Change Underway*, Paris: OECD.

Patnaik, U (2009) "Origins of the Food Crisis in India and in Developing countries" *Monthly Review* 61, 3, July-August 2009 , 63-77.

Patnaik, U. (2010) “Changes in Urban Poverty after economic reforms” *Economic and Politcal Weekly*, 28 July.

Rosegrant, M.W., M. Agcaoili-Sombilla and N.D. Perez, (1995), 'Global Food Projections to 2020: Implications for Investment', *2020 Vision Discussion Paper 5*, Washington D.C.: International Food Policy Research Institute.

Simpson, JR., X. Cheng and A. Miyazaki, (1994), *China's Livestock and Related Agriculture: Projection to 2025*, Wallingford: CAB International.

Smil, V (1999) “China’s Agricultural Land”, *China Quarterly, 158.*

USDA :ERS, (1994), *'The Country Projections and Policy Analysis Model Builder: An Overview of Its Uses and Features*', Washington D.C.: ERS/USDA.

USDA :ERS (1997), 'International Agricultural Baseline Projections to 2005', *Agricultural Economic Report No.750*, Washington D.C.: ERS/USDA.

Wu Ziping Wu and Wang Zhifang (2000) “The Accuracy of China's Grain Production Data” in Yang and Tian (2000)

Yotopoulos, P.A. (1985), “Middle-Income Classes and Food Crises: The “New” Food-Feed Competition”, *Economic Development and Cultural Change*, (33:3).

Zhang Xiaoguang, (2000) “China's Comparative Advantage in Agriculture”, in Yang and Tian (ed.) (2000)

Zhang XiaoYong (2004) “ A comparative study of projection models on China's food economy”, in Ho et al (eds) (2004)

| Table 11. China: Rural Consumption and Urban Purchases of Food, 1990-2009, kgs | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rural Per Capita Consumption** | | | | | | | | | | | | | |
| | **1990** | **1995** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** |
| **Grain*** | 262.1 | 256.1 | 247.5 | 250.2 | 238.6 | 236.5 | 222.4 | 218.3 | 208.8 | 205.6 | 199.5 | 199.1 | 189.3 |
| **Wheat** | 80.0 | 81.1 | 79.2 | 80.3 | 76.8 | 76.3 | 73.2 | 72.4 | 68.4 | 66.1 | 64.4 | 62.7 | 59.6 |
| **Other grain** | 47.1 | 43.5 | 43.9 | 40.6 | 36.5 | 34.9 | 27.9 | 26.6 | 25.1 | 25.5 | 24.0 | 23.6 | 22.3 |
| **Rice** | 135.0 | 129.2 | 121.6 | 126.8 | 122.9 | 123.1 | 119.3 | 117.4 | 113.4 | 111.9 | 109.4 | 111.0 | 105.7 |
| **Soybeans** | | 2.3 | 2.7 | 2.5 | 2.5 | 2.2 | 2.1 | 1.9 | 1.9 | 2.1 | 1.7 | 1.8 | 1.7 |
| **Vegetables** | 134.0 | 104.6 | 108.9 | 106.7 | 109.3 | 110.6 | 107.4 | 106.6 | 102.3 | 100.5 | 99.0 | 99.7 | 98.4 |
| **Edible Oil** | 5.2 | 5.8 | 6.2 | 7.1 | 7.0 | 7.5 | 6.3 | 5.3 | 6.0 | 5.8 | 6.0 | 6.3 | 6.3 |
| **Pork** | 10.5 | 10.6 | 12.7 | 13.3 | 13.4 | 13.7 | 13.8 | 13.5 | 15.6 | 15.5 | 13.4 | 12.7 | 14.0 |
| **Beef and Mutton** | 0.8 | 0.7 | 1.2 | 1.1 | 1.2 | 1.2 | 1.3 | 1.3 | 1.5 | 1.6 | 1.5 | 1.3 | 1.4 |
| **Poultry** | 1.3 | 1.8 | 2.5 | 2.8 | 2.9 | 2.9 | 3.2 | 3.1 | 3.7 | 3.5 | 3.9 | 4.4 | 4.3 |
| **Eggs** | 2.4 | 3.2 | 4.3 | 4.8 | 4.7 | 4.7 | 4.8 | 4.6 | 4.7 | 5.0 | 4.7 | 5.4 | 5.3 |
| **Milk** | 1.1 | 0.6 | | 1.1 | 1.2 | 1.2 | 1.7 | 2.0 | 2.9 | 3.1 | 3.5 | 3.4 | 3.6 |
| **Aquatic Products** | 2.1 | 3.4 | 3.8 | 3.9 | 4.1 | 4.4 | 4.7 | 4.5 | 4.9 | 5.0 | 5.4 | 5.2 | 5.3 |
| **Sugar** | 1.5 | 1.3 | 1.5 | 1.3 | 1.4 | 1.6 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| **Fruits** | 5.9 | 13.0 | 18.4 | 18.3 | 20.3 | 18.8 | 17.5 | 17.0 | 17.2 | 19.1 | 19.4 | 19.4 | 20.5 |
| **Nuts &Kernels** | | 0.1 | 1.8 | 0.7 | 0.8 | 0.8 | 0.7 | 0.7 | 0.8 | 0.9 | 1.0 | 0.9 | 1.1 |
| **Urban Per Capita purchases** | | | | | | | | | | | | | |
| | **1990** | **1995** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** |
| **Grain** | 130.7 | 97.0 | 84.9 | 82.3 | 79.7 | 78.5 | 79.5 | 78.2 | 77.0 | 75.9 | 77.6 | | 81.3 |
| **Vegetables** | 138.7 | 116.5 | 114.9 | 114.7 | 115.9 | 116.5 | 118.3 | 122.3 | 118.6 | 117.6 | 117.8 | 123.2 | 120.5 |
| **Edible Oil** | 6.4 | 7.1 | 7.8 | 8.2 | 8.1 | 8.5 | 9.2 | 9.3 | 9.3 | 9.4 | 9.6 | 10.3 | 9.7 |
| **Pork** | 18.5 | 17.2 | 16.9 | 16.7 | 16.0 | 20.3 | 20.4 | 19.2 | 20.2 | 20.0 | 18.2 | 19.3 | 20.5 |
| **Beef & Mutton** | 3.3 | 2.4 | 3.1 | 3.3 | 3.2 | 3.0 | 3.3 | 3.7 | 3.7 | 3.8 | 3.9 | 3.4 | 3.7 |
| **Poultry** | 3.4 | 4.0 | 4.9 | 5.4 | 5.3 | 9.2 | 9.2 | 6.4 | 9.0 | 8.3 | 9.7 | 8.0 | 10.5 |
| **Eggs** | 7.3 | 9.7 | 10.9 | 11.2 | 10.4 | 10.6 | 11.2 | 10.4 | 10.4 | 10.4 | 10.3 | 10.7 | 10.6 |
| **Aquatic Products** | 7.7 | 9.2 | 10.3 | 11.7 | 10.3 | 13.2 | 13.4 | 12.5 | 12.6 | 13.0 | 14.2 | | |
| **Milk** | 4.6 | 4.6 | 7.9 | 9.9 | | 15.7 | 18.6 | 18.8 | 17.9 | 18.3 | 17.8 | 15.2 | 14.9 |
| **Fruits** | 41.1 | 45.0 | 54.2 | 57.5 | | 56.5 | 57.8 | 56.5 | 56.7 | 60.2 | 59.5 | 54.5 | 56.6 |
| **Nuts &Kernels** | 3.2 | 3.0 | 3.3 | 3.3 | | 2.8 | 2.7 | 2.9 | 3.0 | | | | |
| * Grain in unprocessed form and includes tubers (i/5$^{th}$ weight), soyabeans. And other grains. | | | | | | | | | | | | | |
| Source: China Statistical Yearbook, Various Issues | | | | | | | | | | | | | |

| Table 12. China: Ratio of Rural Consumption to Urban Purchases of Food, 1990-2009 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| Grain | 2.00 | 2.64 | 2.91 | 3.04 | 2.99 | 3.01 | 2.80 | 2.79 | 2.71 | 2.71 | 2.57 | | 2.33 |
| Vegetables | 0.97 | 0.90 | 0.95 | 0.93 | 0.94 | 0.95 | 0.91 | 0.87 | 0.86 | 0.86 | 0.84 | 0.81 | 0.82 |
| Edible Oil | 0.81 | 0.82 | 0.79 | 0.87 | 0.87 | 0.88 | 0.68 | 0.57 | 0.65 | 0.62 | 0.62 | 0.61 | 0.65 |
| Pork | 0.57 | 0.61 | 0.75 | 0.79 | 0.84 | 0.68 | 0.67 | 0.70 | 0.78 | 0.77 | 0.73 | 0.66 | 0.68 |
| Beef & Mutton | 0.24 | 0.29 | 0.38 | 0.34 | 0.36 | 0.39 | 0.38 | 0.36 | 0.40 | 0.41 | 0.38 | 0.38 | 0.37 |
| Poultry | 0.37 | 0.46 | 0.50 | 0.52 | 0.54 | 0.31 | 0.35 | 0.49 | 0.41 | 0.42 | 0.40 | 0.55 | 0.41 |
| Eggs | 0.33 | 0.33 | 0.39 | 0.43 | 0.45 | 0.44 | 0.43 | 0.44 | 0.45 | 0.48 | 0.46 | 0.51 | 0.50 |
| Aquatic Products | 0.28 | 0.37 | 0.37 | 0.33 | 0.40 | 0.33 | 0.35 | 0.36 | 0.39 | 0.39 | 0.38 | | |
| Milk | 0.24 | 0.13 | 0.00 | 0.11 | | 0.08 | 0.09 | 0.11 | 0.16 | 0.17 | 0.20 | 0.23 | 0.24 |
| Fruits | 0.14 | 0.29 | 0.34 | 0.32 | | 0.33 | 0.30 | 0.30 | 0.30 | 0.32 | 0.33 | 0.36 | 0.36 |
| Nuts &Kernels | 0.00 | 0.04 | 0.56 | 0.22 | | 0.28 | 0.27 | 0.25 | 0.27 | | | | |
| Liquor | 0.66 | 0.66 | 0.73 | 0.70 | 0.73 | 0.82 | 0.82 | 0.88 | 1.08 | 1.09 | 1.11 | | |
| Source: Calculated from Table 11 | | | | | | | | | | | | | |

| Table: 13. Estimated Urban per capita consumption of food, 1990-2009, kgs | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1990** | **1995** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | 2008 | 2009 |
| **Grain** | 286.0 | 238.2 | 231.6 | 209.0 | 207.1 | 183.6 | 181.5 | 183.6 | 197.0 | 197.4 | 199.6 | 193.4 | 204.5 |
| **Wheat** | 83.3 | 74.9 | 72.8 | 63.0 | 67.8 | 47.9 | 44.0 | 65.9 | 69.7 | 71.8 | 71.1 | 71.9 | 74.2 |
| **Rice** | 147.8 | 150.5 | 156.2 | 138.9 | 135.3 | 122.5 | 112.4 | 111.9 | 117.4 | 120.3 | 120.4 | 115.7 | 122.4 |
| **Soybeans** | | 16.8 | 9.5 | 11.0 | 10.1 | 7.4 | 10.3 | 9.3 | 10.4 | 9.4 | 9.9 | 7.7 | 8.3 |
| **Other grain** | 54.9 | 18.5 | 7.6 | 11.6 | 8.2 | 16.6 | 28.1 | 8.4 | 12.3 | 8.0 | 10.3 | 8.0 | 9.8 |
| **Vegetables** | | 254.0 | 361.7 | 431.9 | 454.8 | 477.8 | 509.8 | 486.9 | 494.3 | 504.3 | 501.5 | 572.7 | 577.2 |
| **Edible Oil** | 8.7 | 10.3 | 11.1 | 10.8 | 11.2 | 12.6 | 18.7 | 10.1 | 9.5 | 11.2 | 13.6 | 9.9 | 11.9 |
| **Pork** | 47.9 | 66.4 | 66.8 | 66.3 | 66.6 | 66.1 | 66.9 | 62.2 | 61.2 | 61.3 | 56.8 | 62.0 | 62.8 |
| **Beef & Mutton** | 5.0 | 13.1 | 15.3 | 15.7 | 15.6 | 16.3 | 17.1 | 14.9 | 14.6 | 14.4 | 15.1 | 14.9 | 15.0 |
| **Poultry** | 9.0 | 20.7 | 23.5 | 24.0 | 22.6 | 22.3 | 22.2 | 20.3 | 20.5 | 21.0 | 21.5 | 22.2 | 22.2 |
| **Eggs** | 17.5 | 35.9 | 36.5 | 36.3 | 36.5 | 37.3 | 38.1 | 33.6 | 33.3 | 31.9 | 32.9 | 33.6 | 33.6 |
| **Aquatic Products** | 37.6 | 63.4 | 65.6 | 64.1 | 61.7 | 58.7 | 55.8 | 54.6 | 53.2 | 52.8 | 52.4 | 59.4 | 60.5 |
| **Milk** | 19.3 | 25.0 | | 24.6 | 27.5 | 32.2 | 38.4 | 46.3 | 51.3 | 57.5 | 59.6 | 58.5 | 59.8 |
| **Sugar** | 24.2 | 20.3 | 16.0 | 14.3 | 14.4 | 14.1 | 16.9 | 13.3 | 13.2 | 13.2 | 17.2 | 14.2 | 11.4 |
| **Fruits** | 46.1 | 78.1 | 91.8 | 86.5 | 88.2 | 91.8 | 96.9 | 110.0 | 111.9 | 116.4 | 119.5 | 123.4 | 131.6 |
| **Ratio of Urban to rural levels (proportions)** | | | | | | | | | | | | | |
| **Grain** | 1.1 | 0.9 | 0.9 | 0.8 | 0.9 | 0.8 | 0.8 | 0.8 | 0.9 | 1.0 | 1.0 | 1.03 | 0.93 |
| **Wheat** | 1.0 | 0.9 | 0.9 | 0.8 | 0.9 | 0.6 | 0.6 | 0.9 | 1.0 | 1.1 | 1.1 | 0.87 | 0.80 |
| **Rice** | 1.1 | 1.2 | 1.3 | 1.1 | 1.1 | 1.0 | 0.9 | 1.0 | 1.0 | 1.1 | 1.1 | 0.96 | 0.86 |
| **Soybeans** | | 7.4 | 3.6 | 4.4 | 4.1 | 3.4 | 5.0 | 4.9 | 5.4 | 4.5 | 5.7 | 0.23 | 0.20 |
| **Other grain** | 1.2 | 0.4 | 0.2 | 0.3 | 0.2 | 0.5 | 1.0 | 0.3 | 0.5 | 0.3 | 0.4 | 2.95 | 2.28 |
| **Edible Oil** | 0.0 | 2.4 | 3.3 | 4.0 | 4.2 | 4.3 | 4.7 | 4.6 | 4.8 | 5.0 | 5.1 | 0.17 | 0.17 |
| **Pork** | 1.7 | 1.8 | 1.8 | 1.5 | 1.6 | 1.7 | 3.0 | 1.9 | 1.6 | 1.9 | 2.3 | 0.63 | 0.52 |
| **Beef & Mutton** | 4.5 | 6.3 | 5.3 | 5.0 | 5.0 | 4.8 | 4.9 | 4.6 | 3.9 | 4.0 | 4.3 | 0.20 | 0.22 |
| **Poultry** | 6.2 | 18.4 | 13.1 | 13.9 | 13.6 | 14.0 | 13.6 | 11.5 | 9.9 | 9.2 | 10.0 | 0.09 | 0.09 |
| **Eggs** | 7.2 | 11.3 | 9.5 | 8.6 | 7.9 | 7.7 | 6.9 | 6.5 | 5.6 | 6.0 | 5.6 | 0.20 | 0.19 |
| **Aquatic Products** | 7.3 | 11.1 | 8.5 | 7.6 | 7.7 | 8.0 | 7.9 | 7.3 | 7.1 | 6.4 | 7.0 | 0.16 | 0.16 |
| **Milk** | 34.2 | 105.7 | | 60.4 | 51.4 | 49.3 | 32.7 | 27.6 | 18.6 | 16.8 | 14.9 | 0.06 | 0.06 |
| **Sugar** | 0.06 | 0.06 | 0.09 | 0.09 | 0.10 | 0.12 | 0.07 | 0.08 | 0.09 | 0.08 | 0.06 | 0.08 | 0.09 |
| **Fruits** | 7.8 | 6.0 | 5.0 | 4.7 | 4.3 | 4.9 | 5.5 | 6.5 | 6.5 | 6.1 | 6.2 | 0.16 | 0.16 |
| Source: Estimated from FAO data on supply per capita and CSY various issues | | | | | | | | | | | | | |

| Table 14. China: Per Capita Energy Supplies in Rural and Urban China, 1990-2009 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1990** | **1995** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** |
| Grain | | 2041 | 1959 | 2013 | 1940 | 1927 | 1846 | 1820 | 1748 | 1721 | 1683 | 1670 | 1588 |
| Wheat | 601 | 609 | 595 | 603 | 577 | 573 | 550 | 544 | 514 | 497 | 484 | 471 | 447 |
| Rice | 1365 | 1307 | 1230 | 1283 | 1243 | 1245 | 1207 | 1187 | 1146 | 1132 | 1106 | 1122 | 1069 |
| Soybeans | | 20 | 24 | 23 | 22 | 20 | 18 | 17 | 17 | 19 | 16 | 16 | 15 |
| Other grain | 105 | 105 | 110 | 104 | 98 | 89 | 71 | 71 | 70 | 74 | 77 | 60 | 57 |
| Vegetables | 89 | 70 | 72 | 71 | 73 | 74 | 71 | 71 | 68 | 67 | 66 | 66 | 65 |
| Edible Oil | 125 | 141 | 150 | 171 | 171 | 183 | 152 | 128 | 146 | 142 | 145 | 152 | 152 |
| Pork | 102 | 102 | 123 | 128 | 129 | 133 | 133 | 130 | 151 | 150 | 129 | 122 | 135 |
| Beef and Mutton | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 4 |
| Poultry | 6 | 9 | 12 | 13 | 13 | 14 | 15 | 15 | 17 | 16 | 18 | 20 | 20 |
| Eggs | 10 | 13 | 17 | 19 | 19 | 19 | 20 | 19 | 19 | 20 | 19 | 22 | 22 |
| Milk | 2 | 1 | 0 | 2 | 2 | 2 | 3 | 4 | 6 | 6 | 7 | 7 | 7 |
| Aquatic Products | 3 | 5 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 8 | 8 | 8 |
| Sugar | 15 | 12 | 14 | 12 | 14 | 16 | 12 | 11 | 11 | 11 | 10 | 11 | 10 |
| Fruits | 7 | 15 | 21 | 21 | 23 | 21 | 20 | 19 | 20 | 22 | 22 | 22 | 23 |
| Total Calories (Rural) | | 2411 | 2377 | 2460 | 2394 | 2397 | 2283 | 2227 | 2196 | 2166 | 2111 | 2103 | 2034 |
| **Urban Calorie Supply per capita** | | | | | | | | | | | | | |
| | **1990** | **1995** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** |
| Grain | | 2278 | 2231 | 2006 | 1989 | 1707 | 1631 | 1733 | 1838 | 1863 | 1873 | 1800 | 1897 |
| Wheat | 626 | 562 | 547 | 473 | 509 | 360 | 331 | 495 | 524 | 539 | 534 | 540 | 558 |
| Rice | 1494 | 1522 | 1580 | 1405 | 1368 | 1239 | 1136 | 1132 | 1188 | 1216 | 1217 | 1170 | 1238 |
| Soybeans | | 150 | 85 | 99 | 90 | 66 | 92 | 83 | 93 | 84 | 89 | 69 | 74 |
| Other grain | 123 | 45 | 19 | 30 | 22 | 42 | 72 | 22 | 34 | 23 | 33 | 22 | 26 |
| Vegetables | | 169 | 241 | 287 | 303 | 318 | 339 | 324 | 329 | 336 | 334 | 381 | 384 |
| Edible Oil | 211 | 249 | 270 | 261 | 272 | 305 | 453 | 245 | 230 | 272 | 330 | 239 | 290 |
| Pork | 463 | 643 | 646 | 642 | 644 | 640 | 647 | 601 | 592 | 593 | 550 | 600 | 607 |
| Beef & Mutton | 13 | 35 | 41 | 42 | 42 | 44 | 46 | 40 | 39 | 39 | 41 | 38 | 38 |
| Poultry | 42 | 97 | 110 | 113 | 106 | 105 | 104 | 95 | 96 | 99 | 101 | 104 | 104 |
| Eggs | 71 | 146 | 149 | 148 | 149 | 152 | 155 | 137 | 135 | 130 | 134 | 137 | 137 |
| Aquatic Products | 75 | 126 | 130 | 127 | 122 | 116 | 111 | 108 | 106 | 105 | 104 | 118 | 120 |
| Milk | 28 | 36 | | 36 | 40 | 47 | 56 | 67 | 75 | 83 | 86 | 85 | 87 |
| Fruits | 447 | 758 | 892 | 840 | 857 | 891 | 941 | 1068 | 1087 | 1130 | 1161 | 1199 | 1278 |
| sugar | 28 | 23 | 18 | 16 | 16 | 16 | 19 | 15 | 15 | 15 | 20 | 16 | 13 |
| Total Calories (Urban) | | 4560 | 4728 | 4518 | 4539 | 4340 | 4502 | 4434 | 4541 | 4664 | 4732 | 4716 | 4954 |
| | | | | | | | | | | | | | |
| **Ratio of rural to urban (energy)** | 0.529 | 0.503 | 0.544 | 0.527 | 0.552 | 0.507 | 0.502 | 0.484 | 0.464 | 0.446 | 0.446 | 0.411 | |
| Source: Tables 11 & 13 and FAO-FBS | | | | | | | | | | | | | |

## ICS MONOGRAPH :

**Kishan Rana & Patricia Uberoi**, India's North East States, The BCIM Forum and Regional Integration

## OCCASIONAL PAPER SERIES (New):

# 1- **ICS-IIC Roundtable** on the Brookings Report: "Addressing the US China Strategic Distrust"

# 2 - **Y J Sithara Fernando**, "China's Relations with the Indian Ocean Region"

# 3 - **Madhavi Thampi & Nirmola Sharma,** Catalogue of Materials Related to Modern China in the National Archives of India Part One (Special Collections)

#4 - **Manmohan Agarwal,** Comparing India and China's Economic Performance since 1991

#5 - **Y J Sithara Fernando**, China and the Cooperative Architecture in the South China Sea: Prospects and Problems

#6 - **Joe Thomas Karackattu**, India–China Economic Relations: Trends, Challenges and Policy Options

## ICS ANALYSIS:

**No.12**. July 2013 **Emerging Trends in Chinese Investments in Bangladesh: Challenges and Opportunities**

**No.11.** June 2013 **China and the Federalism Question in Nepal**

**No.10.** June 2013 **The Recent Violence in Xinjiang and China's Ethnic Policy**

**No.9.** May 2013 **Rising and Shining: The Coming Bloom in Indo-Japanese Economic Relations**

**No.8.** April 2013 **China's Military Power**

**No.7.** March 2013 **Self-Immolations, the Tibet Question and the Way Forward**

**No.6.** August 2012 **China and the Revival of the World Economy**

**No.5.** May 2012 **The US-China "Strategic Distrust": Perceptions from New Delhi**

**No.4.** May 2012 **Chinese Reactions to India's Agni-V Test Firing**

**No.3**. April 2012 **Bo Xilai's Exit : Some Interpretations**

**No.2.** April 2012 **China, India and the Indian Ocean Region: Need to Move from Balance of Power to Cooperation**

**No.1**. November 2011 **Postponement of the 15th Special Representative-level Talks: Possible Causes and Implications**

## ABOUT ICS

中国研究所

**Focussed on CHINA since 1969** **http://icsin.org**

**The Institute of Chinese Studies, Delhi, one of the oldest multi- and interdisciplinary research institutes on China in India, seeks to promote research in areas of history, culture and literature, society, international relations, the economy and polity of China and East Asia. It leads public discourse with regard to India-China relations and facilitates new research in diverse areas. Its chief objectives are to build a national network of China and East Asia scholars, enter into international collaborative programmes for comparative research and expand the frontiers of the study of China in India. It seeks to provide informed and objective inputs in policy formulation through its various publications.**

**These include:**

ICS Working Paper

ICS Analysis

ICS Occasional paper

ICS Monograph


## COLLABORATIONS

CICR 中国现代国际关系研究院 CHINA INSTITUTES OF CONTEMPORARY INTERNATIONAL RELATIONS

**CHINA INSTITUTES OF CONTEMPORARY INTERNATIONAL RELATIONS (CICR), Beijing**

**CHINA INSTITUTE OF INTERNATIONAL STUDIES (CIIS), Beijing**

**SHANGHAI ACADEMY OF SOCIAL SCIENCES (SASS), Shanghai**

YASS 云南省社会科学院

**YUNNAN ACADEMY OF SOCIAL SCIENCES (YASS), Kunming**

**INSTITUTE OF FAR EASTERN STUDIES (IFES), Moscow**

**SHANXI UNIVERSITY OF FINANCE & ECONOMICS**

**HARVARD-YENCHING INSTITUTE**

GRIIS

**GUANGDONG RESEARCH INSTITUTE FOR INTERNATIONAL STRATEGIES, GuangDong**

## MULTILATERAL COOPERATION

BCIM

**BCIM (Bangladesh-China-India-Myanmar) Forum**

Russia India China Academic Trilateral Conference

**RIC (Russia-India-China) Trilateral Academic Conferences**

ASIA BOAO FORUM FOR ASIA

**BOAO Forum for Asia (BFA)**

## ICS EVENTS

ICS EVENT

Om Prakash Memorial Lecture

ALL INDIA CONFERENCE OF CHINA STUDIES

EAST ASIA YOUNG RESEARCH SCHOLARS COLLOQUIUM

ICS Wednesday Seminar

## CONTACT ICS

**ICS Training Programme & Internships : careers@icsin.org**
**Institutional Collaboration & Exchange : info@icsin.org**
**China Report Subscription : http://chr.sgaepub.com**

Institute of Chinese Studies ICS 中国研究所 DELHI

8/17, Sri Ram Road, Delhi–110054, INDIA.
Tel: +91-11-23938202, Fax: +91-11-23830728,
E-mail: info@icsin.org, www.icsin.org

Registered Under the Societies Registration Act XX1 of 1860