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AN ANALYSIS OF GROWTH AND VARIABILITY IN FOOD AVAILABILITY: A KEY DIMENSION OF FOOD SECURITY IN INDIA

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Abstract

The sustainability of economic growth of any nation is contingent upon its food security situation, which constitutes multiple dimensions such as food availability, socio-economic food accessibility, food quality (nutritional status of food) and food stability. Since, the availability of food plays a significant role as far as "supply side" of foodgrains is concerned, the present study attempts to assess the growth and variability in the food availability for a period of 65 years (1951 to 2015). The results showed that the net availability of both pulses and other cereals, which are significantly important for dietary and nutritional requirements, registered negative growth rates during the span of 65 years (1951 to 2015). Wheat registered maximum variability as far as net availability is concerned as compared to rice, which recorded least variability among the foodgrains. Though, from 1951 to 2015, the availability of total foodgrains recorded a meagre growth of 0.1 per cent, however the quinquennial variability in per capita availability of total foodgrains showed a declining trend in 2011-15 as compared to 1951-55. The low growth of availability of foodgrains is a cause of great concern as it poses supply side constraints towards achieving the target of food security. Thus, there is a need for persistent coordinated efforts on the part of individual, society, researchers and policy makers to substantially improve farm production

Keywords:
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so that sufficient food is available to its ever growing population for sustained economic development.

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1. Introduction

The sustainability of economic growth of any nation is contingent upon the magnitude of its food security situation. The significance of food security can be gauged by the fact that "Sustainable Development Goals" have incorporated it as one of their main objectives to be achieved globally by the year 2030. A nation, small or large shall fully be able to reap the benefits of growth when it is able to provide nutritious food in sufficient quantities to its people (Headey and Ecker, 2012). The concept of food security is not single dimensional in nature, it rather has multiple connotations, thereby making it a complex concept to define. However, Food and Agriculture Organization of the United Nations in 2001 provided a globally accepted definition of food security as "a situation when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (Gross, Schoeneberger, Pfeifer and Preuss, 2000). Going by the definition put forth by the United Nations, food security constitutes multiple components such as food availability, socio-economic food accessibility, food quality (nutritional status of food) and food stability, which is influenced by weather conditions, natural resources, political stability and climate related factors. Since, food security encompasses several dimensions; it makes all the more difficult for developing economies with limited resources to fully achieve the food security targets with regard to each of its dimensions (food accessibility, availability, quality and stability)

Fulfillment of the goal of food security is a hard pressing challenge for researchers, planners and policymakers especially of the developing economies. In view of the mounting population pressure in absolute terms and decelerating trends in agriculture growth and productivity, the Indian government launched a nationwide mission known as "National Food Security Mission" in the year 2007 with the objective to boost the foodgrain production (rice, wheat, pulses and

other coarse cereals) by 25 million tonnes by the end of twelfth five year plan. According to the global food security index report for the year 2017, the threat of food insecurity is looming large as approximately sixty per cent of the countries have registered a fall in their food security scores in the year 2017. (The Economist Intelligence Unit, 2017). Ireland has topped the ranking chart by becoming the most food secure nation in the world, whereas the two most populous economies of the world namely China and India have recorded a rank of 45 and 74, respectively. Indian economy's food security score has declined by 0.9 points in 2017 as compared to the previous year mainly due to extreme weather conditions and climate changes, which have adversely affected the food availability dimension of food security. Food availability, which is a significant component of food security, represents physical availability of foodgrains in desired amounts and is measured by adding imports to gross domestic production of foodgrains and deducting exports, seed requirements and food wastage after making allowance for change in stocks. Decline in investments in agriculture, reduced soil fertility, adverse climatic changes have been identified as chief reasons for reduced crop yields and declining per capita availability of foodgrains in India. Swaminathan and Bhavani (2011) have argued that since India shall surpass the population of China and would reach the figure of 1.5 billion by the year 2030, it is imperative to enhance the per capita availability of foodgrains so as to meet the growing food requirements. In the present backdrop and considering the fact that availability of foodgrains plays a paramount role as far as "supply side" of foodgrains is concerned, the present research work attempts to study the growth and variability in the food availability, which is a key dimension of food security situation in India, for a period of 65 years (1951 to 2015).

2. Objectives of the Study

The main objectives of the present research work are outlined below:

1) To study the quinquennial growth of per capita net availability of foodgrains in India from 1951 to 2015.

2) To study the temporal variability in per capita net availability of foodgrains during the aforementioned time period.

3. Data Source and Methodology

Secondary data sources such as "Agricultural Statistics at a Glance" and "State of Indian Agriculture" published by Ministry of Agriculture and Farmers Welfare, Government of India were employed for the purpose of the present study. The compound annual growth rates were calculated for per annum per capita net availability of foodgrains in India from 1951 to 2015. Further, in order to measure the temporal variability, the coefficient of variation was also computed on quinquennial basis for the aforesaid time period. The various concepts, definitions and detailed methodology employed in the present study have been explained below:

- The per capita net availability of foodgrains: Gross Production of foodgrains – exports – farm animal feed, seed requirements and wastage + imports ± change in stocks.

The net availability of foodgrains is further divided by population figures for a given year in order to calculate 'per capita net availability of foodgrains", which is expressed in kgs per annum.

- Foodgrains: It is a broad term which encompasses wheat, rice, pulses and other cereals.

- Temporal Variability: The variability in per capita net availability of each of the foodgrains was calculated quinquenially from 1951 to 2015 using the statistical tool of coefficient of variation.

- Compound Annual Growth Rate: The compound annual growth rate for per capita net availability of wheat, rice, pulses, other cereals and total foodgrains were calculated quinquenially from 1951 to 2015 in the following manner:

The semilog model, in which the only one variable (either dependent or independent variable) is expressed in the logarithmic form (Gujarati, 2006) was employed to calculate the compound annual growth rate.

$$\mathrm{LogDV}=\lambda_1+\lambda_2\mathrm{Time}$$

Where ,

Log DV = natural log of the Dependent Variable (DV), such as per capita net availability of wheat, rice, pulses, other cereals and total foodgrains.

λ_1 refers to the intercept and λ_2 refers to semi-elasticity of dependent variable with respect to time.

$$CAGR = \{Antilog(\lambda_2) - 1\} \times 100$$

Thus, the compound annual growth rate for per capita net availability of each of the foodgrains was computed on quinquennial basis using aforementioned formula.

4. Results and Discussion

Table 1, shows the pattern of per annum per capita net availability of foodgrains (rice, wheat, other cereals and pulses). In absolute terms, the net availability of rice had increased from 58 kgs in 1951 to around 81 kgs in 1991, however it declined sizably to 68 kgs approximately in 2015. The net availability of wheat witnessed almost a similar trend, whereby the per person availability of wheat increased from 24 kgs in 1951 to 61.3 kgs in 2015 in conjunction with lot of fluctuations in the intervening years. However, with respect to both other cereals and pulses, the per capita availability witnessed a declining pattern during 1951 to 2015, which may be due to the change in the consumption pattern as proposed by most researchers. On the whole, the net availability of total foodgrains increased appreciably from 144.1 kgs in 1951 to 186.2 kgs in 1991, however triggered by the decelerating trends in the Indian agriculture growth, the per annum per capita net availability of foodgrains declined post the year 1991.

Table 1: Per Annum per Capita Net Availability of Foodgrains in India from 1951 to 2015

Time Period	Rice	Wheat	Other Cereals	Pulses	Total Foodgrains
1951	58.0	24.0	40.0	22.1	144.1
1956	68.7	22.5	40.7	25.7	157.6

1961	73.4	28.9	43.6	25.2	171.1
1966	59.1	34.8	37.5	17.6	149.0
1971	70.3	37.8	44.3	18.7	171.1
1976	68.5	29.1	39.2	18.5	155.3
1981	72.2	47.3	32.8	13.7	166.0
1986	77.4	55.1	25.8	16.0	174.3
1991	80.9	60.0	29.2	15.2	186.2
1996	74.6	64.3	22.6	12.0	173.5
2001	69.5	49.6	20.5	10.9	151.9
2006	72.3	56.3	22.1	11.8	162.5
2011	66.3	59.7	23.9	15.7	165.6
2015	67.9	61.3	24.6	16.0	169.8

(Kgs. per year)

Source: Ministry of Agriculture, Government of India.

Table 2: Quinquennial Growth Rates of Per Capita Net Availability (per Annum) of Foodgrains in India from 1951 to 2015

(CAGR in per cent)

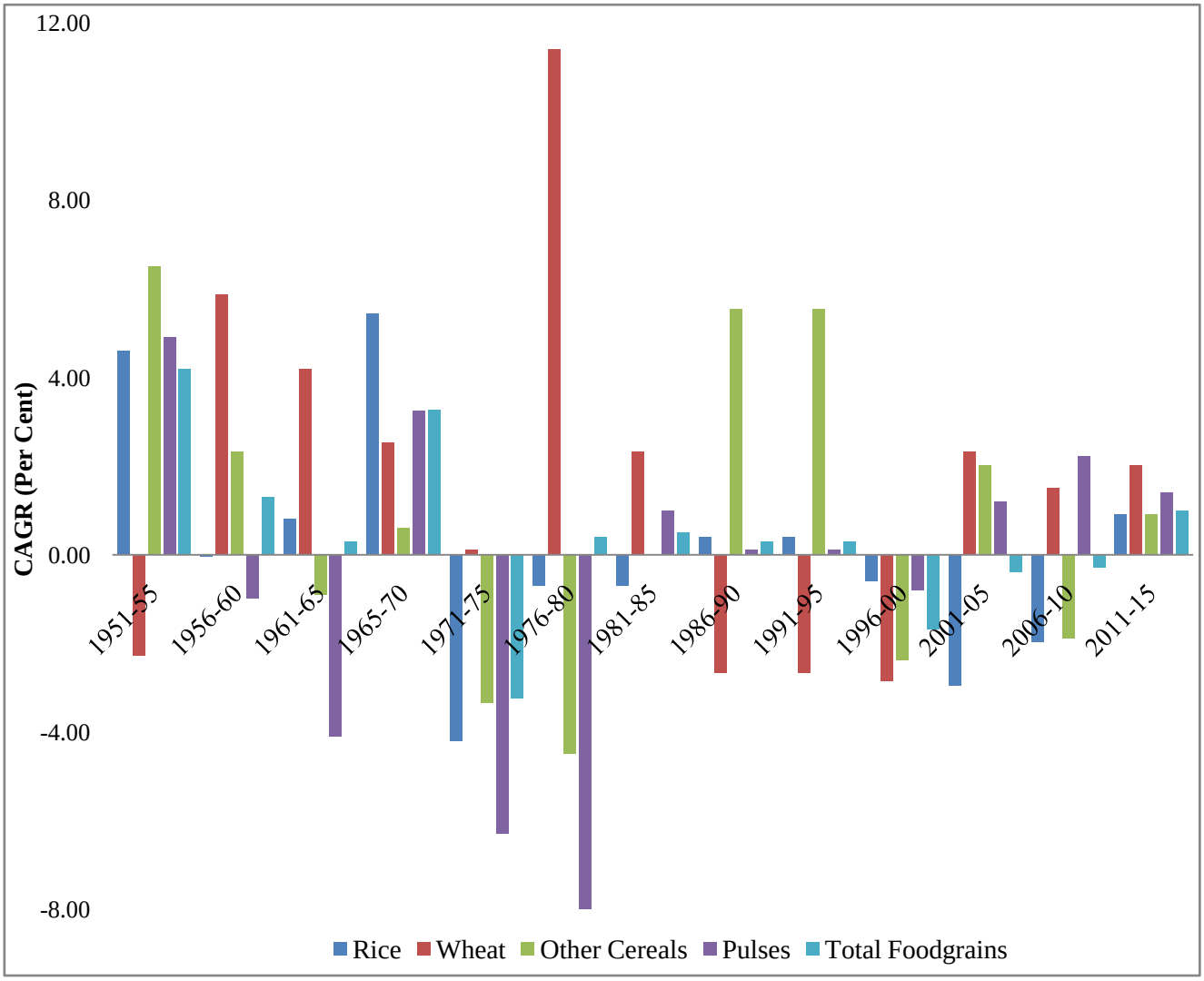
Time Period	**Rice**	**Wheat**	**Other Cereals**	**Pulses**	**Total Foodgrains**
1951-55	4.60	-2.27	6.50	4.92	4.19
1956-60	-0.04	5.87	2.33	-1.00	1.31
1961-65	0.80	4.19	-0.90	-4.11	0.30
1966-70	5.44	2.53	0.60	3.24	3.26
1971-75	-4.21	0.10	-3.34	-6.29	-3.25
1976-80	-0.70	11.40	-4.50	-9.06	0.40
1981-85	-0.70	2.33	-0.01	1.01	0.50
1986-90	0.40	-2.66	5.55	0.10	0.30
1991-95	0.40	-2.66	5.55	0.10	0.30

1996-00	-0.59	-2.86	-2.37	-0.80	-1.69
2001-05	-2.96	2.33	2.02	1.21	-0.40
2006-10	-1.98	1.51	-1.88	2.22	-0.30
2011-15	0.90	2.02	0.90	1.41	1.01

Source: Author's calculations based on Ministry of Indian Agriculture database.

Table 2 and Figure 1 depict the compound annual growth rates of per annum per capita net availability of foodgrains in India which were computed quinquenially from 1951 to 2015. The growth rates of rice witnessed a fluctuating trend during the given period as it registered maximum growth during the green revolution period (5.44 per cent) followed by series of negative growth rate periods and finally settling for a meager growth of 0.90 per cent during 2011-15. Triggered by the adoption of package of inputs under the aeigis of "New Agricultural Strategy", the net availability of wheat crop registered a robust growth rate up till 1985 (Jha, Srinivasan and Landes, 2007). However, growth rate of net availability of wheat became negative after that and finally settled for a modest positive growth rate of 2.02 per cent during 2011-2015. The growth of cereals and pulses, which account for a sizable proportion of agricultural output in India, declined considerably from 6.5 percent to 0.9 per cent and from 4.92 per cent to 1.41 per cent from 1951-55 to 2011-15, respectively. Looking at the overall picture, the net availability of total foodgrains witnessed a considerable decline in terms of quinquennial growth rates during the time period under consideration.

Figure 1: Quinquennial Growth Rates of Per Annum per Capita Net Availability of Foodgrains in India (1951 to 2015)



Source: Graph represented using the data source mentioned in table 2.

Table 3: Quinquennial Variability in Per Capita Net Availability (Per Annum) of Foodgrains in India from 1951 to 2015

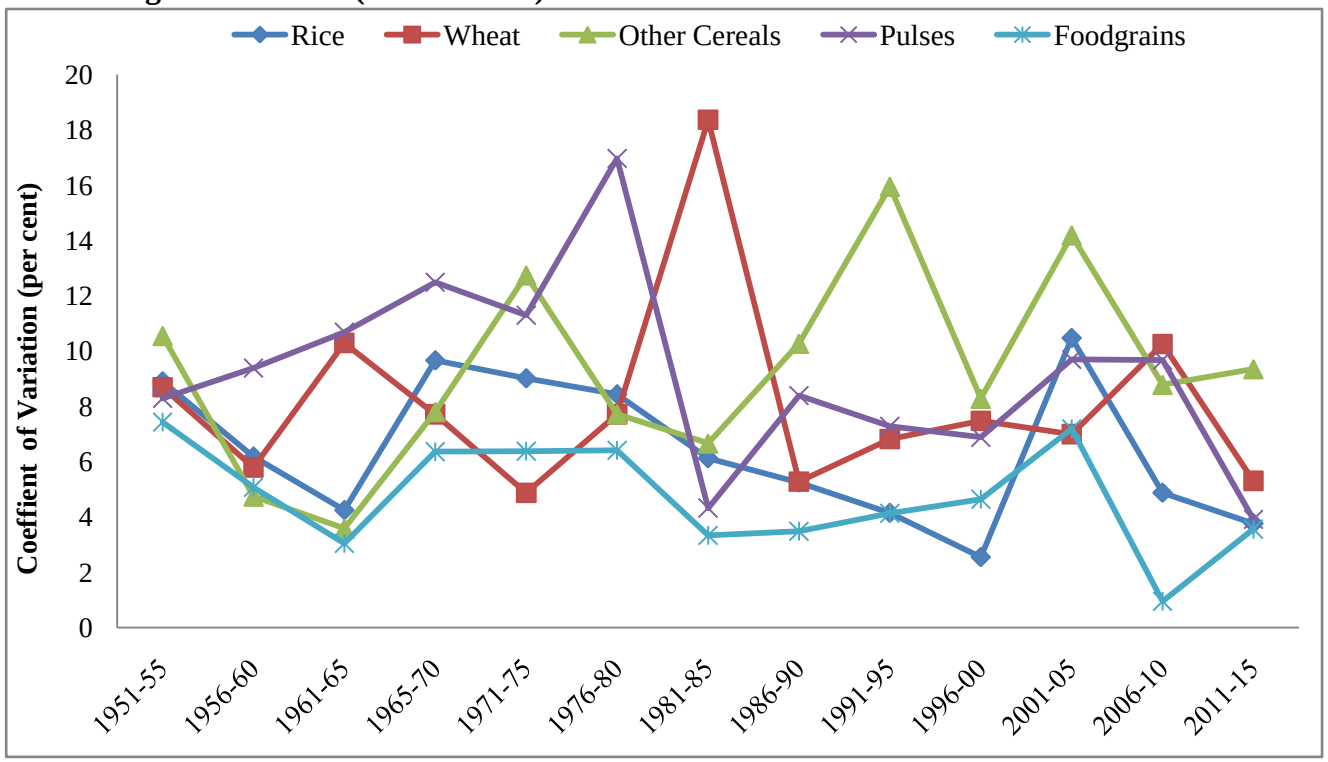
Coefficient of Variation (per cent)

Time Period	Rice	Wheat	Other Cereals	Pulses	Total Foodgrains
1951-55	8.90	8.69	10.55	8.29	7.43
1956-60	6.18	5.79	4.74	9.39	5.07
1961-65	4.24	10.29	3.58	10.68	3.04
1966-70	9.66	7.71	7.80	12.49	6.36
1971-75	9.01	4.87	12.74	11.30	6.38
1976-80	8.43	7.71	7.72	16.97	6.41
1981-85	6.12	18.36	6.66	4.32	3.33
1986-90	5.24	5.27	10.27	8.39	3.48
1991-95	4.14	6.81	15.95	7.28	4.13
1996-00	2.54	7.47	8.28	6.88	4.64
2001-05	10.47	6.99	14.19	9.70	7.19
2006-10	4.87	10.25	8.78	9.68	0.95
2011-15	3.76	5.30	9.35	3.91	3.56

Source: Author's calculations based on Ministry of Indian Agriculture database.

The quinquennial variability in per capita net availability of foodgrains in India from 1951 to 2015 is presented in Table 3 and Figure 2. As compared to 1951-55, the coefficient of variation of net availability of rice witnessed a decline from being 8.90 per cent to 3.76 per cent in 2011-15. Pulses and wheat registered quite high levels of variability specifically during 1976-80 and 1981-85, respectively which also coincided with the series of drought years witnessed by Indian agriculture in 1979, 1982 and 1985. The variability in per capita net availability of other cereals, which was very high during 1971-75 (12.74 per cent) declined during 1981-85 (6.6 per cent) and again increased during 1991-95 (15.95 per cent) before finally decreasing to 9.35 per cent during 2011-15. Looking at the overall picture, the total foodgrains availability recorded a decline in the variability from 7.43 per cent during 1951-55 to 3.56 per cent during 2011-15.

Figure 2: Variability in Per Annum Per Capita Net Availability of Foodgrains in India (1951 to 2015)



Source: Graph represented using the data source mentioned in table 3.

Table 4: Overall Growth and Variability of Per Capita Net Availability (Per Annum) of Foodgrains in India from 1951 to 2015

(per cent)

Description	Growth (CAGR)	Variability (CV)
Rice	0.20	8.69
Wheat	1.71	30.29
Other Cereals	-1.39	28.14
Pulses	-0.99	26.57
Foodgrains	0.10	5.98

Source: Author's calculations based on Ministry of Indian Agriculture database.

Table 4 shows the overall growth and variability of per capita net availability of foodgrains during 65 year time period (1951 to 2015). It was observed that the net availability of both pulses and other cereals, which are significantly important for dietary requirements as far as access to

nutritional food intake dimension of food security is concerned, witnessed negative growth rates during the aforementioned time period. Rice and wheat registered positive growth rates in terms of their net availability during the same time period, however wheat registered maximum variability (30.29 per cent) followed by other cereals (28.14 per cent) and pulses (26.57 per cent). On the whole, the net availability of total foodgrains registered a miniscule growth of 0.1 per cent during the entire 65 years period marked by variability to the tune of 5.98 per cent.

5. Conclusion

Food security, being a complex concept having multiple dimensions, has assumed a lot of significance in India partly on account of it being the home of second largest population in the world and partly due to the decelerating trends in agricultural productivity accompanied by low levels of investment in agricultural sector and climate concerns that India is currently facing. Since food availability represents the supply side of the food security situation in any economy, the present study, therefore is a modest attempt towards assessing the food availability dimension by studying the quinquennial growth and variability of per capita net availability of foodgrains in India from 1951 to 2015. The results indicated that except for wheat, the quinquennial growth in per capita availability of all the foodgrains (rice, pulses and other cereals) have declined during 2011-15 as compared to 1951-55. It was observed that the net availability of both pulses and other cereals registered negative growth rates during the span of 65 years (1951 to 2015). Wheat registered maximum variability as far as net availability is concerned as compared to rice, which recorded least variability among the foodgrains. Though, from 1951 to 2015, the availability of total foodgrains recorded a paltry growth of 0.1 per cent, however the quinquennial variability in per capita availability of total foodgrains showed a declining trend in 2011-15 as compared to 1951-55. The low growth of availability of foodgrains is a cause of great concern as it poses supply side constraints towards achieving the target of food security. Thus, there is a need for coordinated efforts on the part of individual, society, researchers and policy makers to substantially improve farm production so that sufficient food is available to its ever growing population for sustained economic development.

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