I J A B E R, Vol. 14, No. 8, (2016): 5607-5616

THE IMPACT OF MONSOONS ON FOOD GRAIN PRODUCTION IN INDIA AND ITS CONSEQUENCES ON INFLATION AND MONETARY POLICY DECISIONS: AN EMPIRICAL STUDY

Colonel Shabbar Shahid[*] and Mamta Gaur[**]

Abstract: *India is predominantly an agricultural country and a large portion of its population depends on agriculture which is mostly an unorganized sector where farming is done by small time farmers having only a few acres of cultivable land. These small time farmers who pool in their produce to meet the country's food requirement as well as exports are dependent on monsoon rains for their crop. From the fields of a small time farmer starts a vicious circle which never ends but at its centre lies the monetary policy of the country. If the rains are good, a farmer reaps a good harvest and has enough money in his hands to spend. Food is available in abundance so the inflation drops and people are able to purchase more. With falling inflation, Reserve Bank of India is comfortable at being liberal with its monetary policy and the monetary rates are held low. But if the rains are deficient, the crop fails. The farmers who form the major part of population are left with no money in their pockets and the population at large is short of food. This causes the inflation to shoot up and the Reserve Bank of India comes out of its comfort zone to tighten the monetary policy and suck out the liquidity from the market in its bid to control inflation. Inflation has been a perpetual matter of concern for a developing country like India. Monetary policy is focused at controlling money flow in the market to maintain price stability and control inflation while the fiscal policy of a country relates to Government's revenue generation and public spending. Fiscal policy is a prerogative of the Government and is generally liberal aimed at pleasing the vote bank by providing more money in the hands of people. On the other hand, monetary policy, a prerogative of RBI is focused at reining in inflation. It is but sad that even after six decades of independence, the monetary policy of our country is directly or indirectly linked to the rains which fall on its soil. This paper is an Empirical study to quantify the dependence of food grain production on the rains and consequently its relationship with inflation and the monetary policy of the country.*

Index Terms: *Monetary policy, Inflation, Call money rates, Annual rains, Food grain production.*

1. INTRODUCTION

Agriculture, with its allied sectors, is unquestionably the largest livelihood provider in India, more so in the vast rural areas. It also contributes a significant figure to

* M-tech, MBA (Pune), FIE (I), Combat Vehicle Research And Development Establishment, Chennai, Tamil Nadu, India, *E-mail: Shabbarshahid@Rediffmail.com*

** Mba, Phd, HDSE, Dean, Vel Tech Business School, Vel Tech Rangarajan Dr Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu, India, *E-mail: Mamtagaur@Veltechuniv.edu.in*

the Gross Domestic Product (GDP). As per the current figures of IMF, agriculture contributes over 17% of India's GDP. (imf.org n.d.) In a recently concluded seminar at NABARD, the Finance Minister Mr Arun Jaitley said "If India is to grow and get rid of poverty, the agriculture sector has to grow the fastest... agriculture is critical to the economy." (Arun 2014).

Despite the importance attached to agriculture, the fact remains that bulk of the cultivable land in the country is in the hands of small farmers who find it difficult to till the land by the passing days. The cost of seeds, fertilizer and transportation of harvested crop makes it difficult for the farmers to make their ends meet and they land up in debt in the hope of reaping a good harvest subject to the mercy of rain Gods. Inflation is a constant fear looming large and RBI keeps hoping for a good monsoon every year. If the rains are good, the crop yield is better and there is money in the hands of the farmer. With abundance of food for the population, the inflation eases and gives room to the Reserve Bank of India to relax its monetary policy.

The condition of Indian farmers was not so good even during the British Rule and has remained so even after six decades of Independence. To a large extent, this may be attributed to industry oriented policy decisions and lack of infrastructure. Munish Alagh in paper has written about the effects of agriculture on the macro economics as well as the fiscal and monetary policy of the country. He believes that in evaluating the impact of macroeconomic policy the mix of monetary and fiscal policies has to be evaluated. Macroeconomic policy has an effect on the agricultural economy through their impacts on interest rates and inflation. Changing interest rates influence variable production costs, long-term capital investments, cash flow, land values, and exchange rates, while inflation affects input prices, commodity prices, real interest rates and land prices. (Alagh 2011).

2. OBJECTIVE

The objective of this paper is to quantify the dependence of food grain production on the annual average rainfall in India and consequently, determine in terms of quantifiable relationship the impact which it will have on inflation and ultimately the reaction of the Reserve Bank in deciding the key rates of the monetary policy. It may be noted that inflation does not solely depend on production of food grains but many other factors including crude oil price and global economic conditions. Nevertheless, in the Indian scenario, monsoons do remain an important deciding factor.

3. METHODOLOGY

In order to establish a relationship between the Monsoons in India, their impact on food grain production in the country, the inflation during the following year and the manner in which the Reserve Bank of India tweaks the monetary policy to manage the inflation we have considered the following statistical data:-

(a) All India Weighted Average Annual Rainfall in mm since 1950. (Source Govt of India, open govt data) (*www.data.gov.in* 2016).

(b) Agricultural production – Total Food Grains in million tones since 1950. (*www.dbie.rbi.org n.d.*)

(c) Historic Inflation in India since 1958. (*www.inflation.eu n.d.*)

(d) The Call money Rates promulgated by RBI. (*www.rbi.org.in n.d.*)

Having collated the data from various sources, we have established a correlation amongst them to understand how they have been interrelated in the past. Mathematically. (Kothari 2011)

$$r = \frac{\text{cov}(x,y)}{\delta x \delta y}$$

For N pair of observations $(x_1\, y_{1)},\, (x_2\, y_{2),\, \ldots..}(x_n y_n),$

$$r = \frac{\Sigma[(x-\overline{x})(y-\overline{y})]}{\sqrt{\Sigma(x-\overline{x})^2\ \Sigma(y-\overline{y})^2}}$$

$$r = \frac{\Sigma(\delta x \delta y)}{\sqrt{\Sigma(\delta x)^2\ \Sigma(\delta y)^2}}$$

Where,

r = Karl Pearson's coefficient of Correlation

$\delta x = x - \overline{x}\ and\ \delta y = y - \overline{y},$

The Probability of error is represented by:-

$$PE_{(r)} = \frac{0.6745(1-r2)}{\sqrt{2}}$$

If the value of r is less than PE then it is

Considered as insignificant

Thereafter, we conducted a Regression Analysis amongst the related variables ie. the average rainfall and food grain production to establish an equation as to how the food grain production will be dependent on the rainfall in the future. (Kothari 2011).

$(Y)_{i} = a + b(X)I + (error)i$ Where;-

$(Y)_{i} =$ value of average inflation for $year_{i}$

a = mean value of inflation (intercept coefficient)

b = average change in inflation when one unit change in crude oil price (slope of crude oil price)

(X)i = value of crude oil price for $year_{i}$

4.1. The collated data is illustrated at Table 1

A	D	E	F	G	H	I	J	K	L
S #	Year	Annual Rain mm	% change from the last year	Annual food grain prodn Milion Tons	% change from the last year	Average Annual Inflation	% change from the last year	Average Call money rates	% change from the last year
1	1950-51	1174.2		50.83					
2	1951-52	1060.6	-9.7%	51.99	2.3%				
3	1952-53	1110.1	4.7%	59.20	13.9%				
4	1953-54	1222.1	10.1%	69.82	17.9%				
5	1954-55	1181.4	-3.3%	68.03	-2.6%				
6	1955-56	1275.4	8.0%	66.85	-1.7%				
7	1956-57	1362.6	6.8%	69.86	4.5%				
8	1957-58	1131.9	-16.9%	64.31	-7.9%				
9	1958-59	1312.3	15.9%	77.14	20.0%	4.74			
10	1959-60	1376.9	4.9%	76.67	-0.6%	4.61	-2.7%		
11	1960-61	1154.8	-16.1%	82.02	7.0%	1.83	-60.3%		
12	1961-62	1399.2	21.2%	82.71	0.8%	1.69	-7.7%		
13	1962-63	1198	-14.4%	80.15	-3.1%	3.63	114.8%		
14	1963-64	1220.9	1.9%	80.64	0.6%	2.94	-19.0%		
15	1964-65	1244.4	1.9%	89.36	10.8%	13.27	351.4%		
16	1965-66	947.4	-23.9%	72.35	-19.0%	9.65	-27.3%		
17	1966-67	1058	11.7%	74.23	2.6%	10.77	11.6%		
18	1967-68	1154	9.1%	95.05	28.0%	13.13	21.9%		
19	1968-69	1059.3	-8.2%	94.01	-1.1%	3.36	-74.4%		
20	1969-70	1147.8	8.4%	99.50	5.8%	-0.56	-116.7%		
21	1970-71	1255	9.3%	108.42	9.0%	5.09	-1008.9%	6.38	
22	1971-72	1216.9	-3.0%	105.17	-3.0%	3.07	-39.7%	5.16	-19.1%
23	1972-73	947.1	-22.2%	97.03	-7.7%	6.43	109.4%	4.15	-19.6%
24	1973-74	1219.5	28.8%	104.67	7.9%	16.79	161.1%	7.83	88.7%
25	1974-75	1055.3	-13.5%	99.83	-4.6%	28.52	69.9%	12.82	63.7%
26	1975-76	1294.8	22.7%	121.03	21.2%	6.62	-76.8%	10.55	-17.7%
27	1976-77	1131.6	-12.6%	111.17	-8.1%	-7.57	-214.4%	10.84	2.7%
28	1977-78	1269.7	12.2%	126.41	13.7%	8.31	-209.8%	9.28	-14.4%
29	1978-79	1237.2	-2.6%	131.90	4.3%	2.54	-69.4%	7.57	-18.4%
30	1979-80	1030.2	-16.7%	109.70	-16.8%	6.23	145.3%	8.47	11.9%
31	1980-81	1182.3	14.8%	129.59	18.1%	11.38	82.7%	7.12	-15.9%
32	1981-82	1170.7	-1.0%	133.30	2.9%	13.11	15.2%	8.96	25.8%

33	1982-83	1084.4	-7.4%	129.52	-2.8%	7.93	-39.5%	8.78	-2.0%
34	1983-84	1320.9	21.8%	152.37	17.6%	11.83	49.2%	8.63	-1.7%
35	1984-85	1160.8	-12.1%	145.54	-4.5%	8.43	-28.7%	9.95	15.3%
36	1985-86	1144.9	-1.4%	150.44	3.4%	5.55	-34.2%	10	0.5%
37	1986-87	1137.6	-0.6%	143.42	-4.7%	8.72	57.1%	9.99	-0.1%
38	1987-88	1088.9	-4.3%	140.35	-2.1%	8.79	0.8%	9.88	-1.1%
39	1988-89	1342.1	23.3%	169.92	21.1%	9.39	6.8%	9.77	-1.1%
40	1989-90	1127.4	-16.0%	171.04	0.7%	7.11	-24.3%	11.49	17.6%
41	1990-91	1401.4	24.3%	176.39	3.1%	8.92	25.5%	15.85	37.9%
42	1991-92	1170.2	-16.5%	168.38	-4.5%	13.88	55.6%	19.57	23.5%
43	1992-93	1102.7	-5.8%	179.48	6.6%	11.88	-14.4%	14.42	-26.3%
44	1993-94	1207.8	9.5%	184.26	2.7%	6.31	-46.9%	6.99	-51.5%
45	1994-95	1295.3	7.2%	191.50	3.9%	10.24	62.3%	9.4	34.5%
46	1995-96	1242.4	-4.1%	180.42	-5.8%	10.22	-0.2%	17.73	88.6%
47	1996-97	1182.9	-4.8%	199.43	10.5%	8.98	-12.1%	7.84	-55.8%
48	1997-98	1183.1	0.0%	193.12	-3.2%	7.25	-19.3%	8.69	10.8%
49	1998-99	1208.8	2.2%	203.61	5.4%	13.17	81.7%	7.83	-9.9%
50	1999-00	1116.6	-7.6%	209.80	3.0%	4.84	-63.2%	8.87	13.3%
51	2000-01	1035.4	-7.3%	196.81	-6.2%	4.02	-16.9%	9.15	3.2%
52	2001-02	1105.2	6.7%	212.85	8.1%	3.77	-6.2%	7.16	-21.7%
53	2002-03	981.9	-11.2%	174.78	-17.9%	4.31	14.3%	5.89	-17.7%
54	2003-04	1243.6	26.7%	213.19	22.0%	3.81	-11.6%	4.62	-21.6%
55	2004-05	1080.5	-13.1%	198.36	-7.0%	3.77	-1.0%	4.65	0.6%
56	2005-06	1208.3	11.8%	208.60	5.2%	4.25	12.7%	5.6	20.4%
57	2006-07	1161.6	-3.9%	217.28	4.2%	5.79	36.2%	7.22	28.9%
58	2007-08	1179.3	1.5%	230.78	6.2%	6.39	10.4%	6.07	-15.9%
59	2008-09	1118	-5.2%	234.47	1.6%	8.32	30.2%	7.26	19.6%
60	2009-10	953.7	-14.7%	218.11	-7.0%	10.83	30.2%	3.29	-54.7%
61	2010-11	1215.5	27.5%	244.49	12.1%	12.11	11.8%	5.89	79.0%
62	2011-12	1116.3	-8.2%	259.29	6.1%	8.87	-26.8%	8.22	39.6%
63	2012-13	1054.7	-5.5%	257.13	-0.8%	9.3	4.8%	8.09	-1.6%
64	2013-14	1092.5	3.6%	265.04	3.1%	10.92	17.4%	8.28	2.3%
65	2014-15	1045.2	-4.3%	252.68	-4.7%	6.37	-41.7%	7.97	-3.7%

Table 2

S No	*Variables*	*Inference*
1	Annual Rainfall v/s Annual Food grains production	Strong positive correlation
2	Annual Rainfall v/s Annual Inflation	Small inverse correlation
3	Annual Rainfall v/s Annual Food grains production	Small correlation
4	Annual food grain production v/s Annual Inflation	Small inverse correlation

4. RESULTS

The results Correlation are illustrated at Tables 2 and 3 and the results of Regression are illustrated from Tables 4 to 6 and Graphs 1 to 3.

Table -2 ; CORRELATION ANALYSIS				
	Annual Rain % change from the last year	Annual Foodgrain Prodn % change from the last year	Annual Inflation % change from the last year	Annual Call money rate % change from the last year
Annual Rain % change from the last year	1			
Annual Foodgrain Prodn % change from the last year	**0.724973328**	1		
Annual Inflation % change from the last year	-0.063318208	-0.079191231	1	
Annual Call money rate % change from the last year	**0.15332178**	-0.080487717	**0.285589722**	1

4.1. Inference from Correlation

The Correlation between the various variables confirms the following:

(a) There is a strong positive correlation between the average rainfall in a year and the average quantum of food grain production during the following year. If there are good rains, the crop is good and vice versa.

(b) There is a small inverse correlation between the quantum of food grain production and the call money rate promulgated by the RBI. It implies that when food grain production is low, the inflation tends to rise and in order to control the inflation the RBI increases the call money rate thereby sucking liquidity from the market. This makes sense.

(c) There is a small inverse correlation between the average annual rainfall and the average call money rate implying that when the rains are deficient, the food grain production in the following year is less which tends to increase inflation and RBI has to tweak the monetary rates to control inflation.

(d) There is a small inverse correlation between the average annual rainfall and the average inflation again implying that deficient rains will raise inflation.

4.2. Inference from Regression, Food Grain v/s Inflation

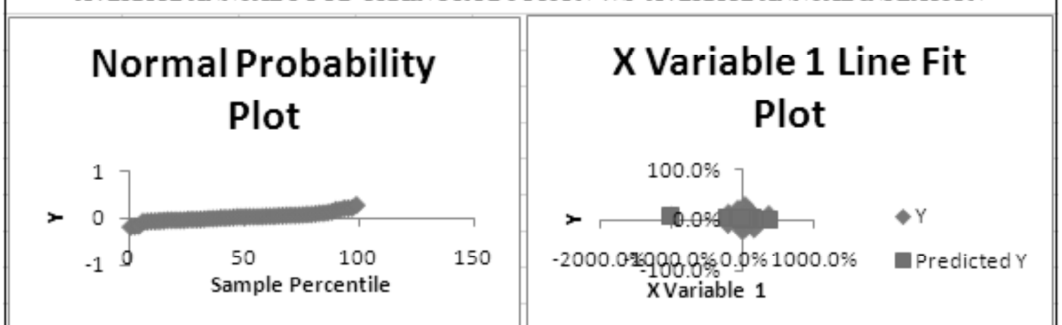
Table - 4

REGRESSION ANALYSIS : AVERAGE ANNUAL FOOD GRAIN PRODUCTION V/S AVERAGE ANNUAL INFLATION

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.079191231							
R Square	0.006271251							
Adjusted R S	-0.012131133							
Standard Error	0.095823328							
Observations	56							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	0.00312912	0.003129123	0.340784706	0.561807241			
Residual	54	0.49583395	0.00918211					
Total	55	0.49896307						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.025116591	0.01284823	1.954868221	0.055783385	-0.00064255	0.05088	-0.0006	0.05088
X Variable 1	-0.004759926	0.0081538	-0.583767682	0.561807241	-0.02110732	0.01159	-0.0211	0.01159

Graph-1

PLOTS FOR REGRESSION ANALYSIS :
AVERAGE ANNUAL FOOD GRAIN PRODUCTION V/S AVERAGE ANNUAL INFLATION



a = 0.02512 (Intercept coefficient)

b = 0.00476 (coefficient of X)

Regression equation is thus given by;-

Y = 0.02512 + 0.00476 (X) where;-

Y is inflation and X is the Food grain production.

Adjusted R square = 0.006 which measures the fit implying that 0.6% of inflation is determined by production of food grains

Thus, the results indicate that in future a small amount of inflation will be dependent on food grains.

4.3. Inference from Regression, Rainfall v/s Inflation

Table -5

REGRESSION ANALYSIS: AVERAGE ANNUAL RAINFALL V/S INFLATION

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.063318208
R Square	0.004009195
Adjusted R Square	-0.01443508
Standard Error	0.134507505
Observations	56

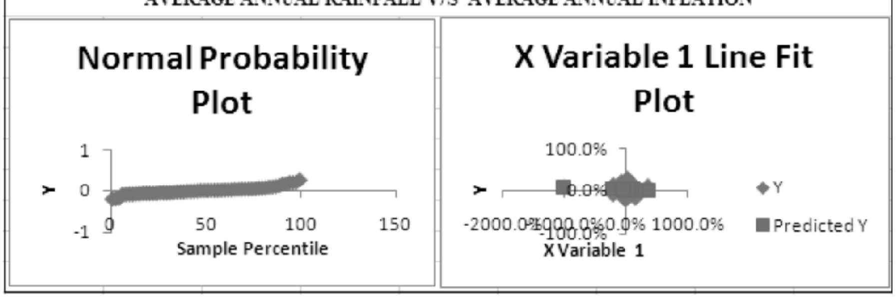
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.00393	0.003933	0.21736802	0.642928
Residual	54	0.97698	0.018092		
Total	55	0.98092			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.003759123	0.01804	0.208434	0.8356745	-0.032399	0.039917	-0.032399	0.03992
X Variable 1	-0.00533621	0.01145	-0.46623	0.64292804	-0.028283	0.017611	-0.028283	0.01761

Graph-2

PLOTS FOR REGRESSION ANALYSIS :
AVERAGE ANNUAL RAINFALL V/S AVERAGE ANNUAL INFLATION



a = 0.00376 (Intercept coefficient)

b = 0.005 (coefficient of X)

Regression equation is thus given by;-

Y = 0.00376 + 0.0005 (X) where;-

Y is inflation and X is the Annual rainfall.

Adjusted R square is -Ve implying inverse dependence

Thus, the results indicate that in future if rains are deficient there will be rise in inflation though very small.

4.4. Inference from Regression, Rainfall v/s Food Grain

Table - 6

REGRESSION ANALYSIS : AVERAGE ANNUAL RAINFALL V/S AVERAGE ANNUAL FOOD GRAIN PRODUCTION

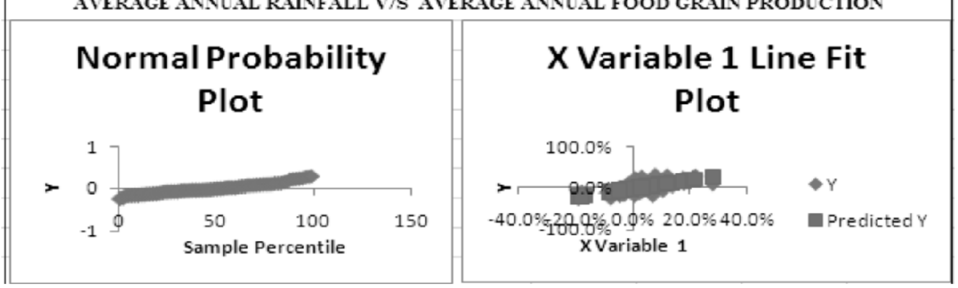
SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.724973328
R Square	0.525586327
Adjusted R Square	0.517934493
Standard Error	0.090373055
Observations	64

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.560992	0.56099	68.6876	1.25492E-11
Residual	62	0.506372	0.00817		
Total	63	1.067364			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.022924456	0.011835	-1.937	0.0573	-0.046582294	0.00073	-0.0466	0.00073
X Variable 1	0.983110827	0.118621	8.2878	1.3E-11	0.745989943	1.22023	0.74599	1.22023

Graph-3

PLOTS FOR REGRESSION ANALYSIS :
AVERAGE ANNUAL RAINFALL V/S AVERAGE ANNUAL FOOD GRAIN PRODUCTION



a = 0.0229 (Intercept coefficient)

b = 0.9832 (coefficient of X)

Regression equation is thus given by;- Y = 0.0229 + 0.9832 (X) where;-

Y is food grain production and X is the Annual rainfall.

Adjusted R square is 0.52 and Multiple R is 0.72 implying high dependence of food grains production on annual rains.

Thus, the results indicate that in future the production of food grains will have about 72% dependence on Annual Rainfall.

5. CONCLUSION

No country would want to link their monetary policy decisions to natural phenomenon in any way. However, the topography and a deficient irrigation system in India make the farmers dependent on rains to a very large extent. Since the production of food grains is directly linked to the quantum of rains and also inversely linked to the inflation, the monetary policy decisions of the RBI also gets influenced by the monsoons or the average annual rainfall.

Bibliography

Alagh, Munish. "Agricultural Economy of India and Macro-Economic Effects." *Indian Institute of Management* , 2011: 6.

Arun, Jaitley. *Nabard.* Pune: NABARD, 2014.

imf.org. n.d. http://www.imf.org/external/pubs/ft/weo/2014/01/weodata/weorept.aspx?pr.x=79&pr.y=7&sy=2012&ey=2015&scsm=1&ssd=1 &sort=country&ds=.&br=1& c=534&s=NGDPD%2CNGDPDPC%2CPPPGDP%2CPPPPC&grp=0&a= (accessed Mar 20, 2016).

Kothari, C R. *Research methodology.* second revised. Delhi: New Age International, 2011.

www. inflation.eu. n.d. *http://www.inflation.eu/inflation-rates/india/historic-inflation/cpi-inflation-india.aspx* (accessed Mar 22, 2016).

www.data.gov.in. Mar 21, 2016. *https://data.gov.in/catalog/all-india-area-weighted-monthly-seasonal-and-annual-rainfall-mm* (accessed Mar 21, 2016).

www.dbie.rbi.org. n.d. *http://dbie.rbi.org.in/DBIE/dbie.rbi?site=statistics* (accessed Mar 21, 2016).

www.rbi.org.in. n.d. *https://rbi.org.in/scripts/FS_Overview.aspx?fn=2752* (accessed Mar 22, 2016).