

Structural Break Characterisation: A Case on Key Indian Agricultural Indicators and Indian Securities Market

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Abstract

This study focuses to examine the i) dependence structure pertaining to a) Per Capital GDP on selected agricultural indicators such as Agricultural Production (Food Grains), Agricultural Yield (Food Grains) and Area under Cultivation (Food Grains) b) Agricultural Production (Food Grains) on Food Credit c) Agricultural Yield (Food Grains) on Food Credit and d) Market Capitalisation of BSE Limited on Per Capital GDP ii) parameter stability due to financial crisis on the aforementioned notions from 1992-93 to 2018-19. The study showed that the relationship between Per Capita GDP and selected agricultural indicators as well as the relationship between food grains' agricultural yield and food credit undergone structural change during the study period. However, no statistically significant relationship between food grains' agricultural production and food credit as well as relationship between market capitalisation of BSE Limited and Per Capita GDP for structural change attributing to global financial crisis.

Keywords: Structural Break, Agricultural Production, Agricultural Yield, Per Capital GDP, Market Capitalisation, Food Credit

Introduction

After the 1929 Great Depression, the financial markets around the world had trembled during the financial years 2007-08 and 2008-09, which profoundly affected the economic activity around the globe. In consequence of the financial crisis, the market capitalisation of the BSE Limited, formerly known as Bombay Stock Exchange Limited had slipped to Rs. 30,86,076 crores in the financial year 2008-09 as it was Rs. 51,38,015.26 crores in 2007-08 (Source: BSE Limited), which had had cascading effect in all industry verticals in India. From the pragmatic perspective, during the financial year 2008-09, on account of various pressure from the external sector such as commodity prices around the world with inflationary trend, capital inflows, financial meltdown baffled the Indian economy. As iterated in the Economic survey 2007-08, the Indian economy, on its growth trajectory, it had reached increased level of growth with Gross Domestic Product (GDP) at market prices exceeding 8 per cent every financial year since 2003-04. Apparently, in consequence of higher growth, the confrontations with the challenges have become more critical due to globalisation. Surprisingly, until the middle of financial year 2008-09, it was believed and firmly felt that the financial crisis coupled only with the developed economies, but the illusion fled sooner. Eventually, its

reflection, the 2008-09 third quarter GDP growth fell to 6.2 per cent and again dipped to 5.8 per cent during fourth quarter. The financial crisis effect strongly laid its footprint in Indian agricultural sector as well exhibiting -1.4 per cent growth rate (Source: Reserve Bank of India) during third quarter of 2008-09 pertaining to agriculture and allied activities. Hence it is pertinent to examine relationship amongst key economic indicators and structural change attributing to financial crisis.

Literature Review

Cornia (1985) examined the relationship between labour productivity, land yields and factor inputs for farms of different sizes amongst 15 developing countries. The study found that small farms rendered higher yields as compared to large farms due to more intense use of land and negative correlation had been observed between farm size and yield per hectare and factor inputs.

Sriram (2007) advocated that the Indian agriculture has been undergoing fundamental change due to the very fact that the inputs and technology have been leaving the hands of farmers to the external resources. The study exhibited that there is a need to perceive the rural financial markets through the existence of demand pattern and also described that the rural markets should be focused holistically rather than concentrating only on agriculture.

Anjani et al. (2010) expressed that due to financial crisis uncertainty in Indian Agricultural sector perhaps be evident. On account of high economic recession at USA, UK, Japan and Saudi Arabia, the Indian agricultural exports had slowed down. The study exhibited that the institutional credit towards agriculture had remained stable and attributing to reduced level of Private and Public investments, it may considerably take few more years to see the better prospects in Indian agricultural sector.

Shah (2010) delineated that due to financial crisis, farmers of cash crops were witnessed lower prices for their crops despite there were rise in food prices. Albeit, that the Government of India has brought various regulatory measures to curb price fluctuations on the commodity prices, furthermore adequate control need to be exercised especially domestic prices pertaining to essential commodities.

Jarko & Likka (2010) analysed the business cycles in India and China as an effect of transmission of the financial crisis that affected the global economy. They found that the global financial crisis had significantly impacted the economic activities of Asian economies. The study also showed that in OCED countries and emerging Asian countries, there were significant association between trade

ties and dynamic correlations of the GDP growth rates.

Ali & Afzal (2012) chose KSE 100 and BSE 100 stock indices from Pakistan and India for the period between 1st January 2003 and 31st August 2010 to examine the impact of global financial crisis. The study revealed that the negative shocks had deeper impact on the indices volatility than the positive shocks. As compared to Pakistan, Indian stock markets had intense impact due to global financial crisis.

Das et al. (2012) narrated that the Indian economy had feeble impact during and after the financial crisis due to people's perception towards savings, fundamental attributes of the organisations, intense regulatory and protective measures.

Naidu et al. (2013) analysed the effect of agricultural credit on agricultural productivity and production during the period between 1985-86 and 2011-12 in India and concluded that agricultural credit plays a pivotal role to enhance the agricultural productivity along with technological advancements in agriculture.

Mensi et al. (2014) examined how the global factors influence the BRICS countries stock markets and analysed the dependence structure between BRICS countries for the period from 1997 to 2013. Their study showed that BRICS countries' stock markets had statistically significant dependence structure with developed countries' global indices such as S&P Index and commodities index pertaining to oil and gold. It was also observed that the dependence structure often skewed due to the global financial crisis, however, the uncertain US economic policy had no influence on the BRICS stock markets.

Shalini and Prasanna (2016) studied the presence of regime shift or structural break in volatility during the financial crisis by selecting the spot prices of eighteen distinct commodities. They found that during the global financial crisis, there was a shift from low volatility to high volatility in commodities market. The selected agricultural commodities had showed faster convergence to long run equilibrium. The study also showed that the systematic risk exposure from exogenous factors pertaining to Indian commodities market had caused more volatility during and after the financial crisis.

Objectives, Data and Methodological Framework

Objectives of the Study

To examine the impact of key Indian agricultural indicators on Per Capita GDP and its parameter stability (Constant term and Exposure from Agricultural indicators) before and after the financial crisis.

To examine the impact of Indian Agricultural Production & Yield on Food Credit rendered by Scheduled Commercial Banks in India and its parameter stability (Constant term and Exposure from Agricultural Production and Yield) before and after financial crisis.

To study the impact of Per Capital GDP on Market Capitalisation of BSE Limited and its parameter stability (Constant term and Exposure from Per Capita GDP) before and after financial crisis.

Data and Methodological Framework

In order to study the aforementioned objectives, following key variables are considered for the period between 1992 and 2019 (27 Financial Years).

1. Per Capita Gross Domestic Product (GDP) at Current Prices (PCGDP)

2. Agricultural Production (Food Grains) (AP)

3. Area Under Cultivation (Food Grains) (AUC)

4. Agricultural Yield (Food Grains) (AY)

5. Food Credit given by Scheduled Commercial Banks (FC)

6. Market Capitalisation of BSE Limited (MC)

The values pertaining to the iterated study variables are collected from the Reserve Bank of India (<https://www.rbi.org.in>) and BSE Limited (<https://www.bseindia.com>).

The study is broadly categorized in three distinct stages to validate the parameter stability of derived regression models.

Stage 1: Examining the parameter stability pertaining to Per Capital GDP on Agricultural indicators of Indian economy as specified in the following regression models.

Before financial crisis (1992-93 to 2006-07): $PC\widehat{GDP}_t = \gamma_1 + \gamma_2 AP_t + \gamma_3 AUC_t + \gamma_4 AY_t + \varepsilon_{1t}$

After financial crisis (2007-08 to 2018-19): $PC\widehat{GDP}_t = \beta_1 + \beta_2 AP_t + \beta_3 AUC_t + \beta_4 AY_t + \varepsilon_{2t}$

Pooled regression (1992-93 to 2018-19): $PC\widehat{GDP}_t = \alpha_1 + \alpha_2 AP_t + \alpha_3 AUC_t + \alpha_4 AY_t + \varepsilon_t$

H_0 : There is no structural change in the entire period i.e. $\alpha_1 = \beta_1 = \gamma_1, \alpha_2 = \beta_2 = \gamma_2, \alpha_3 = \beta_3 = \gamma_3, \alpha_4 = \beta_4 = \gamma_4$

H_1 : There is a statistically significant structural change in the entire period i.e. $\alpha_1 \neq \beta_1 \neq \gamma_1, \alpha_2 \neq \beta_2 \neq \gamma_2, \alpha_3 \neq \beta_3 \neq \gamma_3, \alpha_4 \neq \beta_4 \neq \gamma_4$

Stage 2: Examining the parameter stability pertaining to Agricultural Production and Yield on Food credit as mentioned in the following regression models.

Before financial crisis (1992-93 to 2006-07): $\widehat{AY}_t = \gamma_1 + \gamma_2 FC_t + \varepsilon_{1t}$

After financial crisis (2007-08 to 2018-19): $\bar{A}\bar{Y}_t = \beta_1 + \beta_2 FC_t + \varepsilon_{2t}$

Pooled regression (1992-93 to 2018-19): $\bar{A}\bar{Y}_t = \alpha_1 + \alpha_2 FC_t + \varepsilon_t$

H_0 : There is no structural change in the entire period i.e. $\alpha_1 = \beta_1 = \gamma_1, \alpha_2 = \beta_2 = \gamma_2$

H_1 : There is a statistically significant structural change in the entire period i.e. $\alpha_1 \neq \beta_1 \neq \gamma_1, \alpha_2 \neq \beta_2 \neq \gamma_2$

Before financial crisis (1992-93 to 2006-07): $\bar{A}\bar{P}_t = \gamma_1 + \gamma_2 FC_t + \varepsilon_{1t}$

After financial crisis (2007-08 to 2018-19): $\bar{A}\bar{P}_t = \beta_1 + \beta_2 FC_t + \varepsilon_{2t}$

Pooled regression (1992-93 to 2018-19): $\bar{A}\bar{P}_t = \alpha_1 + \alpha_2 FC_t + \varepsilon_t$

H_0 : There is no structural change in the entire period i.e. $\alpha_1 = \beta_1 = \gamma_1, \alpha_2 = \beta_2 = \gamma_2$

H_1 : There is a statistically significant structural change in the entire period i.e. $\alpha_1 \neq \beta_1 \neq \gamma_1, \alpha_2 \neq \beta_2 \neq \gamma_2$

Stage 3: Examining the parameter stability pertaining to Market Capitalisation of BSE Limited on Per Capital GDP as iterated the following regression models.

Before financial crisis (2001-02 to 2006-07): $\bar{M}\bar{C}_t = \gamma_1 + \gamma_2 PCGDP_t + \varepsilon_{1t}$

After financial crisis (2007-08 to 2018-19): $\bar{M}\bar{C}_t = \beta_1 + \beta_2 PCGDP_t + \varepsilon_{2t}$

Pooled regression (2001-02 to 2018-19): $\bar{M}\bar{C}_t = \alpha_1 + \alpha_2 PCGDP_t + \varepsilon_t$

H_0 : There is no structural change in the entire period i.e. $\alpha_1 = \beta_1 = \gamma_1, \alpha_2 = \beta_2 = \gamma_2$

H_1 : There is a statistically significant structural change in the entire period i.e. $\alpha_1 \neq \beta_1 \neq \gamma_1, \alpha_2 \neq \beta_2 \neq \gamma_2$

In order to test the null hypothesis, Chow test is used. As iterated by Chow test, if there are no structural changes before and after the financial crisis, then, essentially the unexplained variance of pooled regression (RSS_R) and unexplained variance of before & after regression model (RSS_{UR}) shall not be statistically different. Thus, the model is iterated below.

$$F = \frac{(RSS_R - RSS_{UR})/k}{RSS_{UR}/(n_1 + n_2 - 2k)} \sim F_{[k, n_1 + n_2 - 2k]}$$

Where, 'k' is the number of parameters estimated. If the calculated F-ratio is greater than the F-critical value at 0.01, 0.05, 0.1 for ascertained degrees of freedom, reject the null hypothesis, otherwise retain the null hypothesis.

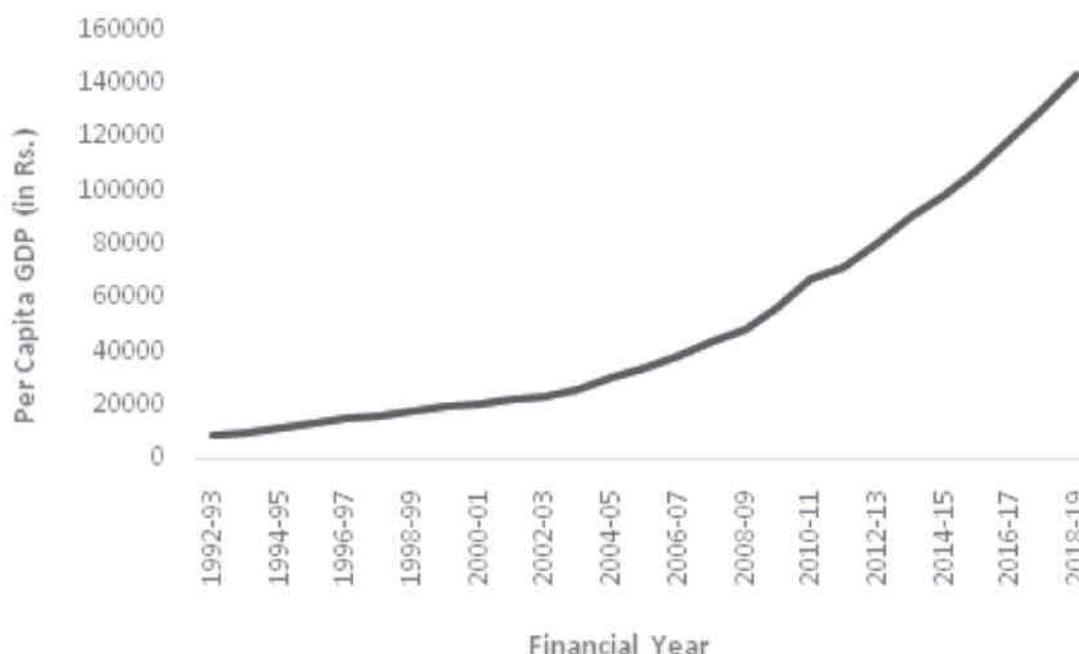
Results and Discussion

Descriptive Statistics pertaining to selected study variables:

Per Capita GDP: The average pre and post financial crisis Per capita GDP are found to be Rs. 20,189.9 and Rs. 87,761.3 respectively. Diagram 4.1 depicts the Per Capita Gross Domestic Product between the financial years 1992-93 and 2018-19. The observed coefficient of variation of Per Capita GDP stood 41.84 per cent before the financial

crisis and exhibited 35.26 per cent after the financial crisis. Indeed, after the financial crisis the Per Capita GDP has become less variable due to strong fundamentals of Indian industry verticals.

Diagram 4.1

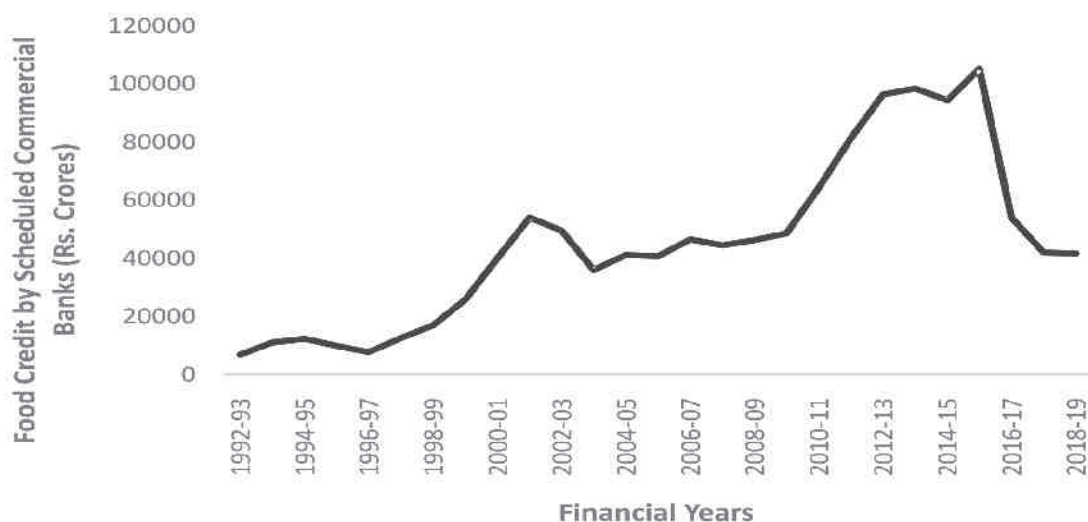


Source: Reserve Bank of India - Handbook of Statistics on Indian Economy for the year 2018-19

Food Credit: Food credit is one of the significant indicator of Indian economy which signifies quantum of funds dispersed by the scheduled commercial banks to Food Corporation of India and other agencies for conservation food items. Diagram 4.2 depicts the Food Credit rendered by scheduled commercial banks to Food Corporation of India and other agencies between the financial years 1992-

93 and 2018-19. It is seen that the average food credit accounted to Rs. 68,062.7 crores after the financial crisis as compared to Rs. 27,336.5 crores prior to financial crisis and eventually, after the financial crisis the coefficient of variation recorded at 35.47 per cent as compared to 60.65 per cent before the crisis.

Diagram 4.2

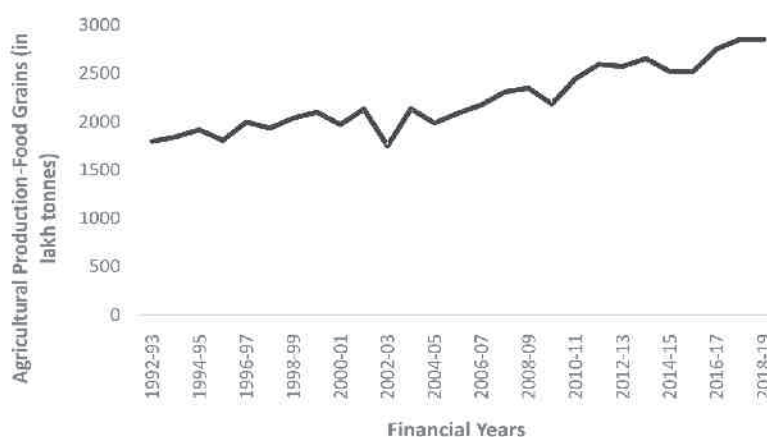


Source: Reserve Bank of India - Handbook of Statistics on Indian Economy for the year 2018-19

Agricultural Production: The agricultural production, one of the significant indicator of Indian agricultural sector, during 2007-08 to 2018-19, the average production recorded at 2548.31 lakh tonnes as compared to 1975.66 lakh tonnes during 1992-92 to 2006-07. The coefficient of

variation increased by 1.27 per cent after the financial crisis. Diagram 4.3 depicts the agricultural production of food grains (in lakh of tonnes) between the financial years 1992-93 and 2018-19.

Diagram 4.3

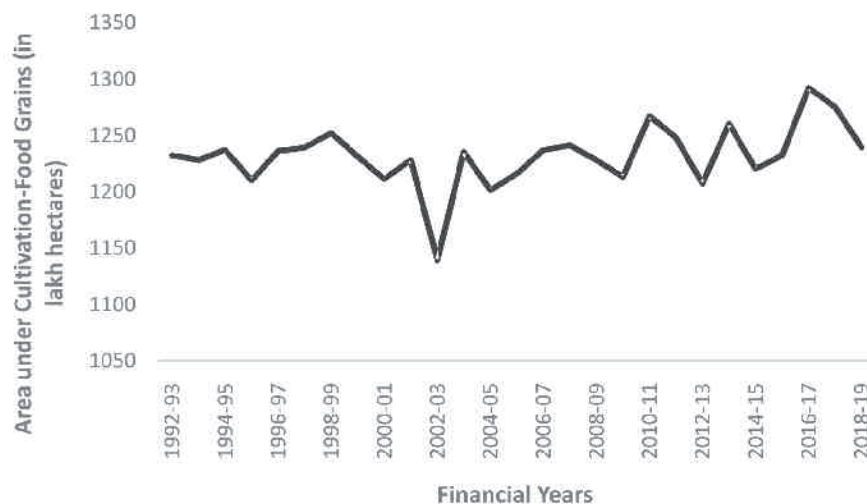


Source: Reserve Bank of India - Handbook of Statistics on Indian Economy for the year 2018-19

Area under Cultivation: Diagram 4.4 depicts the area under cultivation for food grains (in lakh hectares) between the financial years 1992-93 and 2018-19. The area under cultivation measured in lakh hectares for food grains has exhibited dynamic trend since the beginning of the study

period. The average lakh of hectares for food grains cultivation during 1992-07 were 1222.13 lakh hectares as against 1234.5 lakh hectares during 2007-19 and the coefficient of variation remained equal with feeble decrease in its proportion.

Diagram 4.4

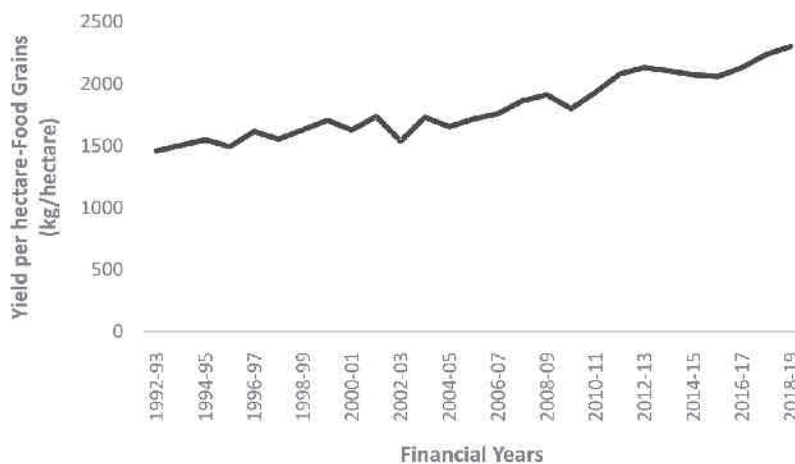


Source: Reserve Bank of India - Handbook of Statistics on Indian Economy for the year 2018-19

Food Grains-Yield per hectare: The average food grains yield per hectare has increased to 1646.5 kg during 2007-19 as compared to 1615.8 kg during 1992-07. Diagram 4.5 depicts the food grains yield per hectare (kg/hectare)

between the financial years 1992-93 and 2018-19. In fact, the yield per hectare's coefficient of variation increased to 8.7 per cent during 2007-19 as compared to 5.86 per cent during 1992-07.

Diagram 4.5

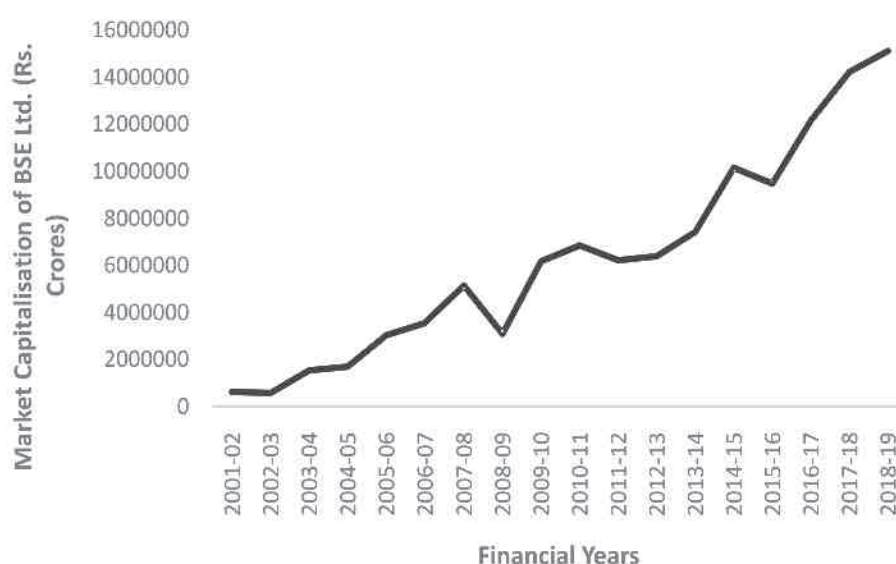


Source: Reserve Bank of India - Handbook of Statistics on Indian Economy for the year 2018-19

Market Capitalisation of BSE Limited: The BSE Limited, erstwhile known as Bombay Stock Exchange Limited is the barometer of Indian economy. In order to study the impact of financial crisis, the BSE Limited's market capitalisation has been considered for the financial years between 2001-02 and 2018-19. Diagram 4.6 depicts the Market capitalisation of all securities traded at BSE Limited between the financial years 2001-02 and 2018-19. Though, during the initial phase of financial crisis, the Indian securities markets both primary and secondary

markets trembled and apparent investors' turmoil, due to very strong fundamentals of Indian industry verticals, markets shown the growth trajectory to the investing community nationally and internationally. It is seen that the average market capitalisation of BSE Limited were Rs. 18,31,613 crores prior to financial crisis and after the financial crises, the average market capitalisation recorded Rs. 85,29,978 crores. Surprisingly, after the financial crisis, the coefficient of variation has drastically reduced to 41.89 per cent as it was 61.16 per cent before the financial crisis.

Diagram 4.6



Source: Reserve Bank of India - Handbook of Statistics on Indian Economy for the year 2018-19

The data analysis has been carried in four distinct phases.

Phase 1: Measuring the parameter stability pertaining to Per Capita GDP on agricultural production, area under cultivation and agricultural yield before and after the financial crisis.

Phase 2: Measuring the parameter stability pertaining to agricultural production (food grains) on food credit before and after the financial crisis

Phase 3: Measuring the parameter stability pertaining to agriculture yield (food grains) on food credit before and after the financial crisis

Phase 4: Measuring the parameter stability pertaining to market capitalisation of BSE Limited on Per Capital GDP

before and after the financial crisis

The first phase of data analysis is presented in Table 4.1

Table 4.1 describes the results of structural break related to Per Capita GDP

Pooled regression (1992-93 to 2018-19): $R^2 = 0.9196$			
Intercept / Explanatory Variable	Coefficient (t, Sig.)	df	Unexplained Variance (Residuals)
Constant term	-140414.92 (-1.2003, 0.2422)	23	3456645600
Agricultural Production	-10.10* (-1.7856, 0.0874)		
Area Under Cultivation	-72.46 (-0.7205, 0.4785)		
Agricultural Yield	166.69*** (13.4270, 0.0000)		
Before financial crisis regression (1992-93 to 2006-07: 15 years): $R^2 = 0.7787$			
Constant term	605980.91 (0.6285, 0.5425)	11	237090700.8
Agricultural Production	289.25 (0.5802, 0.5735)		
Area Under Cultivation	-583.17 (-0.7382, 0.4758)		
Agricultural Yield	-275.12 (-0.4518, 0.6602)		
After financial crisis regression (2007-08 to 2018-19: 12 years): $R^2 = 0.8289$			
Constant term	-344190.02 (-1.2863, 0.2343)	8	1965489302
Agricultural Production	-6.41 (-0.7829, 0.4562)		
Area Under Cultivation	37.44 (0.1664, 0.8720)		
Agricultural Yield	195.37*** (5.5682, 0.0005)		
Chow Test: F-ratio = 2.7045			
F-distribution critical values at 0.01, 0.05, 0.1 for (4,19) = 4.5, 2.9, 2.27			
Decision: Retain the H_0 at 0.01 and 0.05, Reject the H_0 at 0.1 level of significance			
*** 0.01, ** 0.05, * 0.1 Level of Significance			

The Per Capita GDP, although it is constituted by various components, the study considers only the selected agricultural indicators. From the financial year 1992-93 to 2006-07 has been considered as pre-financial crisis period and from 2007-08 to 2018-19 has been considered as post-financial crisis period. The regression results pertaining to pre-financial crisis period has shown no statistically significant results though the model could explain 77.87 per cent variation in Per Capital GDP, however, post-financial crisis results showed that agricultural yield's systematic risk is statistically significant at 0.01 level of

significance and other indicators such as agricultural production and area under cultivation remained insignificant. The pooled regression results showed that agricultural production is statistically significant at 0.1 level of significance, agricultural yield is statistically significant at 0.01 level of significance and area under cultivation remained insignificant. The pooled multiple regression model from the year 1992-93 until 2018-19 exhibited 91.96 per cent coefficient of determination. The parameter stability examination through Chow test has rendered the following results.

- At 0.01 and 0.05 level of significance $\rightarrow$ Statistically insignificant $\rightarrow \alpha_1 = \beta_1 = \gamma_1, \alpha_2 = \beta_2 = \gamma_2, \alpha_3 = \beta_3 = \gamma_3, \alpha_4 = \beta_4 = \gamma_4$, which signifies that there were no structural change due to financial crisis.
- At 0.1 level of significance $\rightarrow$ Significant $\rightarrow \alpha_1 \neq \beta_1 \neq \gamma_1, \alpha_2 \neq \beta_2 \neq \gamma_2, \alpha_3 \neq \beta_3 \neq \gamma_3, \alpha_4 \neq \beta_4 \neq \gamma_4$, which narrates that there have been observed structural change in the constant term and systematic risk exposure from respective selected agricultural indicators. However, the study does not attempt to measure whether the structural change has occurred only in the constant term or systematic risk exposure or both.

Table 4.2 describes the results of structural break related to **Agricultural production (food grains)**

Pooled regression (1992-93 to 2018-19): $R^2 = 0.1641$			
Intercept / Explanatory Variable	Coefficient (t, Sig.)	df	Unexplained Variance (Residuals)
Constant term	1829.49*** (11.0960, 0.0000)	25	5222465
Food Credit	0.0068** gression (1992-2018) (2.2156, 0.0361)		
Before financial crisis re		-93 to 2006-	$R^2 = 0.2118$

Constant term	1876.67*** (30.2960, 0.0000)	13	201219.9
Food Credit	0.0036* (1.8690, 0.0890)		
After financial crisis regression (2007-08 to 2018-19: 12 years): $R^2 = 0.0372$			
Constant term	1987.72*** (3.2857, 0.0082)	10	4908525
Food Credit	0.0052 (0.6213, 0.5483)		
Chow Test: F-ratio = 0.2537			
F-distribution critical values at 0.01, 0.05, 0.1 for (2,23) =5.67, 3.42, 2.55			
Decision:Retain the H_0 at 0.01, 0.05 and 0.1 level of significance			
*** 0.01, ** 0.05, * 0.1 Level of Significance			

As iterated in Table 4.2, analysis has been carried to examine the parameter stability pertaining to agricultural production on food credit by scheduled commercial banks. From Table 4.2, it is seen that the constant term (Intercept of regression line) pertaining to three stages of regression (Pre & Post financial crisis and Pooled regression) remained statistically significant at 0.01 level of significance. The explanatory variable of the regression i.e. food credit was statistically significant at 0.1 level of significance during pre-financial crisis period but after the

financial crisis period, it has become insignificant to explain the explained variable i.e. agricultural production. However, considering the pooled regression data, the food credit stood statistically significant at 0.05 level of significance. Although all the models' coefficient of determination exhibits low degree, since we have statistically significant explanatory variable, the model is expected to yield the desired outcome. Analysis pertaining to parameter stability for detecting structural changes has shown the following results.

- Retain the null hypothesis $\rightarrow$ No statistically significant evidence found for structural changes i.e. $\alpha_1 = \beta_1 = \gamma_1, \alpha_2 = \beta_2 = \gamma_2$

This accentuate that the financial crisis has not impacted the model's constant term and beta component pertaining to food credit. Similar exercise has been carried to examine

the parameter stability relating to agricultural yield on food credit and the results are summarized in Table 4.3.

Table 4. 3 describes the results of structural break related to Agricultural yield (food grains)

Pooled regression (1992-93 to 2018-19): $R^2 = 0.5343$			
Intercept / Explanatory Variable	Coefficient (t, Sig.)	df	Unexplained Variance (Residuals)
Constant term	1523.38*** (24.1968, 0.0000)	25	761461.3
Food Credit	0.0063*** (5.3552, 0.0000)		
Before financial crisis regression (1992-93 to 2006-07: 15 years): $R^2 = 0.4658$			
Constant term	1509.20*** (40.7587, 0.0000)	13	71898.44
Food Credit	0.0039*** (3.3670, 0.0051)		
After financial crisis regression (2007-08 to 2018-19: 12 years): $R^2 = 0.0166$			
Constant term	1997.47*** (14.8603, 0.0000)	10	242323.1
Food Credit	0.0008 (0.4107, 0.6899)		
Chow Test: F-ratio = 16.3683			
F-distribution critical values at 0.01, 0.05, 0.1 for (2,23) = 5.67, 3.42, 2.55			
Decision:Reject the H_0 at 0.01, 0.05 and 0.1 level of significance			
*** 0.01, ** 0.05, * 0.1 Level of Significance			

It is seen from Table 4.3 that the constant term pertaining to pre-financial crisis, post-financial crisis and pooled regression remained statistically significant at 0.01 level of significance, however, the systematic risk exposure from food credit remained statistically significant during pre-financial crisis period as well as for the consolidated period at 0.01 level of significance, but it exhibited statistically

insignificant result during the post-financial crisis period. The coefficient of determination has moderately better explaining power for pooled regression and pre-financial crisis period, but it contained less explaining power pertaining to post-financial crisis regression. While examining the structural break for constant term and systematic risk exposure between three regressions, Chow

test results revealed that there is significant structural change had occurred amongst intercept term and systematic risk exposure ($F_{Cal}: 16.3683 > F_{crit}[2,23]: 5.67, 3.42, 2.55$) at all levels of significance. Hence, we can concretely attribute the structural change to financial crisis but no validation has been carried whether the financial crisis has impacted the intercept term or slope of regression or both. On all parance, it can be iterated that the food credit influences the agricultural yield pertaining to food

grains. Although there are mixed parameter stability outcomes pertaining to Per Capita GDP and key agricultural indicators, attempt has been made to examine the structural change related to market capitalisation of BSE Limited while regressing with Per Capita GDP from financial years 2001-02 to 2018-19 and the results are summarized in Table 4.4.

Table 4.4 describes the results of structural break related to market capitalisation of BSE Limited

Pooled regression (2001-02 to 2018-19): $R^2 = 0.9599$			
Intercept / Explanatory Variable	Coefficient (t, Sig.)	df	Unexplained Variance (Residuals)
Constant term	-1386136.29*** (-3.0891, 0.0070)	16	13630300000000
Per Capita GDP	112.86*** (19.5777, 0.0000)		
Before financial crisis regression (2001-02 to 2006-07: 15 years): $R^2 = 0.9539$			
Constant term	-3616434.14*** (-5.9238, 0.0041)	4	3470000000000
Per Capita GDP	189.74*** (9.1022, 0.0008)		
After financial crisis regression (2007-08 to 2018-19: 12 years): $R^2 = 0.9213$			
Constant term	-1195817 (-1.2547, 0.2381)	10	12100000000000
Per Capita GDP	110.82*** (10.8200, 0.0000)		
Chow Test: F-ratio = 0.6655			
F-distribution critical values at 0.01, 0.05, 0.1 for (2,14) = 6.51, 3.74, 2.73			
Decision: Retain the H_0 at 0.01, 0.05 and 0.1 level of significance			
*** 0.01, ** 0.05, * 0.1 Level of Significance			

It is seen from Table 4.4, the R^2 i.e. coefficient of determination pertaining to all three regression lines such as a) pooled regression for the period between 2001-02 and 2018-19 b) pre-financial crisis regression for the period between 2001-02 and 2006-07 and c) post-financial crisis for the period between 2007-08 and 2018-19 were 95.99 per cent, 95.39 per cent and 92.13 per cent respectively. This signifies that the Per Capita GDP explains higher proportion of variance in BSE's market capitalisation. Regression results of all three notions revealed that the systematic exposure is statistically significant at 0.01 level of significance and constant term is statistically significant for pooled regression and pre-financial crisis period, but insignificant for post-financial crisis period. It was quite evident from the extant literature that the financial crisis had impacted Indian financial markets to a large extent (Ali & Afzal, 2012) as compared to neighbouring nations. Hence, in order to validate the structural change in the proposed regression model, the Chow test has been carried and the results are as follows.

Retain the null hypothesis i.e. there is no structural change during the entire period of study ($F_{Cal.}: 0.6655 < F_{Crit.}(2,14 \text{ for } 0.01, 0.05 \text{ \& } 0.1): 6.51, 3.74, 2.73 \text{ respectively})$), which signifies that the financial crisis did not cause any impact in the parameters under study i.e. the intercept term of the regression model and systematic risk exposure of the regression model. Thus, the influence from Per Capita GDP to explain the market capitalisation of BSE Limited remained unchanged during the study period, although the financial crisis impacted the Indian financial markets.

CONCLUSION

The global financial crisis which began during the year 2007 after the break-out of United States sub-prime mortgage market had instantly influenced the Asian markets including India and made all the stakeholders to learn the hard lessons. This study aimed to validate the structural break attributing to financial crisis on selected economic, agricultural and financial market indicators in India. From 1992-93 to 2006-07 and 2007-08 to 2018-19 have been considered as pre-financial crisis period and post-financial crisis period to examine the parameter stability of the aforementioned key indicators. The study shows that Per Capita GDP is negatively influenced by agricultural production (food grains) and area under cultivation (food grains), but positively influenced by agricultural yield (food grains) which is statistically significant at 0.01. The relation between Per Capita GDP and the selected agricultural indicators namely agricultural production (food grains), area under cultivation (food grains) and agricultural yield (food grains) have undergone structural change attributing to financial crisis at 0.1 level of significance. Pooled regression pertaining to agricultural production (food grains) and agricultural yield (food grains) on food credit exhibits positive systematic risk exposure at 0.05 and 0.01 level of significance respectively. Parameter stability examination relating a) agricultural production (food grains) on food credit b) agricultural yield (food grains) on food credit showed no

statistical evidence for the former and statistically strong structural change evidence for the latter. Statistically significant systematic risk is evident from the pooled regression pertaining to market capitalisation of BSE Limited on Per Capital GDP at 0.01 level of significance. The relationship between market capitalisation of BSE Limited and Per Capital GDP of Indian economy have not undergone any structural change on account of financial crisis. Although, on account of global financial crisis, India had had few black-Mondays during 2007-08 and continued impact during 2008-09, the strong fundamentals of Indian industry verticals and investment climate, India has become the most preferred investment designation to all categories of investors especially global investors.

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