

Working Paper

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**Performance of Gujarat Economy :
An Analysis of Growth and Instability**

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Anita Arya and Niti Mehta*

Abstract

Since the State's inception, the growth process in Gujarat and its regions has experienced ups and downs in the economic activities. Not much attention is attributed to short term fluctuations in the growth of economic activities as long as the long term growth depicts an upward trend. However, if the short term fluctuations become frequent and adversely affect the long term rate of growth, there is a need for a closer look. Tackling instability acquires importance for improving the lot of small and marginal farmers, who are more affected by spells of bad years. Instability in agricultural production raises risk in farm production, affecting farmers' incomes and decisions for investments to adopt new technologies.

This paper is devoted to looking at the long term macro-economic growth pattern of Gujarat since its inception. It highlights the problem of instability in economic growth – both for the economy and in particular for agricultural sector. The comparative picture of Gujarat in the national economy is presented, together with a discussion on changing structure of Gujarat's economy from early 1960s to 2008-09. The analysis of instability is also carried out at the sectoral level. Analysis of instability is attempted in terms of structure of the economy. Income is the variable selected for analysis as it is a comprehensive measure of economic activity. For agriculture, the paper opts 'output' for the sectoral analysis.

Key words: Agricultural growth, Instability, Sectoral growth, Gujarat.

JEL Classification: E01, E32, O1, Q10

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I. Introduction

In the economic growth process, it is theoretically envisaged that dependence on agriculture is reduced, while the economy becomes increasingly dependent on the secondary and tertiary sectors. During the initial phase of economic growth, agricultural sector would become a provider of labour, wage goods/food grains and raw materials for the expanding industrial and tertiary sectors. An economy facing structural transformation would experience reduction in the income share of primary sector (with subsequent reduction in share of employment) and increase in the share of secondary and tertiary sectors.

Since the State's inception, the growth process in Gujarat and its regions has experienced ups and downs in the economic activities. Not much attention is attributed to short term fluctuations in the growth of economic activities as long as the long term growth depicts an upward trend. However, if the short term fluctuations become frequent and adversely affect the long term rate of growth, there is a need for a closer look. Tackling instability acquires importance for improving the lot of small and marginal farmers. More than the resource rich farmers, it is the small producers who get affected by spells of bad years. Instability in agricultural production raises risk in farm production, affecting farmers' incomes and possibly their decisions for investments to adopt new technologies. It also affects price stability and vulnerability of low income households to market swings (Chand and Raju, 2009). The impact of new technologies on instability in agricultural production is yet unclear; it has been contended by some researchers that instability has in fact increased with the adoption of green revolution technologies (Hazell, 1982). However, others (Sharma *et. al.*, 2006) have found that production of foodgrains stabilized during the 1990s as compared to 1980s.

Often variability analysis in crop production shows different results depending on the choice of study period. Further, instability in production at the country level may not necessarily depict the picture prevailing at disaggregated levels of state and districts. Besides prices, the environmental factors such as rainfall and irrigation are the most important causes of variations in production across space as application of inputs/fertilizers is sensitive to water availability (Ray, 1983).

This paper is devoted to looking at the long term macro-economic growth pattern of Gujarat since its inception in 1960. We highlight the problem of instability in economic growth – both for the economy and in particular for agricultural sector. The comparative picture of Gujarat in the national economy is presented, together with a discussion on changing structure of Gujarat's economy from early 1960s to 2008-09. The analysis of instability is also carried out at the sectoral level.

Methodology and Data Sources: At the regional level instability can be attended by looking at interrelationship between various regions. This can be attempted in an inter-regional framework. For such an analysis the data requirements comprise information relating to linkage between various sectors of different regions. Since such information is not available, we have attempted analysis of instability in terms of structure of the economy. Income is the variable selected for analysis as it is a comprehensive measure of economic activity and also as income data is readily available.

State Domestic Product (SDP) is available over time at the aggregate level and for various sectors. We look at instability at a disaggregated level in terms of activities within broad sectors. The relevant information is available only for industry and agriculture at disaggregated level. For agriculture, we opt 'output' for the sectoral analysis.

The study period is determined by availability of data for different variables. Data on SDP at constant prices is available from 1960-61 to 2008-09. However, the base has changed in each decade and has been highlighted in the tables. The base is at 1960-61 prices for 60s and mid 70s, at 1980-81 prices for 80s decade, at 1993-94 prices for 1993-94 to 2004-05, and at 1999-2000 prices for the subsequent period. The income data for disaggregated sectors is analyzed for the period 1980-81 to 2004-05. The study by Wadhwa (1983) had ascertained instability in Gujarat at macro-economic level and at sectoral levels upto 1980-81. Hence, for brevity and to prevent repetition, we commence our analysis from 1980-81. For the period 1960-61 to 1980-81, we report trends as observed in other studies (Wadhwa, 1983, Dholakia, 2007 and Dixit, 2009). Data for agriculture is available till 2010-11. The analysis for agriculture is also from 1980-81 onwards. For the period before that we report findings from Wadhwa (1983). Data for various crops at constant prices are derived by multiplying output of different crops by the 1980-81 harvest prices of each of these crops. These harvest prices were readily available for 15 crops, which accounted for 80% of the Gross Cropped Area (GCA) in 2009-10. We confine our analysis of instability in Gujarat's agricultural economy to these crops.

The paper is divided into four sections. Following the introduction, Section II presents the comparative picture of Gujarat in the national economy and highlights main features of the changing structure of Gujarat's economy over 1960-61 to 2008-09. Section III comprises the analysis of instability at sectoral level and concentrates on drawing interrelations between sectors. Last section concludes the discussion.

II. Gujarat in the National Economy

Gujarat has been a frontline state since the accelerated economic reforms began in 1992-93. Its performance in terms of economic growth has always been better than all-India. Gujarat covers 6% of the area of the country and houses nearly 5% of India's population. The state enjoys an entrepreneurial culture, a state government that promotes private initiative and people's participation in development process. It also enjoys several natural advantages. Gujarat has a diversified structure of economy with a large and expanding industrial sector, highly commercialized agriculture and allied activities and very large degree of urbanization (42% in 2011). Gujarat is 2nd most industrialised, 3rd most urbanized and 5th richest state among major states of India.

Gujarat grew in an imbalanced and volatile fashion during the 30 year period upto 2000. Economic growth was mainly sustained by secondary and tertiary sectors and apparently this growth has had no positive impact on primary sector indicating a particular disarticulation between primary, secondary, and tertiary sectors. In 2008-09 the Net State Domestic Product (NSDP) of Gujarat at constant (1999-2000 prices) was Rs. 1,91,932 crore while the all India figure was Rs. 36,88,991 crore, the state having a share of 5.20%. The estimated real per capita income during 2008-09 in Gujarat was Rs. 33,608 compared to all India average of Rs. 31,821. We first compare Gujarat's performance with the national economy. This is followed by an analysis of the overall growth and for economic sectors in Gujarat to ascertain the interrelations in the growth patterns.

Table 1a: Sectoral shares of NDP (India) & NSDP (Gujarat) at constant prices

	% of NDP (India)			% of NSDP (Gujarat)		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
1960-61	52. 83	19. 02	28. 65	41. 82	25. 73	32. 45
1970-71	45. 39	22. 40	32. 21	46. 10	23. 08	30. 82
1980-81	41. 30	23. 00	35. 70	40. 81	27. 24	31. 95
1984-85	39. 11	24. 43	36. 46	39. 26	27. 94	32. 80
1990-91	34. 22	26. 58	39. 20	27. 61	34. 62	37. 77
1994-95	31. 55	26. 69	41. 74	31. 13	32. 69	36. 18
1999-2000	28. 74	21. 36	49. 90	19. 81	35. 44	44. 75
2004-05	22. 42	24. 03	53. 60	20. 10	34. 70	45. 30
2008-09*	18. 03	25. 61	56. 35	19. 94	35. 63	45. 02

Note: For Gujarat, 2007-08.

Source: Dixit (2009), CSO (various years).

In the 1960s and 1970s the primary sector in Gujarat had a lower income share from agriculture than India (Table 1a). In the 60s and 70s, share of primary sector in the state remained stagnant. At the all India level it declined from 52% to 41% between 1960-61 and 1980-81. In the latter half of 80s the share of agriculture in Gujarat started declining rapidly, faster than that in India. In 1990-91 the share in Gujarat was 27. 6% , while at all India level the decline was from 41% to 34%. In Gujarat, primary sector's share had fallen by 2000 to 20% and remained almost unchanged since then. Compared to India, where the services sector has grown rapidly, the secondary sector has recorded fastest growth in Gujarat. A marked increase in share of secondary sector was seen between 1984-85 to 1990-91 when it increased from 28% to 35% and since then it has been consistently around 35% of the NSDP. However, the share of tertiary sector in 2007-08 was 45%, lower than the 56% share at the all India level.

Growth in primary as well as secondary sector is highly fluctuating in the state. This can also be seen from sectoral shares in Tables 1a & 2. While the long term trend in primary sector is of decline (42% in 1960-61 to 20% in 2007-08), it is marked by fluctuations. In terms of income agriculture is no more a dominant sector in Gujarat. After 1986-87, manufacturing replaced agriculture as the single largest activity contributing to SDP. The share of secondary sector upto mid 80s remained around 27%, thereafter there were large fluctuations. After 1999-2000, the share has been maintained between 35 – 36%. The tertiary sector on the other hand, shows a smooth, long term upward trend and depicts least fluctuations in its share in NSDP.

Broadly it can be seen that the tertiary sector lags behind the country as a contributor in Gujarat. The share of secondary sector in Gujarat has increased much more rapidly than India especially after mid 80s. Growth in the state unlike the country appears to be led by secondary sector, even though its share in NSDP and growth fluctuates (with an overall rising trend). After mid 80s, the share of primary sector in total NSDP also started recording a steep fall, declining from 39% (1984-85) to 20% (2007-08).

Table 1b : Rate of Growth of NDP, SDP of Major Sectors for Gujarat, 1960-61 to 2008-09

	Linear Growth rate (%)	R²
	1960-61 to 1974-75 (at 1960-61 prices)	
NDP (India)	3. 22	0. 96
SDP (Gujarat)	2. 41	0. 64
Agriculture	0. 30	0. 004
Manufacturing	4. 92	0. 90
Infrastructure	3. 52	0. 97
SDP per capita	-0. 15	0. 007
	1980-81 to 1992-93 (at 1980-81 prices)	
NDP (India)	4. 96	0. 98
SDP (Gujarat)	4. 80	0. 80
Agriculture	0. 33	0. 00
Primary sector	0. 57	0. 01
Manufacturing	7. 19	0. 82
Secondary sector	7. 05	0. 88
Tertiary sector	6. 53	0. 98
SDP per capita	2. 92	0. 62
	1993-94 to 2004-05 (at 1993-94 prices)	
NDP (India)	5. 70	1. 00
SDP (Gujarat)	5. 58	0. 90
Agriculture	1. 60	0. 07
Primary sector	1. 45	0. 08
Manufacturing	5. 24	0. 81
Secondary sector	5. 78	0. 86
Tertiary sector	7. 73	0. 99
SDP per capita	3. 61	0. 79
	1999-00 to 2008-09 (at 99-00 prices)	
NDP (India) ¹	10. 05	0. 95
SDP (Gujarat) ²	9. 34	0. 95
Agriculture ³	10. 19	0. 9
Primary sector ³	8. 98	0. 9
Manufacturing ³	10. 98	0. 87
Secondary sector ³	10. 63	0. 87
Tertiary sector ³	8. 50	0. 94
SDP per capita ²	7. 73	0. 93
Note:		
1 2009-10		
2 2008-09		
3 2007-08		
Source: For 1960-61 to 74-75, Wadhwa (1983). For remaining, CSO (various years)		

The linear growth rate in the state NSDP averaged at 5% over the period 1960-61 to 2004-05 (Dixit, 2009). In the 60s decade relative to India as a whole, the rate of growth in real state domestic product was lower at 2.4% (1960-61 to 1974-75) (Table 1b). Overall growth rate also reported a sharper decline within 1960-61 to 1974-75 sub periods. Wadhwa (1983) reports that Gujarat's SDP during this period was characterized by wide fluctuations from year to year and did not show substantial upward trend. Since 1972, fluctuations in SDP were reported to be more frequent and intense. Distance between upswing decreased from 2 to 1 year and variations in rate of growth were much sharper. In the post 1991-92 period, Gujarat improved its growth performance remarkably, its annual growth accelerating from 4.8% (in 80s) to 5.6% in the period of 1993-94 to 2004-05. The growth acceleration was very noticeable after 1999-00 as can be seen from the trend growth at 9.3% in the overall NSDP between 1999-00 to 2008-09. This high growth can be attributed to economic policy reforms. Apparently, Gujarat has benefited from liberalization much more than the other states (Dholakia, 2007).

Primary sector from 1960-61 onwards shows fluctuating growth. Upto 1980-81 the agriculture sector grew at 0.3%. In 1990s decade upto mid 2000s, long term agriculture growth rate hovered at 1.6% along with primary sector (1.45%). Thus agriculture sector showed hardly any upward growth trend in its value added. The linear growth rate of the primary sector after 1999-00 accelerated to 9%. Agriculture sector alone grew at nearly 10%. The regression results for various sectors confirm this fact. Calculation of trend rates of growth gave very low R^2 upto 1990s. After 2000 the trend was very significant for agriculture with R^2 being 0.90. R^2 of other sectors are more than 0.80 from 1961 onwards.

Study by Dixit (2009) reports that “in the 45 years series, there are 20 years with negative growth and eight years when the annual growth rate is less than 0.1% Even during the 6 years 2000-06, where the compound growth rate is as high as 16% in agriculture as a sub-sector, every alternate year has shown a decline in production due to uncertainty of weather conditions.” (P. 66).

Secondary sector on the other hand showed very low growth upto mid 1970s. In the 80s growth in manufacturing sector was quite high at 7%; coming down to 5% in the nineties. Thus this period was volatile for the industries sector. After this period, secondary sector has shown a steady increase in growth at nearly 11%. Tertiary sector on the other hand has registered a steady growth throughout the period.

Apparently the fluctuations in trend of Gujarat's income is the result of fluctuations in some major economic sectors and possibly also a reflection of the changing structure of the economy when new activities have been unable to offset impact of declining economic activities.

Table 2: Indices of value added by various sectors in Gujarat economy

Year	Agriculture	Forestry & logging	Fishing	Mining & quarrying	Manufacturing	Construction	Electricity, gas and Water supply	Transport, storage & communication	Trade, hotels and restaurants	Banking & insurance	Real estate, business services etc	Public administration	Other services	Net state domestic product
Base: 1980-81														
1980-81	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1981-82	119.66	97.69	102.53	84.85	103.99	92.63	107.06	116.63	111.87	105.70	102.15	100.90	102.41	109.93
1982-83	101.59	99.48	90.32	72.57	118.08	94.12	105.32	120.21	118.11	118.04	105.16	122.15	107.72	108.29
1983-84	125.25	97.09	101.74	82.47	158.39	90.29	119.47	176.25	125.97	122.53	109.33	123.59	116.54	129.07
1984-85	125.84	100.41	129.71	98.11	143.17	93.42	121.10	201.08	124.17	131.54	112.73	145.63	125.59	129.00
1985-86	93.56	104.62	137.66	104.71	164.53	112.04	128.56	217.51	131.23	144.19	116.34	152.68	136.00	125.46
1986-87	93.55	99.83	141.54	95.62	180.80	117.06	144.42	240.39	143.73	175.13	120.19	164.50	141.16	133.19
1987-88	46.78	89.23	146.29	81.05	179.06	132.85	179.62	267.56	134.33	214.00	123.25	180.35	140.35	118.35
1988-89	136.85	89.93	154.98	90.45	210.17	126.21	198.81	294.18	164.14	297.51	127.23	183.85	145.20	166.07
1989-90	119.20	94.05	167.59	113.72	202.79	123.13	230.14	328.47	180.50	313.76	131.35	190.70	158.45	163.13
1990-91	110.28	91.83	228.57	119.11	231.00	120.18	274.45	234.19	181.78	351.10	136.17	172.55	170.89	165.55
1991-92	88.64	95.25	240.58	103.53	179.86	177.03	336.96	246.05	169.11	380.08	139.94	175.56	182.42	151.88
1992-93	138.30	95.07	268.25	93.10	295.15	140.64	440.60	267.99	197.40	468.26	144.27	172.60	183.46	200.75
Base: 1993-94														
1993-94	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1994-95	147.00	102.81	106.72	106.66	123.42	97.79	98.17	109.71	116.61	104.41	102.60	102.78	109.46	120.07
1995-96	127.10	103.80	93.95	110.27	133.89	106.76	120.28	127.21	129.86	119.31	105.26	111.00	114.51	123.66
1996-97	175.90	103.50	103.06	111.67	153.24	107.08	123.35	135.85	150.96	108.11	107.66	111.80	126.13	142.51
1997-98	158.46	109.28	108.47	109.74	135.90	132.41	134.11	171.90	166.64	121.68	118.59	126.98	138.99	142.54
1998-99	170.07	107.24	90.90	110.01	145.99	144.42	146.08	181.17	172.39	130.97	125.55	166.25	152.02	152.54
1999-00	115.13	105.05	100.60	104.40	157.85	193.22	154.79	217.67	166.39	160.77	134.97	193.62	182.82	153.11
2000-01	99.87	108.36	92.57	102.53	146.31	159.94	156.08	238.98	176.05	139.45	147.54	184.28	198.53	147.03
2001-02	137.28	110.90	87.13	107.45	148.51	145.76	157.05	273.03	194.10	146.89	155.88	174.30	210.33	160.46
2002-03	114.82	113.70	91.43	113.44	177.66	189.80	214.29	302.56	211.56	164.02	165.07	171.89	223.12	173.07
2003-04	190.59	118.78	88.56	124.18	198.48	205.30	205.34	325.87	234.62	176.26	175.77	176.05	238.92	202.39
2004-05	170.12	117.26	87.99	128.65	217.95	242.74	223.34	371.89	258.28	190.64	187.87	173.93	254.59	213.30
Base 2004-05														
2004-05	100	100	100	100	100	100	100	100	100	100	100	100	100	100
2005-06	124.17	98.92	108.43	107.81	113.17	147.53	71.41	138.35	101.73	125.53	99.23	99.32	99.16	114.28
2006-07	120.58	98.05	110.12	107.94	128.39	165.38	78.17	175.36	113.04	150.62	101.09	104.20	103.83	125.15
2007-08	141.99	100.00	107.48	112.68	145.56	186.19	73.68	224.10	128.31	178.94	102.66	107.85	107.62	141.62

Source: CSO (various years)

The behaviour of the various components of the SDP (Table 2 depicts the index of value added by various sectors), during the period 1981 to 2008, shows that nearly all sectors recorded ups and downs in growth. Agriculture sector had shown largest fluctuation in value added with no discernable upward trend. Between 1980-81 and 1992-93 high rate of growth was observed in fishing, manufacturing, utilities, services particularly banking and insurance, transport and communications. Mining & quarrying and forestry related activities depicted a fluctuating rate of growth. The trend seemed significant for manufacturing, utilities, trade, banking, real estate and other services. The R^2 for these sectors ranged from 0.82 to 0.99. Beyond 1992-93, manufacturing growth slowed down, but the activities showing high upward trend were construction, utilities, transport, storage and communication, trade, real estate and other services. The trend was also significant for these sectors, the R^2 ranging from 0.81 to 0.98 (Table 3). Agriculture started depicting a very high growth rate after 2000, as growth between 1994 and 2005 was quite negligible at 1.6% and not significant.

Table 3: Growth Rate of Major sectors, Gujarat (1980-81 to 2004-05)				
	1980-81 to 1992-93		1993-94 to 2004-05	
Sector	(at 1980-81 prices)		(at 1993-94 prices)	
	Growth	R ²	Growth	R ²
1 Agriculture	0.34	0.00	1.61	0.07
2 Forestry & logging	-0.67	0.31	1.40	0.87
3 Fishing	8.92	0.57	-1.57	0.53
4 Mining & quarrying	1.69	0.22	1.41	0.46
5 Sub Total Primary	0.57	0.01	1.45	0.07
6 Manufacturing	7.20	0.82	5.24	0.81
7 Construction	4.49	0.69	7.92	0.85
8 Electricity, gas and WS	12.66	0.82	7.38	0.92
9 Sub Total Secondary	7.05	0.88	5.78	0.86
10 Transport, storage & com.	7.13	0.72	11.63	0.98
11 Trade, hotels and restaurants	5.21	0.92	7.30	0.95
12 Banking& Insurance	13.42	0.91	5.64	0.91
13 Real estate, business services	3.10	1.00	6.14	0.97
14 Public administration	4.73	0.80	5.64	0.73
15 Other services	5.22	0.98	8.71	0.98
16 Sub Total Tertiary	6.53	0.98	7.73	0.99
17 Net state domestic product	4.81	0.80	5.59	0.90
18 Per capita NSDP (Rs.)	2.92	0.62	3.61	0.79

Source: Authors' calculations based on CSO data for various years

The above discussion reveals volatility in growth of the agriculture sector in Gujarat. After 2000, both agriculture and manufacturing recorded growth rates exceeding 10% per annum, but manufacturing remained the most important contributor to Gujarat economy. Agriculture follows manufacturing in terms of value added. It remains the single largest employment generator and hence its prominence in Gujarat economy cannot be denied.

Certain structural changes are evident. In the early years of state's formation, the NSDP shared a close relationship with behaviour of the agriculture sector. Agricultural performance affected total output in the state. The rate of growth in agriculture and that of SDP were found to be significantly correlated (Correlation coefficient of 0. 52). The rate of growth of manufacturing on the other hand showed no relationship with that of SDP, even though it showed a positive rate of growth. Coefficient of the rate of growth between SDP and manufacturing then was insignificant at 0. 11. The performance of NSDP post 1980-81 though still influenced by agriculture sector, follows the trend of other two sectors, mainly manufacturing and tertiary activities.

Correlation Coefficient between Growth in NSDP, Agriculture and Non-agriculture Sectors

	Agriculture	Manufacturing	Tertiary
1960-61 to 1974-75	0. 52	0. 11	-
1980-81 to 1992-93	0. 48	0. 84	0. 73
1993-94 to 2004-05	0. 52	0. 98	0. 96
2005-06 to 2007-08	0. 85	0. 99	0. 99

Source: Authors' calculations

After 2004-05, NSDP growth while attributable to size of manufacturing and tertiary sectors, is also significantly correlated with the agriculture sector. Manufacturing and tertiary sectors have taken centre stage as contributors to Gujarat economy. Even though the relationship between SDP and behaviour of agriculture has weakened, instability in agriculture on its own, effects around 18% of the economic activity. Needless to add that while Gujarat economy in terms of income generation is relatively insulated from the performance of agriculture, but unstable agriculture still affects around 52% of population in (2001) and 77% of the working population in rural areas in 2004-05.

During the 2000s decade, the trend is again being reversed and evidence points to a high and significant relation emerging between the agriculture and overall GDP (0.85). Of late the primary sector is being integrated with the rest of the economy. Agriculture and manufacturing sectors together account for nearly 55% of the state's income. The service sector taken together though contributes around 45% to SDP, none of its components (except trade, hotels and restaurants) is important enough by itself. Further, activities such as transportation, construction, utilities, trade and other services which have shown a very high rate of growth over the period, make only a small proportion of SDP. It is apparent that clue to the behaviour of SDP lies in the behaviour of activities in agriculture and manufacturing sectors.

III. Instability in Agriculture in Gujarat: 1980-81 to 2009-10

Agriculture in Gujarat is affected by erratic and uneven rainfall that often leads to scarcity conditions, especially in Kutch and parts of Saurashtra. In triennium ending 2010, gross cropped area in the State was 115623 thousand ha. By the end of 2007, of the cultivated area, 42% was irrigated. Land holdings in the state are becoming increasingly marginalized. Average size of operational land holding during 2005-06 was 2.2ha, with 86% of the total operational holdings being less than 4 ha. Upto 1991-93 the contribution of sown area to output growth was on the wane whereas rising intensity of cultivation was more important. Net sown area has been lost to fallow/wasteland and diverted to non-agriculture/urban uses. In the decade of 90s and early 2000s, cropping intensity too had taken a beating falling to 1.11%. By the end of 2010, the cropping intensity showed an appreciable increase to 1.16% on account of improvement in water availability.

The study by Wadhwa (1983) on the behaviour of agricultural activities for the period 1960-61 to 1979-80, concluded:

“.... . almost all of the crops show highly fluctuating series of output over time. Excepting wheat and bajri, no other important crop shows any significant positive trend over time...The severity of fluctuation has been different for various crops.”

Period of decline was found to coincide for most of the crops with a few exceptions.

Further, “Amongst the important crops, cotton is the least volatile as also the least growing crop. The volatility of groundnut, the most important crop of the region, is not offset by its growth record. Of all the important crops, only wheat shows relatively greater stability as well as greater growth in its performance.....The important crops either do not show enough growth and/or are too volatile. The agricultural economy of the region under these conditions will naturally show a pattern depicting low rate of growth and high instability (pp. 67-68).

We extend the analysis of instability in crop sector for Gujarat beyond 1980-81 upto 2009-10. The major part of agricultural output in Gujarat is contributed by groundnut, cotton, sugarcane, wheat, rice, jowar, bajra, tobacco and castor. The contribution of these crops together was 84% in 2009-10 (Table 4). For the purpose of analysis the category of other crops in Table 4 includes pulses, sesame, potato and spices that contributed nearly 16% of the total agricultural output. Diversification towards fruits and vegetables is an important phenomenon in Gujarat. However, these crops have not been considered in the analysis due to unavailability of continuous series on production.

In terms of real value of output (1980-81 base), groundnut is the most important crop. The second place was occupied by wheat and sugarcane till 2003-04. After this, the second place was taken over by cotton. The area of different crops has recorded wide fluctuation over time. Except jowar and bajra, there has not been any significant change in the shares of various crops. Groundnut continues to remain the most important crop, though its share in the total output has dwindled over time. Oscillations in shares of major crops are more a reflection of unstable production patterns due to weather adversities rather than changes in importance of these crops in the agriculture economy of the state.

Bajra and jowar on the other hand, are being replaced and cease to be major constituents of the total output. Contribution of crops such as tobacco and spices individually to the total output is not significant enough to cause major disturbances in the agricultural economy of Gujarat. Oilseeds such as rape and mustard and castor are recording increasing importance in the state's output. Castor increased its share from 2.3% in 1980-81 to 7% in 2009-10. Rape and mustard during the same period also improved their share from 3.7% to 4.6%. At current prices the share of some of the crops, notably oilseeds and spices would be higher as their prices have increased faster than many other crops. The production index of castor (1980-81 base) showed an increase from 126 in 1981-82 to 568 in 2010-11.

Table 4: Shares of Selected Crops in Agricultural Output of Gujarat (1980-81 to 2009-10) (at 1980-81 prices)

	Rice	Wheat	Jowar	Bajra	Groundnut	Castor	Rape /Must	Cotton	Sugarcane	Tobacco	Total	Others
1980-81	4.93	11.00	5.30	8.96	27.85	2.26	3.72	6.84	11.09	2.95	84.90	15.10
1981-82	5.51	9.70	4.21	9.09	31.05	2.37	5.77	6.65	9.61	2.70	86.68	13.32
1982-83	4.54	12.67	4.28	8.99	22.60	3.98	5.06	6.54	12.53	2.34	83.53	16.47
1983-84	5.39	12.50	3.90	10.30	25.30	3.43	5.33	4.69	10.35	2.66	83.86	16.14
1984-85	6.48	11.12	4.34	3.20	25.63	5.04	6.03	7.92	10.74	2.91	83.42	16.58
1985-86	5.83	11.05	4.68	7.51	11.78	4.11	7.39	12.07	14.55	4.55	83.52	16.48
1986-87	4.64	7.48	2.86	10.19	27.53	1.92	6.95	5.47	15.25	3.75	86.03	13.97
1987-88	6.26	9.86	3.12	8.53	6.04	5.52	10.11	3.46	26.25	6.05	85.20	14.80
1988-89	4.87	9.25	2.36	8.49	34.93	3.63	6.12	4.33	9.17	2.32	85.46	14.54
1989-90	5.35	7.87	2.74	9.19	24.74	5.06	6.96	6.42	12.76	2.91	83.99	16.01
1990-91	6.56	10.22	2.73	7.95	15.50	7.64	6.67	5.51	15.58	3.45	81.81	18.19
1991-92	6.45	10.47	1.72	6.97	13.43	7.25	8.91	5.19	18.73	4.25	83.37	16.63
1992-93	5.03	8.28	2.08	9.48	26.45	5.18	5.62	5.66	13.51	2.35	83.65	16.35
1993-94	7.04	9.11	2.33	6.22	10.41	7.97	6.61	6.97	21.18	3.96	81.81	18.19
1994-95	5.23	11.39	1.35	6.39	25.66	6.68	6.66	6.41	15.37	2.53	87.66	12.34
1995-96	6.39	8.58	1.90	6.91	14.37	7.49	6.47	7.65	23.47	2.70	85.92	14.08
1996-97	5.60	7.96	1.87	6.89	25.08	6.71	5.84	6.82	14.44	2.35	83.55	16.45
1997-98	5.60	8.58	0.71	7.48	27.13	7.29	4.13	8.49	13.06	2.20	84.67	15.33
1998-99	5.98	7.74	1.28	6.23	25.43	6.74	5.24	9.43	14.64	2.29	85.01	14.99
1999-00	6.72	8.27	1.67	6.38	11.25	8.55	5.04	7.52	23.45	3.58	82.42	17.58
2000-01	4.29	7.02	0.95	7.54	14.88	10.62	6.04	5.74	22.47	2.88	82.44	17.56
2001-02	4.64	6.15	0.81	5.74	42.54	3.84	3.80	4.18	10.96	1.40	84.07	15.93
2002-03	5.43	7.21	1.37	7.57	16.74	5.15	4.16	6.63	22.16	3.13	79.56	20.44
2003-04	4.63	8.80	0.76	6.22	38.66	3.59	4.14	7.94	8.95	0.97	84.66	15.34
2004-05	5.87	10.54	0.70	5.38	21.15	5.07	5.73	14.51	13.92	1.19	84.05	15.95
2005-06	4.64	9.99	0.60	4.39	28.89	4.40	5.13	13.50	12.53	0.78	84.85	15.15
2006-07	4.85	14.14	0.68	4.10	18.73	4.58	5.84	18.21	13.72	0.89	85.75	14.25
2007-08	4.76	14.77	0.54	4.25	25.37	4.19	5.14	14.53	9.56	0.54	83.67	16.33
2008-09	5.12	12.13	0.87	3.80	24.88	6.12	3.79	14.97	11.87	0.59	84.13	15.87
2009-10	6.00	13.00	0.81	3.88	19.41	7.06	4.57	16.43	12.03	1.00	84.20	15.80

Note: "Others" includes sesame, pulses, potato, chilly, cumin
Source: As cited in text.

Table 5: Production Indices for Principal Crops

Years	Rice	Jowar	Bajra	Wheat	Maize	Gram	Tur	Ground-nut	Castor	Sesame	Rape & Mustard	Cotton	Tobacco	Sugar-cane
1980-81	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1981-82	135.10	96.07	122.66	106.43	102.00	172.22	84.12	134.65	126.32	119.44	180.54	117.38	137.70	105.51
1982-83	90.31	79.18	98.45	112.85	108.25	212.96	84.98	79.52	171.93	130.56	134.05	93.73	98.43	111.67
1983-84	134.65	90.83	141.65	131.66	119.25	205.56	104.72	111.94	186.55	163.89	172.97	82.16	152.88	115.90
1984-85	138.03	88.21	135.78	109.17	99.25	194.44	130.47	98.76	238.60	163.89	167.57	124.22	142.93	104.74
1985-86	80.76	61.14	58.11	69.51	27.50	83.33	113.30	29.27	125.73	69.44	132.43	122.09	127.75	91.67
1986-87	78.41	44.98	94.70	56.58	119.00	59.26	62.66	82.24	70.76	33.33	149.73	66.57	105.76	115.26
1987-88	60.35	27.95	45.23	42.55	28.25	42.59	54.51	10.33	115.79	11.11	120.00	238.84	97.38	113.33
1988-89	140.09	63.32	134.39	119.20	121.00	118.52	127.47	177.78	227.49	258.33	224.32	89.64	111.52	118.46
1989-90	126.58	60.84	119.40	83.15	136.75	101.85	138.20	103.34	259.65	188.89	209.19	89.13	139.79	134.87
1990-91	145.37	56.33	88.92	101.49	128.75	148.15	156.65	60.83	368.42	189.10	188.65	88.09	127.75	132.69
1991-92	119.53	29.69	71.07	86.83	91.00	87.04	110.30	44.00	292.40	113.89	210.27	69.22	131.94	155.38
1992-93	146.26	56.19	151.83	107.92	147.00	124.07	151.50	136.14	328.07	469.44	208.65	118.58	114.14	176.03
1993-94	141.12	43.38	68.62	81.74	98.25	94.44	159.23	36.88	347.37	105.56	169.19	171.06	132.46	190.00
1994-95	164.46	39.45	110.51	160.27	90.25	209.26	102.58	142.64	456.73	263.89	267.03	145.11	94.76	216.28
1995-96	160.50	44.25	95.52	96.55	107.00	100.00	119.31	63.86	409.36	247.22	207.57	138.55	113.09	264.10
1996-97	184.73	57.35	125.26	117.71	166.50	155.56	165.24	146.53	481.87	405.56	245.95	162.20	129.84	213.46
1997-98	179.74	43.38	132.36	123.43	178.75	181.48	116.74	154.33	509.36	491.67	169.73	196.61	118.32	188.08
1998-99	202.64	40.47	116.30	117.48	190.00	196.30	109.87	152.54	496.49	380.56	226.49	230.38	129.84	222.31
1999-00	153.16	35.37	80.03	84.40	146.75	72.22	127.47	45.36	423.39	236.11	146.49	123.48	136.13	239.36
2000-01	70.93	14.26	67.07	50.86	72.25	16.67	45.92	42.57	373.68	272.22	150.27	66.80	78.01	162.82
2001-02	152.72	24.60	102.85	89.73	221.25	50.00	80.26	163.80	271.93	630.56	143.78	97.99	75.92	159.87
2002-03	123.20	17.76	94.54	73.20	198.25	53.70	84.55	125.56	254.39	341.67	120.54	108.40	60.21	225.13
2003-04	187.52	28.53	138.63	151.72	208.00	244.44	110.73	283.23	316.37	669.44	205.95	234.58	130.37	162.44
2004-05	175.77	19.51	88.43	141.54	103.25	183.33	101.29	116.77	330.41	325.00	218.92	313.23	59.69	186.79
2005-06	188.49	22.85	98.27	181.76	180.60	233.89	118.45	207.80	388.89	395.83	265.84	395.37	53.14	228.08
2006-07	167.58	21.73	77.99	218.77	50.43	346.67	92.40	114.50	344.44	291.67	257.35	453.19	51.52	212.18
2007-08	216.48	22.77	106.49	300.76	145.78	389.26	126.27	204.14	414.04	391.39	297.89	476.16	41.20	194.74
2008-09	191.32	30.31	78.35	203.18	150.65	327.41	112.75	164.66	498.25	235.83	180.70	403.56	36.70	198.85
2009-10	189.87	23.78	67.55	184.27	99.15	244.81	103.65	108.72	485.96	223.33	184.54	374.74	53.14	170.51
2010-11	222.76	18.49	70.90	303.06	204.50	359.26	130.90	208.91	567.84	247.22	191.35	601.55	67.54	182.56

Source: Authors' calculation as cited in text from Crop and Season reports (various years), Directorate of Agriculture, Govt. of Gujarat

Table 5 gives indices of production of selected crops of Gujarat. For the purpose of undertaking instability analysis, we have looked at crops individually (and not crop groups). The production indices are derived by considering 1980-81 production value as 100. It is evident that nearly all the crops show highly fluctuating trend in output over time. Crops that show a significant positive trend over time are wheat, gram, castor and cotton. Cotton and castor have experienced the fastest growth. Jowar, bajra and tobacco show a negative trend. Rice, groundnut and sesame also show a steady increase over time.

For cash crop spanning 1980-81 to 2001-10 period, the index of average relative decline was computed along with the average transition period. Each cell in Table 6 denotes the difference between a peak and trough production index as a percentage of the peak value. The average relative decline for a crop thus is calculated by adding all the cell values so derived and dividing by the number of observed transitions.

As can be seen from Table 6, the severity of fluctuation has been different for various crops over the period. The average relative decline over all cycles was least for sugarcane (0.15), rice (0.19) and maximum for groundnut (0.59). Cotton, sesame were second with an average decline of 0.50. High levels of fluctuations have also been recorded for maize, gram and bajra. Fluctuations have been relatively lower in case of castor, rape and mustard seed, tobacco and wheat. The peak to trough transition has been made on an average in one year, in some cases in 2-4 years. Greater the decline per unit of time, more severe is the cycle (Stanley, 1968). Thus measuring the severity of the cycle by quantum of relative decline together with time taken to reach the trough reveal that on an average sugarcane followed by rice have experienced the least and groundnut the most severe of the cycles.

For nearly all the crops; the cycles covering the period 1984-85 to 1987-88, 1998-99 to 2000-1 and recently 2007-09 to 2009-10 have been the severest of all.

Table 6 (last column) also reveals on closer examination that the period of decline coincided for several of the crops, however, there appears to be exceptions. Thus cotton in 1987-88 to 1988-99, sugarcane in 1995-96 to 1996-97 and in 2002-03 to 2003-04 were the only crops showing a decline in output. Similarly in 1991-92 to 1992-93, rape and mustard seeds and tobacco and in 2002-04 to 2005-06 tobacco and sugarcane output was declining. Table 6 further shows that a cluster of crops were found to record output decline in the period 1984-85 to 1987-88, 1991-92 to 1992-93, 1994-95 to 1995-96, 1998-99 to 2000-01, 2007-08 to 2009-10. These are the years facing widespread stagnancy in the agricultural economy. These seem to occur due to general adverse conditions related to weather and rainfall scarcity that affects all the crops in a similar fashion.

Magnitude of fluctuations now is much higher for all crops vis-à-vis experience of 60s and 70s. For most crops the indices for average relative decline is higher, bajra 0. 4 (as against 0. 29 in earlier study), wheat 0. 34 (0. 21), groundnut 0. 60 (0. 4), cotton 0. 23 (0. 14). Thus fluctuations in 80s, 90s and 2000s decade are of higher amplitude than in initial years of State's existence (Table 8).

Table 6: Relative change and Transition Period (from Peak to Trough) in Agricultural Production of Selected Crops of Gujarat (1980-81 - 2009-10)

Peak to trough period	Rice	Bajra	Wheat	Maize	Gram	Tur	Ground nut	Castor	Sesame	Rape & Mustard	Cotton	Tobacco	Sugar cane	No. of crops whose output declined
1980-81 to 1981-82														0
1981-82 to 1982-83	0.33 ¹	0.20 ¹					0.41 ¹			0.26 ¹	0.30 ²	0.29 ¹		7
1982-83 to 1983-84													0.007 ³	3
1983-84 to 1984-85		0.59 ²		0.77 ²			0.74 ²			0.23 ²				8
1984-85 to 1985-86			0.68 ⁴					0.70 ²			0.46 ²	0.36 ⁴		11
1985-86 to 1986-87	0.56 ³				0.80 ³	0.58 ³			0.93 ³					9
1986-87 to 1987-88		0.52 ¹		0.76 ¹			0.87 ¹			0.20 ¹			0.017 ¹	10
1987-88 to 1988-89														1
1988-89 to 1989-90	0.09 ¹		0.30 ¹		0.14 ¹						0.71 ⁴			8
1989-90 to 1990-91		0.47 ³		0.33 ²			0.75 ³		0.56 ³	0.16 ²		0.09 ¹	0.016 ¹	8
1990-91 to 1991-92	0.18 ¹		0.14 ¹		0.41 ¹	0.30 ¹		0.21 ¹						10
1991-92 to 1992-93									0.20 ²			0.03 ¹		2
1992-93 to 1993-94	0.04 ¹	0.55 ¹	0.24 ¹		0.24 ¹		0.73 ¹		0.78 ¹					8
1993-94 to 1994-95				0.39 ²		0.36 ¹								3
1994-95 to 1995-96	0.02 ¹	0.14 ¹	0.40 ¹		0.52 ¹		0.55 ¹	0.10 ¹	0.06 ¹	0.22 ¹	0.19 ²			10
1995-96 to 1996-97													0.29 ²	1
1996-97 to 1997-98	0.03 ¹					0.33 ²			0.31 ¹		0.09 ¹			5
1997-98 to 1998-99									0.52 ²					5
1998-99 to 1999-00	0.65 ²	0.49 ³	0.59 ³	0.62 ²	0.92 ²		0.72 ³	0.50 ⁵		0.35 ¹	0.71 ²			11
1999-00 to 2000-01						0.64 ¹							0.32 ¹	10
2000-01 to 2001-02							0.23 ¹			0.20 ²		0.56 ³		4
2001-02 to 2002-03	0.19 ¹	0.28 ¹	0.25 ¹	0.10 ¹					0.46 ¹				0.28 ¹	8
2002-03 to 2003-04									0.51 ¹					1
2003-04 to 2004-05	0.07 ¹	0.36 ¹	0.07 ¹	0.50 ¹	0.25 ¹	0.08 ¹	0.59 ¹							9
2004-05 to 2005-06														2
2005-06 to 2006-07	0.11 ¹			0.72 ¹		0.22 ¹	0.45 ¹	0.11 ¹	0.26 ¹	0.03 ¹		0.72 ⁵	0.15 ²	9
2006-07 to 2007-08										0.39 ¹	0.21 ²			2
2007-08 to 2008-09														10
2008-09 to 2009-10	0.12 ²	0.37 ²	0.39 ²	0.34 ¹	0.37 ²	0.17 ²	0.47 ²	0.02 ¹	0.43 ²				0.14 ¹	11
Average Relative Decline	0.19	0.40	0.34	0.50	0.46	0.34	0.59	0.27	0.50	0.23	0.50	0.31	0.15	
Average duration of peak to trough transition (years)	1.33	1.6	1.67	1.44	1.75	1.50	1.55	1.83	1.67	1.36	2.67	2.29	1.50	

Source: Calculated from data in Crop & Season Reports, Directorate of Agriculture, Govt. of Gujarat.

Note: Calculated as cited in text.

Superscripts denote number of years taken to make the transition from peak to trough.

Table 7: Relative change (from Peak to Peak) in Agricultural Production for selected crops (1980-81 to 2010-11)

Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle	Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle	Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle
RICE				BAJARA				WHEAT			
1	1981-82-1984-85	0.02	3	1	1981-82-1983-84	0.16	2	1	1981-2-1983-84	0.24	2
2	1984-85-1988-89	0.02	4	2	1983-84-1986-87	-0.35	3	2	1983-4-1988-89	-0.1	5
3	1988-89-1990-91	0.04	2	3	1986-87-1988-89	0.42	2	3	1988-9-1990-91	-0.15	2
4	1990-91-1992-93	0.01	2	4	1988-89-1992-93	0.13	4	4	1990-1-1992-93	0.06	2
5	1992-93-1994-95	0.12	1	5	1992-93-1994-95	-0.23	2	5	1992-3-1994-95	0.49	2
6	1994-95-1996-97	0.12	2	6	1994-95-1997-98	0.20	3	6	1994-5-1997-98	-0.23	3
7	1996-97-1998-99	0.10	2	7	1997-98-2001-02	-0.22	4	7	1997-8-2001-2	-0.27	4
8	1998-99-2001-02	-0.25	3	8	2001-02-2003-04	0.26	2	8	2001-2-2003-4	0.69	2
9	2001-02-2003-04	0.23	2	9	2003-04-2005-6	-0.29	2	9	2003-04-2007-08	0.98	4
10	2003-04-2005-06	0.01	2	10	2005-06-2007-8	-0.08	2	10	2007-08-2010-11	0.007	3
11	2005-06-2007-08	0.15	2	11	2007-08-2010-11	-0.33	3				
12	2007-08-2010-11	0.03	3								
Average Relative change		0.05		Average Relative change		-0.03		Average Relative change		0.17	
Average duration of cycle			2.33	Average duration of cycle			2.64	Average duration of cycle			2.9

Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle	Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle	Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle
MAIZE				GRAM				TUR			
1	1981-2-1983-84	0.17	2	1	1981-82-1982-83	0.24	1	1	1984-85-1990-91	0.2	6
2	1983-4-1986-87	-0.002	3	2	1982-83-1984-85	-0.09	2	2	1990-91-1993-94	0.02	3
3	1986-7-1989-90	0.15	3	3	1984-85-1988-89	-0.39	4	3	1993-94-1996-97	0.04	3
4	1989-9-1992-93	0.08	3	4	1988-89-1990-91	0.25	2	4	1996-97-1999-00	-0.23	3
5	1992-3-1998-9	0.29	6	5	1990-91-1992-93	-0.16	2	5	1999-00-2003-04	-0.13	4
6	1998-9-2001-2	0.16	3	6	1992-93-1994-95	0.69	2	6	2003-04-2005-06	0.07	2
7	2001-2-2003-4	-0.07	2	7	1994-95-1998-99	-0.06	4	7	2005-06-2007-08	0.07	2
8	2003-04-2005-06	-0.13	2	8	1998-99-2003-04	0.25	5	8	2007-08-2010-11	0.04	3
9	2005-06-2008-09	-0.17	3	9	2003-04-2007-08	0.59	4				
10	2008-09-2010-11	0.36	2	10	2007-08-2010-11	-0.08	3				
Average Relative change		0.08		Average Relative change		0.12		Average Relative change		0.01	
Average duration of cycle			2.9	Average duration of cycle			2.9	Average duration of cycle			3.25

Table 7 contd.

Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle	Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle	Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle
	GROUNDNUT				SESAME				RAPE & MUSTARD		
1	1981-82-1983-84	-0.17	2	1	1981-82-1984-85	0.37	3	1	1981-82-1983-84	-0.04	2
2	1983-84-1986-87	-0.27	3	2	1984-85-1988-89	-0.58	4	2	1983-84-1986-87	-0.13	3
3	1986-87-1988-89	1.16	2	3	1988-9-1992-93	0.82	4	3	1986-87-1988-89	0.5	2
4	1988-89-1992-93	-0.23	4	4	1994-95-1997-98	-0.86	3	4	1988-89-1991-92	-0.06	3
5	1992-93-1994-95	0.05	2	5	1998-99-2001-02	0.66	3	5	1991-92-1994-95	0.27	3
6	1994-95-1997-98	0.08	3	6	2003-04-2005-06	-0.41	2	6	1994-95-1996-97	-0.08	2
7	1997-98-2001-02	0.06	4	7	2007-08-2010-11	-0.37	3	7	1996-97-1998-99	-0.08	2
8	2001-02-2003-04	0.73	2					8	1998-99-2000-01	-0.34	2
9	2003-04-2005-06	0.27	2					9	2000-01-2005-06	0.77	5
10	2005-06-2007-08	0.02	2					10	2005-06-2007-08	0.12	2
11	2007-08-2010-11	-0.023	3					11	2007-08-2010-11	-0.36	3
Average Relative change		0.15		Average Relative change		-0.05		Average Relative change		0.05	
Average duration of cycle			2.6	Average duration of cycle			3.1	Average duration of cycle			2.6

Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle	Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle	Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle
	CASTOR				TOBACCO				SUGARCANE		
1	1981-82-1984-85	0.89	3	1	1981-2-1983-84	0.11	2	1	1983-84-1986-87	-0.006	3
2	1984-85-1990-91	0.54	6	2	1983-4-1989-90	-0.09	6	2	1986-87-1989-90	0.19	3
3	1990-91-1994-95	0.24	4	3	1989-90-1991-92	-0.06	2	3	1989-90-1995-96	0.96	6
4	1994-95-1997-98	0.12	3	4	1991-92-1993-94	0.04	2	4	1995-96-1999-00	-0.09	4
5	1997-98-2005-06	-0.24	8	5	1993-94-1996-97	-0.02	3	5	1999-00-2002-03	-0.06	3
6	2005-06-2008-09	0.28	3	6	1996-97-1999-2000	0.05	3	6	2002-03-2005-06	0.013	3
7	2008-09-2010-11	0.01	2	7	1999-00-2003-04	-0.04	4	7	2005-06-2008-09	-0.13	3
				8	2003-04-2010-2011	-0.48	7	8	2008-09-2010-11	0.07	2
Average Relative change		0.26		Average Relative change		-0.06		Average Relative change		0.12	
Average duration of cycle			4.1	Average duration of cycle			3.6	Average duration of cycle			3.4

Table 7 Contd.

Sr. No	Period of cycle	Relative change from peak to peak	Duration of cycle
	COTTON		
1	1981-82-1984-85	0. 06	3
2	1984-5-1987-88	0. 92	3
3	1987-88-1994-95	-0. 38	7
4	1994-95-1998-99	0. 59	4
5	1998-99-2007-08	1. 07	9
6	2007-08-2010-11	0. 26	3
Average Relative change		0. 42	
Average duration of cycle			4. 8

Source : Computed as cited in text

Sharp decline in production of various crops intermittently leads to their declining or low rate of growth over the 30 years period. Rate of growth has been calculated in terms of relative change in production of crops over successive peaks as seen in Table 7.

The crops show a mixed behaviour. A closer look at Table 7 reveals that rice, wheat, and cotton have done fairly well, as most of their successive peaks have been higher and declines were marginal. Castor too seemed to have offset the decline in some peaks. Continuous increase with 2 or 3 instances of decline is shown by maize and also by groundnut. In case of tur and gram changes in production were too small to show any significant trend. On the other hand, crops such as sesame, tobacco and sugarcane have shown large declines that override any significant change from peak to peak. Comparison of the pre- and post 1980-81 situation reveals (Table 8) that in 1980s, 1990s and 2000's decade for almost all crops the growth as seen by the difference in two subsequent peaks was of lower magnitude than in 1960s and 1970s.

The above analysis of past 30 years of growth stability in the crop sector of Gujarat, brings out that amongst the important crops, castor, rice, and wheat are less volatile and also fast growing crops. Cotton in Gujarat though experiencing the fastest growth is also a highly volatile crop due to weather and price adversities. The growth record of groundnut, the most important oilseed in Gujarat is offset by the high degree of volatility experienced by the crop. Finally of all the important crops, wheat shows a relatively greater stability as well as higher growth in its performance. Table 9 ranks all the crops according to stability and growth. Sugarcane, rape & mustard seeds, rice, gram score higher than the others post 1980-81. However, these crops are not so important as to have large influence on the agricultural economy of the state. The above analysis reinforces the view that the important crops in Gujarat either do not show enough growth and/or are too volatile. On this count the situation has not changed significantly over the decades of 60's and 70's in Gujarat. Gujarat's agricultural economy thus shows a growth pattern that is accompanied by high instability.

Table 8: Changes in Magnitude of Crop fluctuations before and after 1980-81 in Gujarat

S. No.	Crop	Average Relative Decline		Average Relative Change over 2 peaks	
		Before 1980-81	After 1980-81	Before 1980-81	After 1980-81
1	Rice	0.35	0.19	0.067	0.05
2	Bajra	0.29	0.40	0.23	-0.03
3	Wheat	0.21	0.34	0.24	0.17
4	Maize	-	0.50	-	0.08
5	Gram	-	0.46	-	0.12
6	Tur	-	0.34	-	0.01
7	Groundnut	0.40	0.59	0.08	0.15
8	Castor	0.28	0.27	0.51	0.26
9	Sesame	-	0.50	-	-0.05
10	Rape & Mustard	0.17	0.23	0.48	0.05
11	Cotton	0.14	0.50	0.003	
12	Tobacco	0.16	0.31	0.11	-0.06
13	Sugarcane	0.20	0.15	0.25	0.12

Source: Cols. 2 and 4, Wadhwa (1983)
Cols. 3 and 5, Tables 6 and 8.

Table 9: Ranks of Selected Crops in Terms of Stability and Growth

S. No.	Crop	Rank in terms of stability@		Rank in terms of Growth#	
		Before 1980-81	After 1980-81	Before 1980-81	After 1980-81
1	Rice	9	2	8	8
2	Bajra	8	8	5	11
3	Wheat	5	6	4	3
4	Maize	-	10	-	7
5	Gram	-	9	-	5
6	Tur	-	6	-	10
7	Groundnut	10	13	7	4
8	Sesame	-	10	-	12
9	Castor	7	4	1	2
10	Rape & Mustard	3	3	2	8
11	Cotton	1	10	9	1
12	Tobacco	2	5	6	13
13	Sugarcane	4	1	3	5

Note: @ Crops with the least fluctuation is given the highest rank.

Crop with maximum growth (as shown by average change from peak to peak) is given 1st rank.

Source: Cols. 3 and 5, Wadhwa (1983)
Cols. 4 and 6, Tables 6 & 7

IV. Conclusion

Upto 1984-85 the primary sector in Gujarat contributed the highest share (39%) to GDP. The share of secondary sector was 28% and the remaining 33% was the contribution of tertiary sector. Agriculture was in fact the most important sector in Gujarat's GDP.

Since then though agriculture's share in the state's total output has dwindled considerably, it is still the largest employment generator. The sector is highly unstable but due to its reduced output share, the state's economy is insulated from fluctuations in its growth pattern. Secondary sector, mainly manufacturing despite instability has shown growth over the time. The tertiary sector on the other hand, has recorded a smooth long term upward trend and depicts least fluctuations. Growth, unlike other states, is led by secondary sector and has often acted as a cushion against volatility experienced by the agriculture sector.

Analysis of crop sector reveals that most of the important crops in the state either do not show enough growth or have a volatile production record. In the final analysis, wheat and castor are the most stable crops having high growth. Fast growth in output for cotton and groundnut is offset by high instability recorded by both these crops.

Studies (Kumar et. al. 2010) after examining historical data for 1949-2006 have also shown that production of wheat after mid 1980s has become highly erratic with sharp declines in production during drought years. Cotton and groundnut also reported fluctuations in output, a consequence of inter-annual yield fluctuations. Sharp decline in yield levels was observed during drought years. After 1988, yield fluctuations in groundnut too have become severe. Thus yields of crops having a substantial rainfed component are highly vulnerable to droughts.

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