Future of Indian Agriculture

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What Determines Future?

- Challenges
- Opportunities
- Changes in operating environment:
  - Physical, economic, institutional
- Needs and requirement of society

CURRENT SCENE

- Number of holdings (2001): 11.5 crore
- Preponderance of small farmers
  - Less than 1 hectare: 62%
  - Less than 2 hectare: 80%
  - Average size: 1.3 hectare
- Crop Intensity: 1.35
- Irrigation coverage: 40%

- Heavy dependence on rainfall
- Use of modern inputs: low
- Regional variations
- Mixed crop –livestock farm

IMPORTANCE OF AGRICULTURE IN INDIAN ECONOMY

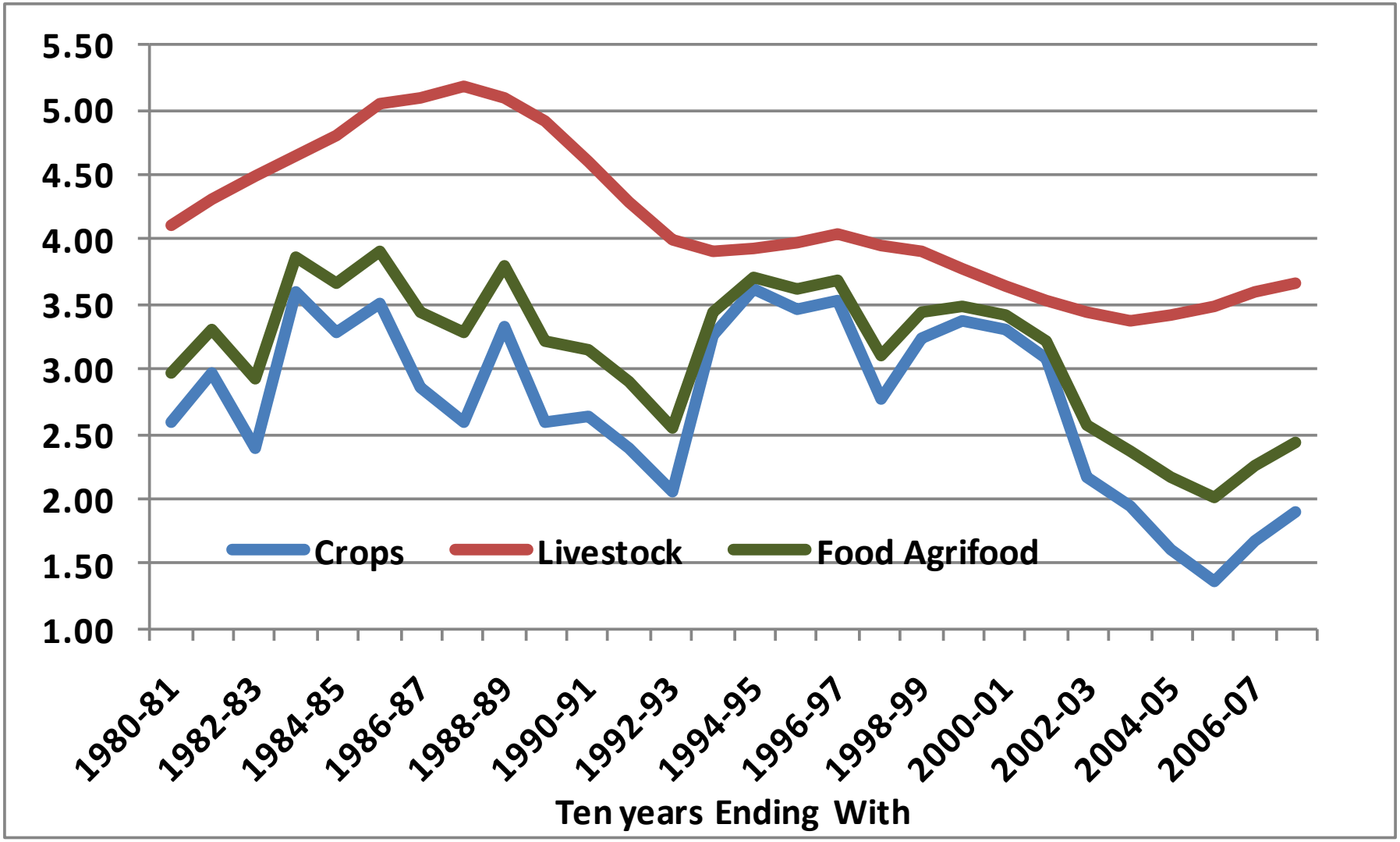
- **Share in output: 17.7%**

  (includes crop, livestock, fishery and forestry)
- **Share in employment: 55%**
- **Share in merchandise export: 10.7%**
- **Net trade (X-M) 2008-9:**
  - **Rs. 47 thousand crore ; 4.7% of VFO**
- **Food needs and food Security**

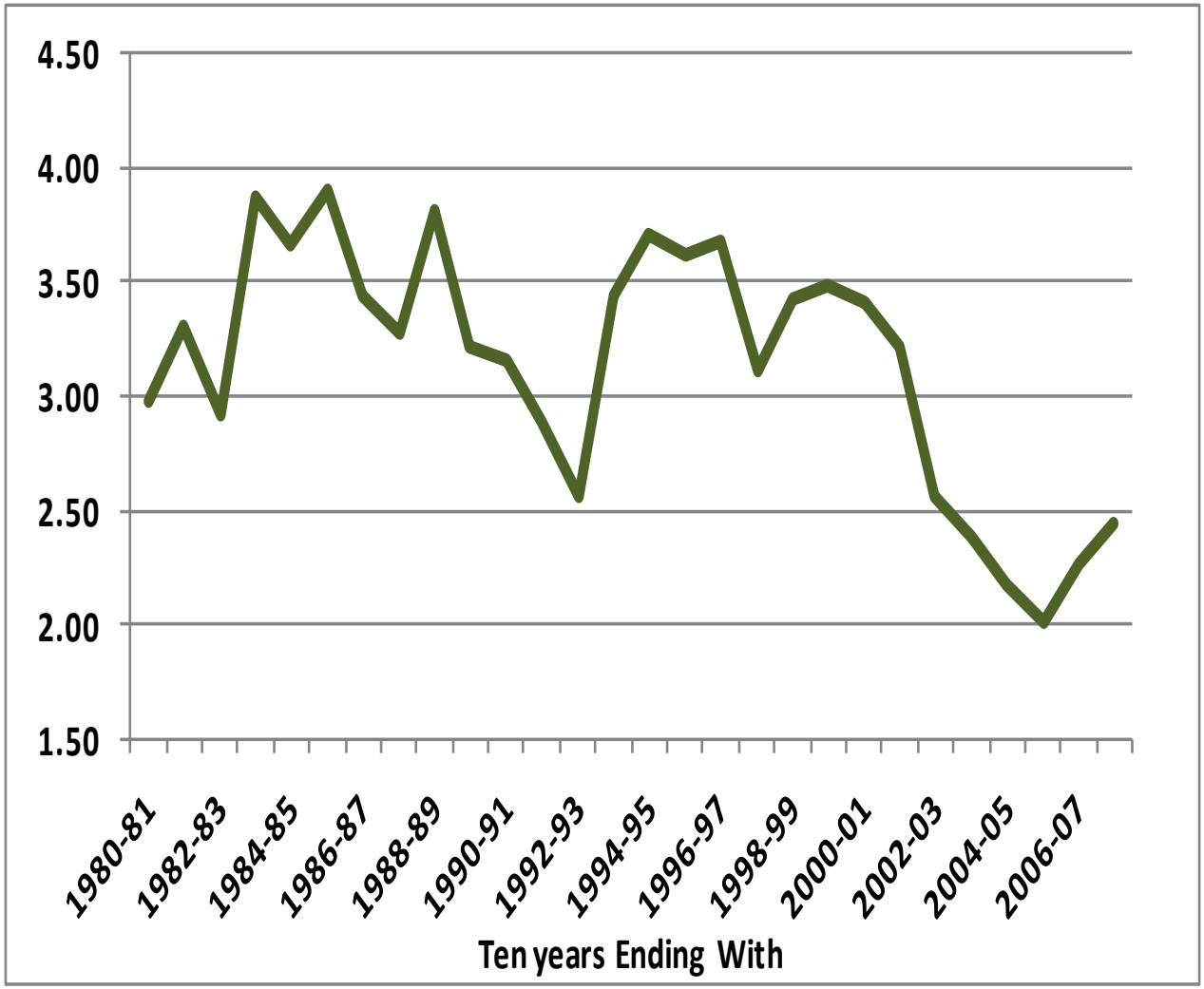
Main Challenges

- ✓ Slowdown in growth
- ✓ Regional disparities
- ✓ Efficiency
- ✓ Sustainability
- ✓ Mismatch between changes in sectoral share in output and employment
- ✓ Poorly functioning agricultural markets
- ✓ Agrarian distress, low income
- ✓ Nutrition and food security
- ✓ Food safety

Growth Rate in Value of Crop, Livestock and Agro-food Output at 1999-00 Prices Based on 10 Years Period



Growth Rate in Total Agri-food Output at 1999-00 Prices Based on 10 Year Period DE1980-81 to 2008-09



Matter of concern for several reasons:

1. **Potential**
2. **Requirement**
3. **Parity with non agri**
4. **No slowdown in GR of rural consumption: mounting debt**

Regional Disparities

Distribution of Districts According to Per Hectare Productivity 2003-4 and 2004-05

Category	Range: (Rs/ha)	Districts	Area share %	Output share %
1 Very Low	< 18199	120	31.46	13.00
2 Low	18199 - 27955	161	28.38	22.86
3 Average	27955 - 37712	102	15.86	17.71
4 High	37712 - 57225	105	15.06	24.28
5 Very High	> 57225	63	9.24	22.15
Overall	32834	551	100.00	100.00

INPUT USE EFFICIENCY

- **A case of water and fertiliser**

Crops and Crop Products[b]	Average amount of water (in cubic meters/tonne) needed to grow crops in			
	Brazil	India	China	US
Maize (corn)	1180	1937	801	489
Soya beans	1076	4124	2617	1869
Wheat and meslin	1616	1654	690	849
Rice, semi-milled or wholly milled, whether or not polished or glazed	4447	4113	1906	1840

Virtual water content of different crops for the period (1997-2001) are from Appendix XVI of Hoekstra and Chapagain (2008).
(b) The codes, value and quantity produced for crops and crop products are from Appendix XIV of Hoekstra and Chapagain (2008).
Source: Hoekstra and Chapagain (2008).

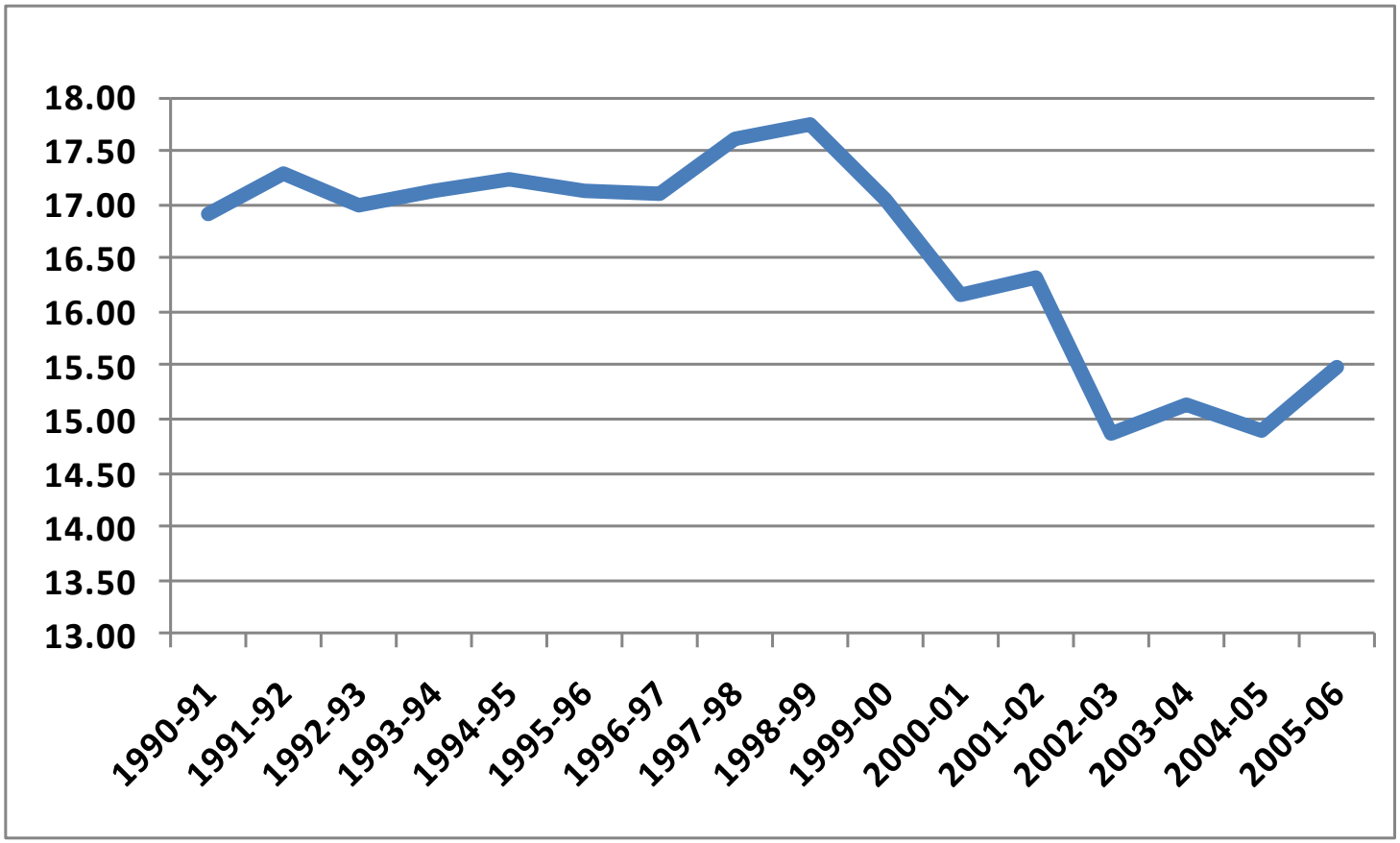
Fertiliser Use and Response Ratio in Wheat in Selected Countries

Fertilizer use (nutrients Kg/ha), average of 2006-07 & 2007-08, Wheat

	World	Argentina	Australia	Canada	China	India	Pakistan	EU	USA
N	80	54	22	64	181	109	123	121	79
P	30	30	24	18	81	41	33	27	30
K	8	0.2	2	3	11	7	1.4	20	11
NPK	117	85	48	85	273	158	157	169	120
Yield	2829	2725	1359	2647	4698	2832	2617	4965	3062
Y/NPK	24	32	29	31	17	18	17	29	25
Share % in total NPK in country	15	31	28	29	13	19	37	23	12

Source: International Fertilizer Association

Net Irrigated Area by Canals million hectare



Should India divert from medium and major irrigation to traditional sources of water: harvesting, conservation, ponds, tanks, watershed

Natural Resource Degradation

Ground Water Exploitation (BCM)

Dynamic resources	Punjab	Haryana	India
Annual replenishable ground water resources	23.8	9.3	433.0
Net annual ground water availability	21.4	8.6	399.3
Annual ground water draft	31.2	9.5	230.6
Stage of Ground Water Development (%)	145	109	58

Categorization of administrative units according to status of water, 2004

	Percent Distribution of Assessed Units		
Region	Safe	Over Exploited	Semi-critical or Critical
Punjab	18	75	7
Haryana	37	49	14
India	71	15	14

Mismatch in Structural Changes in Output and Occupation

Share of agriculture in employment and output (%)

Aspect	Year	Punjab	Haryana	India
Employment	1971	62.7	65.3	71.9
	2001	38.9	51.3	58.4
Output	1971	53.6	59.3	40.9
	2001	38.5	31.1	23.2

Disparity in per worker income in agriculture and non agriculture

Year	Punjab	Haryana	India
1971	1.5	1.3	3.7
2001	1.0	2.3	4.6
2006			6.0

POORLY FUNCTIONING MARKETS

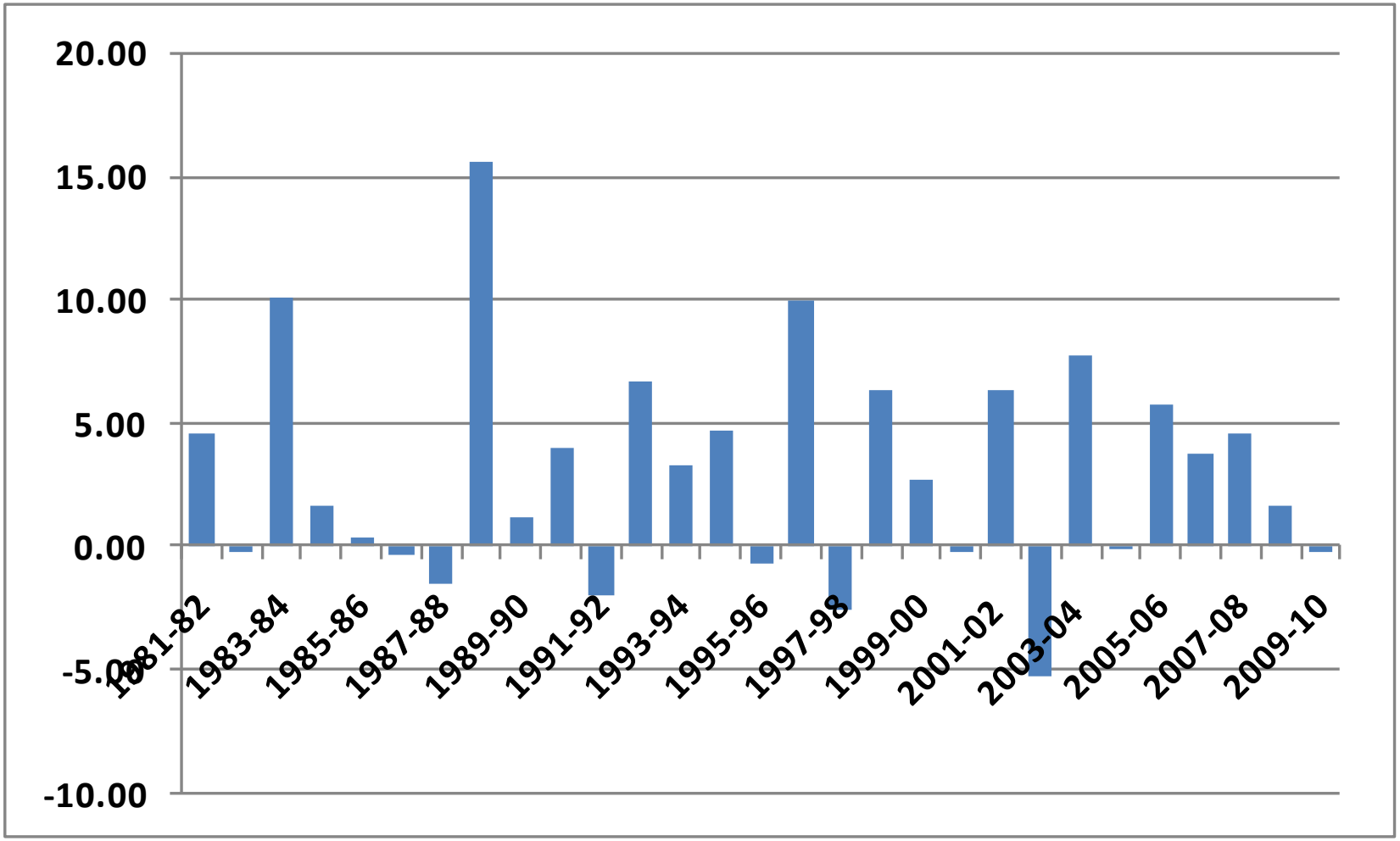
- Myth of MSP
- Farm harvest price turning lower than MSP
- Dominance of small/medium players
  - Scale, number of transactions
- Poor integration between farm and retail prices
- No state encouraging private investments for modernisation and efficiency of marketing

AGRICULTURE SCENE UNDERGOING CHANGE

- Several farmers (younger ones) taking risk to change their conditions: let down by market
- Low per farm income pushing into poverty
  - Value added per hectare (2007-8) Rs.: 48344
  - Average size of holding: 1.33 (2001)
  - Value added per holding: 64297
  - Share of hired labour app. (10%): 6429
  - Income per farm app.: 57867
  - Farm income/per farm household/month: 4822
- Interest in farming diminishing

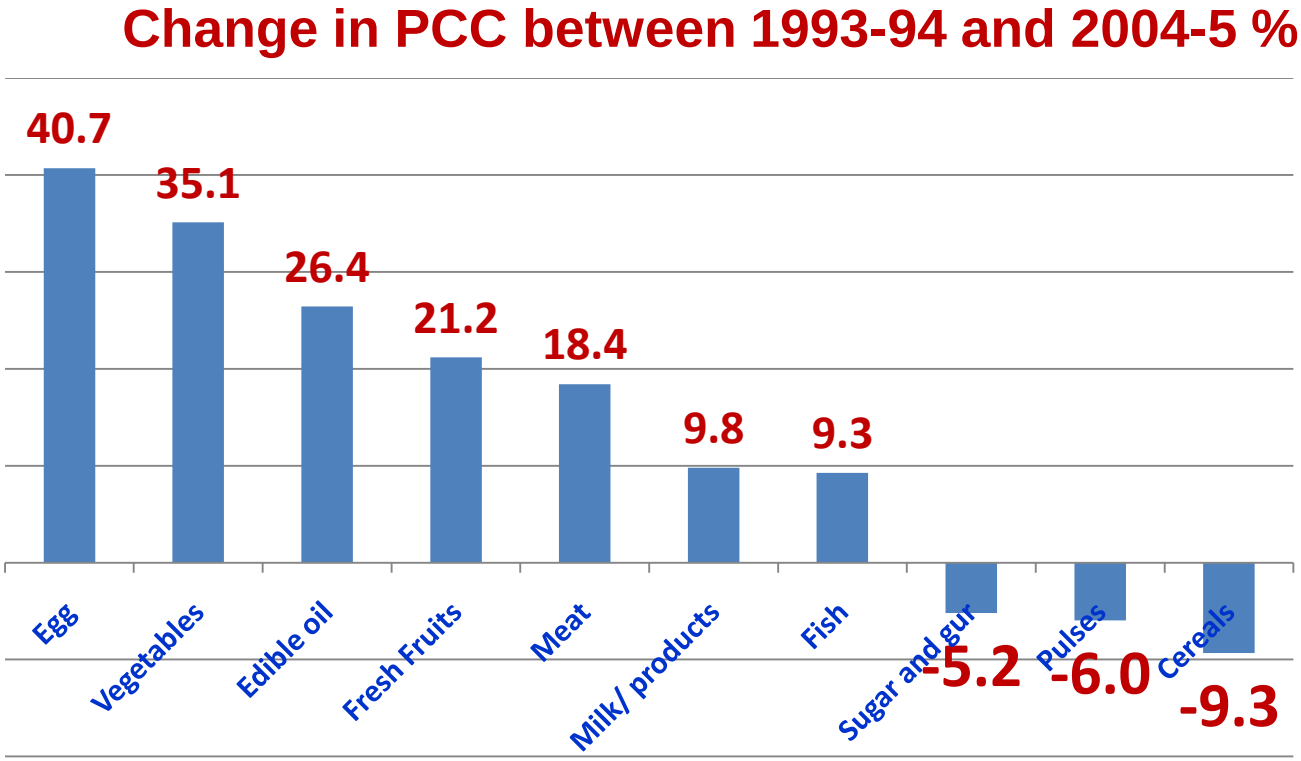
Volatility in Growth in Agri GDP

Annual Rate of Change at 1999-00 prices



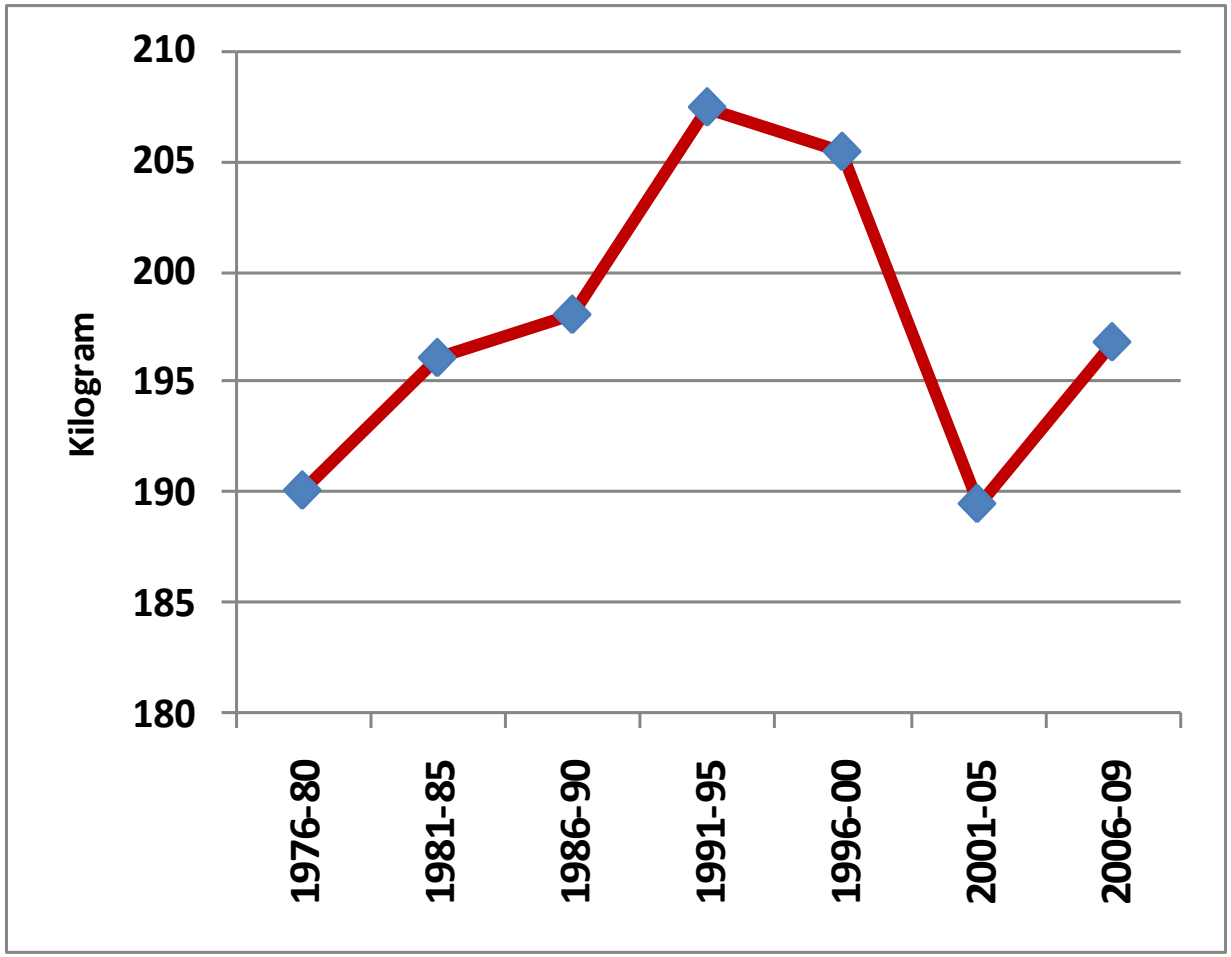
Diets diversifying, nutrition worsening

- Improvement in PCP and PCC of some commodities
- Nutrition tradeoffs in diet div: staple food



THREAT TO BASIC FOOD SECURITY

- **Per capite foodgrain production: Kg**



FOOD SAFETY

- Low use of chemicals, high residue
- Rising use of unsafe growth stimulating chemicals
- Adulteration
- Not only affecting health, also prices fetched by farmers
- Require monitoring and effective implementation of regulation at all levels

OPPORTUNITIES AND PERSPECTIVE

RENEWED IMPORTANCE OF AGRICULTURE

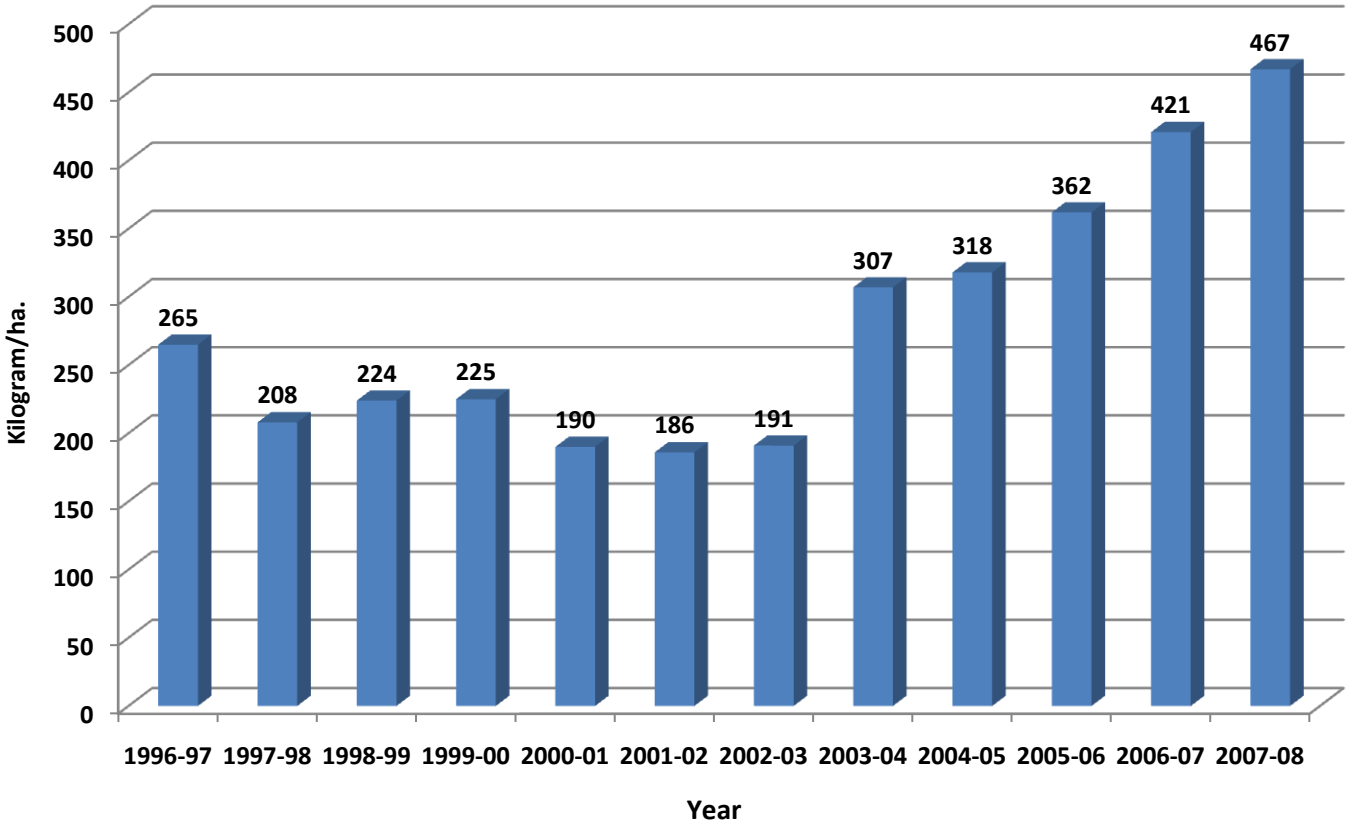
- Importance for inclusive growth and equity
- Agriculture and health link
- Opportunities for new business
- Geo political and strategic factors
- Paradigm shift: from being part of problem to part of solution
  - Global energy crisis
  - Global climate change
- Trend towards Bios'
  - Bio energy, bio medicine, bio-pesticides, bio cosmetics

POTENTIAL OF MODERN BIOTECHNOLOGY

- Lot of promise: projected to offer solution for almost all problems:
  drought, salinity, quality, resistance
- Research focus shifting towards modern biotechnology
  Experience with Bt cotton
  Spectacular increase in yield
  Seed price : contentious
- Stiff opposition from some influential NGOs:
  Scary stories v/s developmental stories
- Resource requirement: capital and knowledge intensive. R&D funding of SAUs

Status of GM Crops

- No Gm crop in India so far except Bt cotton
- Globally acceptability of GM food increasing
- Cotton yield/ hectare before and after adoption of Bt



Structure of Land Holdings

Concentration Towards Small or Large Farms?

	Punjab	Haryana	All India
Land holdings (Thousand)			
1971	1375	914	70493
1981	1027	1012	89392
1991	1117	1513	106637
2001	997	1528	119931
Share of small farmers (%)			
1971	56.5	46.3	69.7
1981	38.6	51.4	74.6
1991	44.7	61.2	78.3
2001	29.7	65.3	81.8
Average farm size (ha)			
1971	2.89	3.77	2.3
1981	3.79	2.76	1.82
1991	3.61	2.43	1.57
2001	4.03	2.32	1.33
Fragments per holding			
2001	1.38	1.48	2.18

1. Opportunities in non farm, particularly rural sector

1. Land prices
2. Land policies

Projecting Growth in Food Demand by 2020-21

Food item	Past trend 1994 -2005	Proj. 2020-21 based on 7.3% GDP growth
Foodgrain	0.91	1.93
Milk and milk products	2.72	2.89
Meat	3.43	3.72
Fish	2.68	4.25
Sugar and gur	1.36	1.91
Eggs	5.07	3.85
Edible oil	4.05	2.81
Vegetables	4.68	2.11
Fresh Fruits	3.65	3.24
Total Food	2.22	2.44
Due to population growth	83.36	53.23
Other Factors: Rise in PCC	16.64	46.77

With same growth in demand, per capita availability will experience twice the improvement in the past

Total Food Scenario: 2020-21

Base scenario	2007-8	
Production	100	
Import	2.96	
Export	8.04	
Domestic demand	94.93	
Projected Demand	**2020-21**	**2020-21**
	Quantity	**Growth rate**
No trade	129.06	1.98
Export same	137.10	2.46
Export share same	139.43	2.59
Past growth 1991 to 2008	2.7	
Prospects: Growth rate to decelerate, trade surplus decline		

Sources of Growth

1. Area
2. Productivity
3. Change in product composition

- Area
  - Horizontal : Shrinking
  - Change in Land use pattern: From barren, grazing,
  - Vertical : Crop intensity

    Considerable scope even after adjustment for annual and perennial crops

Area Expansion

- **Crop Intensity**

	1980-81	1990-91	2000-01	2005-06
Overall	1.23	1.30	1.31	1.36
Rainfed area	1.21	1.29	1.26	1.35
Irrigated area	1.29	1.32	1.39	1.37
GCA irrigated %	28.8	34.0	41.3	42.9

- **Except North West India, Irrigated Crop Intensity is not much different than crop intensity of unirrigated area.**

- **Rice fallow: east India, 10-12 million hectare**

Growth in Productivity

- Technological change
- More intensive use of inputs
- Quality input (seed)
- Improvement in efficiency

Performance and potential of wheat as reveled by actual yield and yield with improved practice and farmers practice 2002-03 to 2004-5: Kg/hectare

State	Improved practice	Farmer practice	Actual 2003-04	Yield gap % between	
				I and F	I and A
Uttar Pradesh	4206	3324	2794	26.5	50.5
Bihar	3651	2905	1783	25.7	104.8
Punjab	4463	4035	4207	10.6	6.1
Haryana	4751	4520	3966	5.1	19.8
Rajasthan	3948	3724	2794	6.0	41.3
Gujarat	4034	3491	2681	15.6	50.5
Madhya Pradesh	3297	2472	1789	33.4	84.3
Maharashtra	3411	2907	1335	17.3	155.5
West Bengal	2766	2081	2316	32.9	19.4
Uttaranchal	3388	2444	1877	38.6	80.5

Technology generation and dissemination
Extension

SEED

- Seed is the primary input for raising productivity
- Seed replacement rate quite low
- Major constraint availability

Crop	Share of certified seed in total seed used % 2004-05
Wheat	12.17
Paddy	9.27
Gram	6.92
R&M	29.14

- SSCs / NSCs lost professionalism
- ICAR/ SAUs assigned responsibility

IRRIGATION

- Ultimate irrigation potential : 140 mh
  - Major and medium: 58.5
  - Minor : 81.5
  - – Corresponds to 72% GCA
- Actual turns out to be lesser than created
- Productivity : Irrigated double than rainfed
- Implies 1% increase in irrigation → 0.21% increase in output
- Full exploitation, if it reaches 72%, can result in maximum 21% increase in output.

Growth Through Diversification

- **Horticulture (almost same output as foodgrains in value terms)**
- **Livestock (share rising)**
- **Fishery**

POTENTIAL OF HORTICULTURE: Supply Side

All India productivity of crop groups (Rs./ ha): 2005-06

Crop group	At 1999-00 prices	At current prices	Relative productivity
Cereals	13381	15042	7.64
Pulses	8015	9818	11.70
Oilseeds	13665	16891	6.80
Sugarcane	38567	45945	2.50
Cotton	21627	20438	5.62
Horticulture	95379	114883	1.00
a. Condiments & spices	68141	50540	
b. Fruits & Vegetables	104015	135876	
All Crops	22129	26011	4.42

Need to Sustain Domestic Growth in the Wake of Changes in Global Food Scenario

- Global food system undergoing profound changes
  - Rising unpredictability
  - Rising severity of shocks
  - Rising frequency of shocks
- Slowdown in growth in global food production
- Diversion of staple food for bio-fuel
- Rising volatility in international prices
- New sources of demand

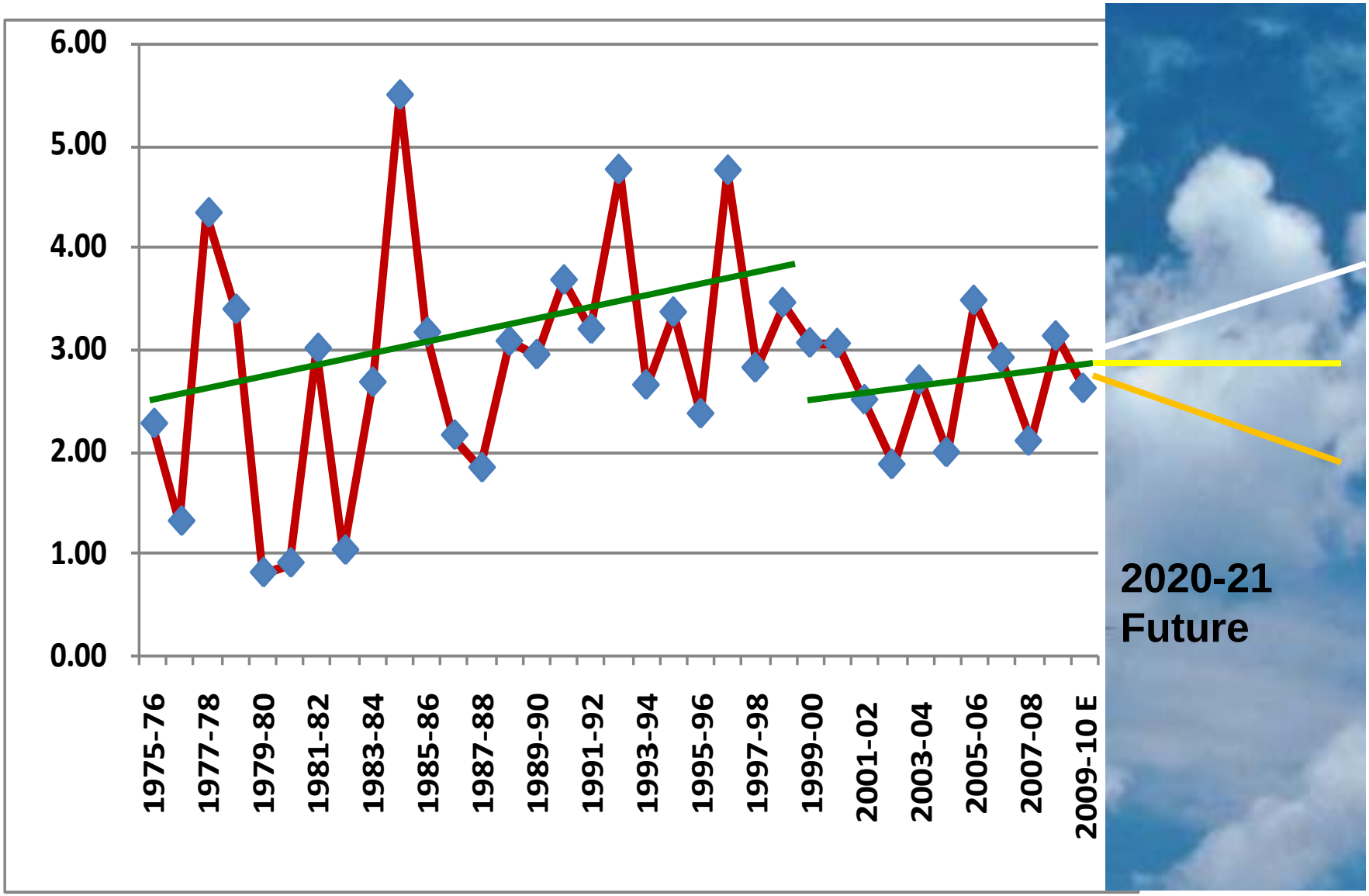
Supply Prospects Towards 2020-21

Factors affecting output	Elasticity	Sc I	Sc II	ScIII	ScIV
Technology frontier growth	0.308	0.00	0.10	1.00	-0.25
Public investments	0.174	4.00	4.00	5.00	5.00
Private investments	0.128	4.00	4.00	4.00	4.00
Area under fruits/vegetble	0.458	2.00	1.75	1.50	1.00
Fertiliser	0.122	5.00	3.50	3.00	3.00
Terms of trade: Rel prices	0.265	2.00	2.00	2.50	2.00
Shock (nature)	Negative	-0.25	-0.50	-1.00	-1.00
Growth in agri -food output		3.01	2.50	2.41	1.66

Technology Scenarios:

I: Technology available to fight degeneration and maintain potential
II: I+Succeeds in small breakthrough
III: I +Major breakthrough
IV: Technology failing to check adverse effect of various stresses

Growth in Agri Food Production
Past, Present and Future



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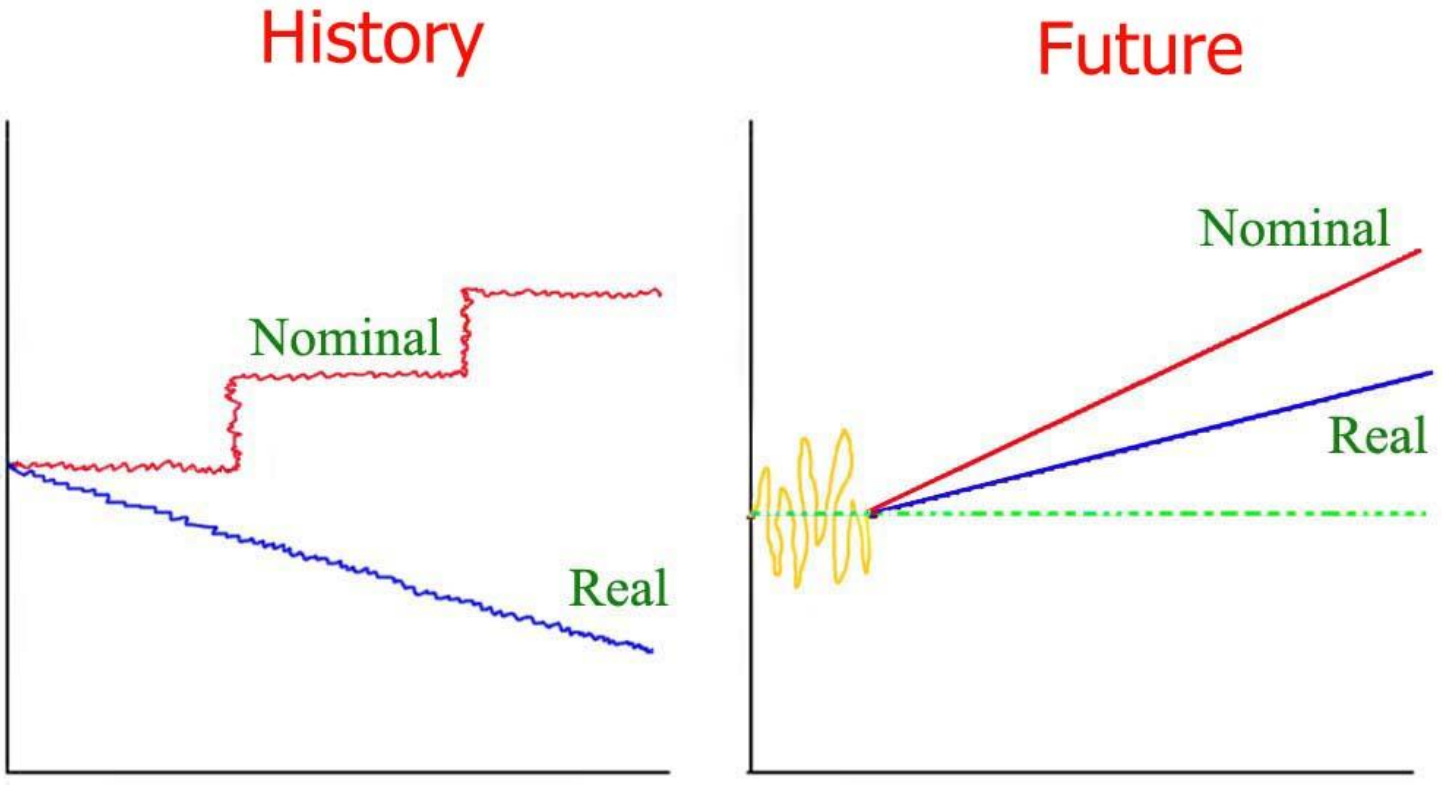
FOOD PRICES: HISTORY AND FUTURE



Why rise in future:

- **Rising cost of production; Environmental stresses**
- **Quality –quantity tradeoffs; Incentive for production**

Thanks