Strategies for Achieving Sustained High Economic Growth

The Case of Indian States

Kaliappa Kalirajan
Richard T. Shand
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To
Professor U. Shankar
and
Professor Yujiro Hayami
who have inspired us with their work and friendship.

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List of Abbreviations

ADF	Augmented Dickey Fuller
AGR	Agriculture growth rate
AIC	Akaike Information Criterion
AIFI	All India Financial Institutions
BERI	Business Environment Risk Intelligence
CUSUM	Cumulative Sum
CV	Coefficient of Variation
EGW	Electricity, Gas and Water Supply
FDI	Foreign Direct Investment
FGQ	Foodgrain output
FPE	Final Prediction Error
FSR	Financial services and real estate
FSZ	Farm size
FY	Financial year (usually March to April)
FYP	Five Year Plan
GDP	Gross Domestic Product
GEFF	General Production Efficiency
GFCF	Gross Fixed Capital Formation
GMM	Generalised Method of Moments
GSDP	Gross State Domestic Product
HPSE	High Performing State Economies
HYV	High Yielding Varieties
HYVP	High Yielding Varieties Programme
IA	Irrigated Area
ICRG	International Country Risk Guide
IEM	Industrial Entrepreneur's Memorandum

IMR	Infant Mortality Rate
LAB	Labour
LOI	Letter of Intent
LPSE	Low Performing State Economies
MGR	Manufacturing growth rate
MPSE	Medium Performing State Economies
NFGQ	Non-foodgrain output
NIC	National Industrial Classification
NSDP	Net State Domestic Product
OECD	Organisation for Economic Cooperation and Development
OEFF	Overall Production Efficiency
PDS	Public Distribution System
PM	Price of manufactured products
POP	Population
PSU	Public Sector Undertaking
R&D	Research and Development
RAIN	Rainfall index
RCM	Random Coefficients Model
ROAD	Index of density of roads per area
RURLIT	Rural literacy percentage
RWFG	Ratio of output of rice and wheat to foodgrain output
TE	Triennium ending
TFP	Total Factor Productivity
THR	Trade, Hotels and Restaurants
TR	Number of tractors
TRST	Transport and Storage
TSC	Transport, Storage and Communication
TVE	Township and Village Enterprises
USA	United States of America

Preface

The diversity of the Indian economy and the wide range of development strategies that India has followed over the past six decades in a federal framework is an extremely valuable source of learning for researchers and policy makers around the world. A sizable literature has now become available on the patterns and determinants of economic growth at the national level in India. However, research on the patterns and determinants of growth at sub-national level is relatively small in number. The objective of this book is to contribute to this area of state level analysis of economic growth. In this book we have summarised our analyses of the experiences of the Indian states as the nation experimented with alternative approaches to achieve sustained economic development. The analyses look at the patterns of economic growth, investment flows, agriculture–industry nexus and income convergence. The inter-linkages of the sectors and regions, and the opportunities they create for raising the level of economic activities further are analysed using a variety of empirical techniques.

Given the varied economic performances of the Indian states, there are several interesting questions to answer. For example, whether there is convergence of economic performance across states in the long run? Whether Indian states are well integrated with the national economy? Whether there is uni-directional or bi-directional causality running between agricultural growth and industrial growth across states? Whether there is significant spillover effects of growth from developed to developing states? Theoretical framework and empirical analyses to answer the above and other related questions have been carried out through our collaborative research work at the Australian

National University in Canberra, at the Foundation for Advanced Studies on International Development in Tokyo and at the National Council of Applied Economic Research in New Delhi.

We would like to acknowledge our intellectual debt to a number of our collaborators in specific research areas on which we have drawn in putting together this book. We have attempted to acknowledge by citing the joint works wherever relevant. However, we would like to mention here our gratitude to Prof. U. Shankar at the Madras School of Economics and Dr Rajesh Chadha at the National Council of Applied Economic Research and Dr Takahiro Akita at the International University of Japan for their collaboration with us jointly or individually at different times.

We would also like to express our gratitude to the three institutions where we have worked during the course of this research, the Australian National University, Canberra, the National Council of Applied Economic Research, New Delhi and the Foundation for Advanced Studies in International Development, Tokyo. We would like to register our appreciation to Edward Elgar publishers, UK and the *Economic and Political Weekly*, Mumbai for their kind permission to draw on some of our earlier published works.

We would also like to thank Sage Publications for their patience with our pace of work and accepting this book for publication.

Finally, we wish to acknowledge the support of our families during the course of our work.

As usual, we remain responsible for all the errors that remain in this work.

Kaliappa Kalirajan
Richard T. Shand
Shashanka Bhide

1

Introduction

India has witnessed one of the fastest rates of economic growth for well over two decades starting in the 1980s. The rate of growth of per capita income at over 4 per cent per annum has raised the hope that with proper balancing of growth across regions and across sectors, the persistent problem of poverty could be overcome within a reasonable period of time. Indeed the Eleventh Five Year Plan of India, covering the period 2007–08 to 2011–12, has targeted a growth of real Gross Domestic Product (GDP) at 9 per cent, which in turn translates into about 7.5 per cent growth in real per capita income. If the current trends continue and with the accelerated economic growth of 9 per cent per year, one may expect a reduction in the incidence of poverty from the current level of about 27 per cent to less than 20 per cent in 2011–12. However, 20 per cent is still a very high rate of incidence of poverty and continuation of high growth rates of the economy is necessary to achieve more rapid decrease in poverty, an important global goal.

India is a large economy, both in terms of geography, population and economic activity. It is also diverse with respect to languages and culture. The country has a federal structure with the central government and the states sharing the responsibilities for development and governance jointly as well as separately. There are 28 states each with democratically elected legislatures and 10 of them have a population of more than 50 million. There are also seven union territories, with two

of them having elected governments and the remaining five directly administered by the centre. This variety and interdependence present both an opportunity and challenge in achieving higher levels of income and living standards to over a billion people today.

An important dimension of overall economic growth in a large economy is the regional balance in growth. In the Indian context, there is considerable variation in economic growth across the states. The high income and relatively large states of Maharashtra and Gujarat also witnessed high rates of growth during the 1980s and 1990s. On the other hand the poor states of Uttar Pradesh and Bihar saw low rates of growth. Although considerable migration does take place from low income regions to higher income regions where there are employment opportunities, it is necessary to achieve balanced growth across regions given the large size of the individual states. Migration will not be able to bring about income growth for the large population in different states.

An understanding of the reasons for variation in the performance of the economies at the state level would be important for designing policies that can significantly improve the performance of the slow growing economies. It is with this broad motivation, we propose to undertake a study of the economies of the Indian states and assess the explanations for variation in their growth performance.

In recent years, a number of studies have attempted to examine different aspects of the economies of the Indian states. For example Ahluwalia (2000) provides an analysis of the variation in the overall performance of the states. Shand and Bhide (2000a) provide an analysis of contribution of different sectors and states to India's economic growth. Mohan (2000) pointed to the worsening fiscal scenario at the state level during the 1990s. Bajpai and Sachs (1999), Debroy, Bhandari and Banik (2000) and Howes, Lahiri and Stern (2004) provide an analysis of the industrial, fiscal and investment sectors of the states.

Kalirajan and Bhide (2003) bring together the state level variations in the agricultural sector of the states within an overall national level macroeconomic framework for analysis.

The different studies point to the dynamics of different factors and their implications to the differential rates of performance of the state economies. The strategy for achieving sustained high rates of economic

growth at the state level will also need to consider the interrelationships both within and across the state economies. The relationship between state and central government policies is also an important factor influencing the performance of the economies at the state level.

In the Indian context, the agricultural sector has been important from a policy perspective for several reasons. Even from the point of view of accelerating economic growth, transition from an agrarian economy to an industrial or modern economy would depend on how well the agricultural sector enables this transition. Therefore, besides the concerns relating to employment and poverty alleviation, the performance of agriculture is of policy interest from the viewpoint of accelerating economic growth as well. For example, between 1970–71 and 1999–2000, India's rate of economic growth (averaging 4.55 per cent per annum) has been slow relative to the countries of North East and South East Asia, owing to a sluggish growth rate in agriculture. India's growth rate of 2.3 per cent per annum of GDP originating in agriculture over the two decades of Green Revolution (1968–88) compares very modestly with trend growth rates for paddy and wheat in most other Asian countries over that period. China, Malaysia, Thailand and Burma each achieved 4 per cent per annum. Indonesia followed closely with 3.9 per cent, while the Philippines and Pakistan recorded between 3.5 per cent and 4 per cent, respectively.

International comparisons reveal a divergence in India's performance between achievements in output and productivity. While India compares favourably in terms of total output, it compares poorly in terms of yield per hectare. For example, India has 60 million hectares of land under irrigation compared with just 47 million in China, but its food grain production is barely 40 per cent of China's output. On the other hand, agricultural performance in certain states, particularly Punjab has been on par with the high performing East Asian countries. This indicates that it is necessary to take into account of such state-level differences in economic performance while analysing the performance of India. What types of performance measures one should use from the policy perspective of achieving sustained economic growth?

Performance of any economic decision making units can be analysed in many ways. Conventionally, researchers use some kind of 'external performance measures' in which an economic decision making unit

is compared with a benchmark unit. For example, India's growth performance is compared with that of China or Japan. Though such a measure, which is theoretically based on neo-classical growth models such as the Harrod–Domar growth models, is useful in certain ways, what is more important is to apply what is called 'internal performance measure'. The latter method, which is theoretically based on new neo-classical growth models such as the endogenous growth model, concerns with measuring the intensity and pace of improvement of performance within the economic decision making unit only. In other words, the economic decision making unit's actual achievement is compared with its potential performance under the existing economic environment. When the 'gap' between potential and actual achievements of a decision making unit is not significant, then the particular decision making unit's performance is considered to be the best performance under a given economic environment. Differences in capacity towards closing the 'gap' would then lead to different growth patterns across economic decision making units. The literature has identified that investments in human capital and infrastructure are crucial to close the 'gap' between potential and actual achievements of economic decision making units. The basic framework for this book is built on the above arguments concerning the economic performance measure, its determinants and the importance of the agricultural sector. With this framework what we examine in detail in this book is the impact of inter-linkages between economies and sectors that can help achieve more balanced economic growth across regions.

Accordingly in this book, we propose to take up the analysis under the following broad themes:

1. Assessment of the evidence on the factors influencing economic growth of the states. We first take up an analysis of the experience of the states in a period of macroeconomic crisis and a recovery from this crisis. This is the period of the early 1990s when India faced a severe balance of payments crisis and it launched a series of reforms in economic policies which also saw a recovery of economic growth. Experience of the states with respect to the impact of crisis and their response leading to

recovery provides some understanding of the commonality and differences in the economic policy conditions in the states.

2. Convergence of per capita income levels of the states or regions has been proposed in the literature as one motivating force that can bring about uniform levels of income across regions. The set of studies available on the Indian experience now on this proposition provide mixed evidence. We will provide an assessment of the available research and examine what factors are associated with the divergence of incomes and what factors are associated with the narrowing of the average per capita income levels at the state level. There is also an important question of whether the interdependence of the economies leads to transmission of growth impulses across regions. We provide an assessment of this proposition through a review of available studies using the data on Indian states.
3. Identifying the sources of economic growth at the state level in terms of sectors. The analysis will examine the pattern of growth of sectors in relation to overall economic performance of the states. In other words, do the state economies get transformed in the same pattern, say from agricultural to industrial and tertiary sector dominated economies? Or, some states continue to be dominated by specific sectors?
4. The sequencing of development of the sectors within an economy has received considerable attention in the studies of economic development. However, whether the interrelationships between agriculture and industry translate into growth stimulus from industry to agriculture, or vice versa? This aspect of interdependence of the sectors has been ignored in empirical studies of Indian state economies. We provide an assessment of the diversity of agricultural growth experience of the states and then examine growth impulses from agriculture to industry and industry to agriculture.
5. How are the investment decisions affected by the increasing level of decentralisation of policies from the central government level to the states and also from the public sector to the markets? The study will examine the patterns of investments

during the period of recovery of the Indian economy from its macroeconomic crisis in the early 1990s.

6. The study will also examine the impact of national level economic policies on agriculture at the state level. Some of the economic polices such as the decisions on input subsidies and output prices are made at the national level. At the macroeconomic level, the policies relating to exchange rate or overall fiscal stance can have differential impact on the economies of the states. The study will examine the potential for such variation in responses.
7. The variations in the responses of agricultural output across the states to the level of development of infrastructure and human capital allow us to examine the impact of these two factors on agricultural productivity.
8. An assessment of the trends in investments in the states with focus on investments in the industrial sector would also help one to understand the strategies followed by the states in accelerating economic growth. Do the strategies indicate differences that take into account the complementarities of the economies?

The above research agenda is wide ranging. Our purpose is to bring together a stream of research that has looked at the inter-linkages of the regional economies as a source of economic growth. The study will aim to provide, based on empirical analysis, insights into factors that can lead to higher and more even growth performance by the Indian states.

This book is organised into seven chapters including this introductory chapter. In Chapter 2 we first review the experience of the states during the macroeconomic crisis years and the few years succeeding the crisis to understand the commonality and diversity in the economic performance of the states. This is followed by a review of the studies which look at some forces that may lead to more uniform development of interconnected economies. Chapter 3 provides a discussion of the pattern of agricultural growth across the states to understand how the growth rates vary across states. We also analyse the nexus between industry and agriculture. In the next chapter, we examine how the agricultural sectors of the state economies may experience different

outcomes in response to national level economic policies. This is done using a macroeconometric model of the Indian economy. Chapter 5 provides an empirical assessment of the impact of infrastructure and education on productivity using the framework of the 'gap' analysis discussed earlier involving the stochastic production frontier model. Chapter 6 provides an assessment of the strategies of the states in attracting investments. We examine how the states have succeeded in attracting new investments. Chapter 7 presents the policy conclusions from the study.

2

Growth Experience of the Indian States: Similarities and Divergence

INTRODUCTION

Economics literature presents a number of factors as important in leading to economic growth of a country. In all these theories accumulation of capital is a driving force in enhancing labour productivity and achieving higher levels of development. Increasingly, there is also recognition that institutions play a very important role in enabling not only capital accumulation, but its allocation in all the economic activities including development and application of new technologies. The economic growth, therefore, is not a simple process and this perhaps explains the slow progress of countries in accomplishing what appears to be a well understood process. Each country has a different set of initial conditions which often determine the strategies needed to achieve growth and development. The external environment also varies over time and each country has to align its policies to get the maximum benefit from the external environment.

There is also the spatial dimension of development and growth which influences economic policies. Do all the sub-national regions

benefit from the economic development uniformly? Experience of the Indian states over the last six decades offers many lessons in the performance of the sub-national units in achieving economic growth and development. Why some large areas of the country remain laggards in development while the others make progress? The modern analysis of economic growth across regions has focused on testing the hypothesis that per capita income levels tend to converge implying that less developed regions would grow faster and catch up with the higher income regions. This process also implies that there are transmission mechanisms of growth across regions. While migration of labour and capital flows may not be 'free' even within national economies, the movement of goods and factors of production may also be limited by poor infrastructure, cultural differences and distances. Finally, economic policies influence economic performance. There have been periods of extreme stress in terms of food scarcity, socio-political crises and economic crises during the period since India's political freedom from colonialism. The most recent period of economic crisis which led to major changes in economic policies was the macroeconomic crisis of 1991. How did this crisis affect the economic performance of the Indian states?

In this chapter, we address these diverse elements which affect performance of the sub-national units of the Indian economy. We first examine the similarities of the growth processes of the Indian states in the context of this macroeconomic shock to the national economy in 1991 and the recovery that followed. This analysis also provides an understanding of the variations in growth experienced by the states or regions within a national economy. Next, we pursue the question of similarities of growth processes. We review the experience of the Indian states with respect to one of the major hypothesis on the variability in regional economic growth, the convergence of per capita income across regions. In the final section of this chapter we examine the notion that regions have strong economic linkages and, therefore, whether these linkages can be exploited to accelerate more even growth across the regions.

ECONOMIC CRISIS AND ADJUSTMENT

Variation in the Impact of the Crisis

Indian economy faced a major economic crisis manifested in its impending inability to meet international payment liabilities in mid-1991. The crisis followed a number of unforeseen international events such as the collapse of the Soviet Union which also meant for India loss of a major source of export earnings and the hike in crude oil prices as a result of the Gulf War in 1990. The crisis did, however, illustrate the vulnerability of the economic system which relied excessively on public sector and import substitution policies to provide the push to economic growth. The economic reforms that followed the crisis, aimed to remedy these rigidities through liberalisation of trade, industrial and fiscal policies. While the impact of the crisis and the recovery from the crisis has been generally viewed at the national level, the impact and adjustment can be expected to vary across regions. To place the crisis of 1991–92 in the context of overall pattern of India's economic growth we present the pattern of overall GDP growth in different years of the past five decades in Table 2.1.

What is striking about the pattern of growth is the steady rise in the number of years of high growth in the recent decades. The years 1991–92 and 1997–98 are the only exceptions in the years since 1990–91 that the GDP growth fell below five per cent. The year 1991–92, therefore, marked a sharp change in the growth pattern early in the decade of the 1990s as growth dipped below one per cent.

Another important feature of the crisis year of 1991–92 was also that it saw sharp decline in the growth rate of industry. The pattern of sectoral growth in the years when overall GDP growth fell below one per cent has been presented in Figure 2.1. With the exception of 1957–58, 1979–80 and 1991–92, in all the previous 'output shock' years it was the decline in agricultural growth that brought down the overall GDP growth. In other words, the economy was vulnerable to major shocks in agriculture and only in a few years that the non-agricultural sectors actually witnessed negative growth.

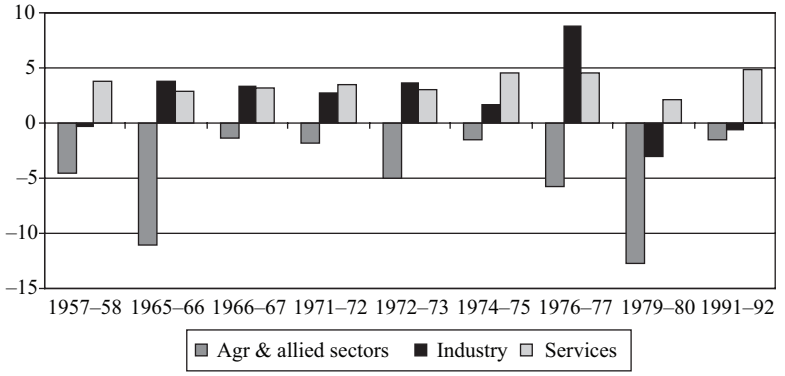
Table 2.1 Acceleration in growth: Years by rate of GDP growth (1993–94 prices) over time

Annual Growth	*1950s*	*1960s*	*1970s*	*1980s*	*1990s*	*2000s*
Below 1%	1957–58	1965–66	1979–80			
			1972–73			
			1971–72			
			1976–77			
1 to <2%		1966–67	1974–75		1991–92	
2 to <3%	1959–60	1962–63				
	1951–52	1968–69				
	1955–56	1961–62				
	1952–53					
3 to <5%	1954–55	1963–64	1973–74	1982–83	1997–98	2002–03
				1987–88		2000–01
				1984–85		
				1986–87		
				1985–86		
5 to <7%	1956–57	1969–70	1970–71	1981–82	1992–93	2001–02
	1953–54		1978–79		1990–91	
					1993–94	
					1999–2000	
					1998–99	
					1989–90	
7% and above	1958–59	1960–61	1977–78	1983–84	1994–95	2004–05
		1964–65	1975–76	1980–81	1995–96	2003–04
		1967–68		1988–89	1996–97	2007–08
						2005–06
						2006–07

Source: Authors' calculations based on data from National Accounts Statistics (Central Statistical Organisation, 2009).

Note: A decade is defined as in 1950–51 to 1959–60. The years are financial years, April–March; the decade of 2000s covers the years 2000–01 to 2007–08.

Figure 2.1 Sectoral performance during output shocks: Annual GDP growth (%) in low growth years



Source: Authors' calculations based on data from RBI (2007).

How should we think of the regional dimension of the impact of the crisis such as the one experienced in 1991–92 and then the recovery that followed? We can expect that there is considerable heterogeneity in the growth experience of the states. While we will discuss the pattern of growth rates across states in greater detail later, we point to the extent of similarity of growth process across states. In Table 2.2 we show that the output of the three major sectors in the states is indeed rising (or falling) along with the national level output. In other words, all states have experienced growth. Table 2.2 also shows that the similarity is the greater in the case of non-agricultural sectors than agriculture. The Index of Similarity, the weighted average of the correlation coefficients between the Gross State Domestic Product (GSDP) of the states with the national GDP, with population shares of the states as weights, is higher for industry and service sectors than agriculture. The correlation coefficients are based on GSDP data for the period between 1980–81 and 2004–05. The agricultural output is more dependent on local agro-climatic conditions and expected to be influenced by local conditions. In the case of non-agricultural sectors the linkages with other regions can be expected to be stronger. This is reflected in the pattern seen here.

Table 2.2 Correlations of GSDP of states with all India GDP (1993–94 prices)

	Correlation Coefficients				*Ranks in Descending Order of Correlation*			
State	*Agriculture and Allied*	*Industry*	*Service*	*Total*	*Agriculture and Allied*	*Industry*	*Service*	*Total*
Andhra Pradesh	0.929	0.997	0.999	0.996	7	1	1	3
Assam	0.933	0.844	0.989	0.967	6	16	14	16
Bihar	0.693	0.922	0.994	0.972	15	15	10	15
Gujarat	0.699	0.973	0.993	0.978	14	12	12	14
Himachal Pradesh	0.840	0.988	0.995	0.986	12	8	9	11
Haryana	0.961	0.987	0.995	0.995	4	10	8	5
Kerala	0.920	0.989	0.998	0.994	9	6	4	6
Karnataka	0.926	0.993	0.999	0.998	8	4	2	2
Maharashtra	0.951	0.972	0.996	0.993	5	13	7	8
Madhya Pradesh	0.785	0.989	0.993	0.991	13	7	11	10
Orissa	0.194	0.964	0.997	0.978	16	14	6	13
Punjab	0.968	0.995	0.988	0.994	3	2	15	7
Rajasthan	0.850	0.994	0.990	0.986	11	3	13	12
Tamil Nadu	0.918	0.982	0.997	0.995	10	11	5	4
Uttar Pradesh	0.971	0.989	0.983	0.992	2	5	16	9
West Bengal	0.986	0.988	0.998	0.999	1	9	3	1
Index of Similarity	0.862	0.975	0.993	0.989				
Maximum Correlation								
Value	0.986	0.997	0.999	0.999				
State	WBL	APR	APR	WBL				
Minimum Correlation								
Value	0.194	0.844	0.983	0.967				
State	ORS	ASM	UPR	ASM				

Source: Authors' calculations based on data from RBI (2007) and EPW Research Foundation (2009).

We pursue this analysis further with the correlations of the growth rates of GSDP from the three main sectors and at the overall level. The correlations of growth rates of output of each state with the growth

rates at the national level are weaker than the correlations of the output levels. In the case of industry, the Index of Similarity of Growth Rates has increased in the more recent period of 1993–94 to 2004–05 than the earlier period of 1980–81 to 1990–91 (Table 2.3). The experience of the service sector is not similar to industry. The Index of Similarity of Growth Rates of service sector declined in the period between 1993–94 and 2003–04 as compared to 1980–81 and 1990–91. However, in the aggregate, the Index has weakened because of the growing dissonance particularly of agricultural growth rates across the states.

The key point that emerges is that the industrial sector provides greater interstate production linkages of the economy. This, of course, does not fully measure the interstate economic linkages because there are strong input–output linkages between sectors such as between input supplying manufacturing sectors in one state with the agricultural output of another state. Presence of increasing interstate linkages in the industrial sector suggests that the impact of shocks of macroeconomic nature is not likely to be limited to only some states. This point is illustrated in the experience of the state economies in 1991–92 and 1992–93 (Figure 2.2). As the overall GDP growth rate declined to 0.9 per cent as compared to the average of about six per cent in the previous five years, not many states were able to avoid the impact of this slowdown.

Only Karnataka, Orissa and West Bengal registered in 1991–92 growth rates higher than the average for the previous decade. Even in these states, growth rates fell below this long term average in the subsequent year, 1992–93. Although the causes of the output shock may have varied, the impact had spread to most of the states. The nature of the macroeconomic crisis of 1991–92 in India has been documented extensively in the literature. The crisis was followed by wide ranging economic reforms. While many of the reforms were of macroeconomic nature and carried out at the national level, the states also had to undertake reforms in economic policies to align these policies with the changed national environment. The recovery of the economy from the crisis year of 1991–92, therefore, also presents an opportunity to understand the similarity in the responses of the states.

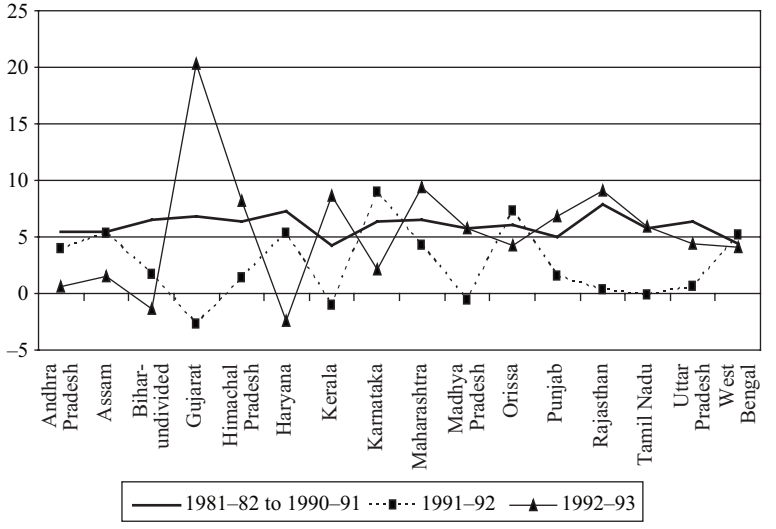
Three types of impact of the crisis and recovery from it can be hypothesised. First, the regions with larger share of industrial output

Table 2.3 Correlations of GSDP growth rates of states with all India GDP (1993–94 prices)

	Agriculture			*Industry*			*Services*			*Total*		
State	*1981–82 to 1990–91*	*1993–94 to 2004–05*	*1981–82 to 2004–05*	*1981–82 to 1990–91*	*1993–94 to 2004–05*	*1981–82 to 2004–05*	*1981–82 to 1990–91*	*1993–94 to 2004–05*	*1981–82 to 2004–05*	*1981–82 to 1990–91*	*1993–94 to 2004–05*	*1981–82 to 2004–05*
Andhra Pradesh	0.66	–0.70	–0.10	–0.19	0.11	0.21	0.10	0.39	0.47	0.60	–0.44	0.30
Assam	–0.19	0.36	0.07	0.17	–0.27	0.00	0.04	0.28	0.17	–0.01	0.04	0.05
Bihar	0.64	–0.30	0.14	0.30	–0.09	0.06	0.05	0.42	0.40	0.57	0.32	0.52
Gujarat	0.91	–0.62	0.37	–0.03	0.13	0.13	0.19	–0.79	0.17	0.89	–0.16	0.54
Himachal Pradesh	0.42	–0.31	0.14	–0.35	0.51	0.13	0.75	0.07	0.51	0.52	–0.10	0.50
Haryana	0.76	–0.54	0.35	–0.37	0.30	0.14	0.31	0.30	0.41	0.51	–0.10	0.38
Kerala	0.13	0.13	0.06	0.41	–0.17	0.02	0.50	–0.12	0.34	0.13	–0.03	0.20
Karnataka	0.22	0.38	0.21	0.20	0.16	0.07	–0.24	0.47	0.46	0.37	0.39	0.16
Maharashtra	0.03	–0.58	–0.02	0.32	0.26	0.31	0.70	–0.26	–0.01	0.48	0.18	0.37
Madhya Pradesh	0.35	–0.54	–0.22	0.33	–0.20	0.25	0.00	0.24	0.12	0.18	–0.29	0.14
Orissa	0.66	–0.14	0.14	0.17	–0.23	0.00	0.55	–0.39	0.15	0.83	0.03	0.37
Punjab	–0.22	–0.60	–0.41	0.38	–0.03	0.19	0.30	0.30	0.55	0.02	–0.23	0.01
Rajasthan	0.96	–0.69	0.10	0.14	0.14	0.23	0.29	0.05	0.15	0.84	–0.22	0.41
Tamil Nadu	0.34	0.14	0.21	0.02	–0.08	0.17	0.46	–0.10	0.40	0.44	0.34	0.46
Uttar Pradesh	0.68	–0.47	0.01	–0.31	0.61	0.36	0.65	0.06	0.16	0.52	0.01	0.32
West Bengal	0.31	0.15	0.15	–0.04	–0.07	–0.09	–0.35	0.29	0.36	0.21	0.47	0.21
Index of Similarity	0.47	–0.32	0.06	0.06	0.12	0.17	0.27	0.09	0.26	0.47	0.05	0.32

Source: Authors' calculations based on data from RBI (2007) and EPW Research Foundation (2009).

Figure 2.2 Measuring state level impact of macroeconomic shock: Annual growth rate (%) of GSDP (constant prices)



Source: Authors' calculations based on data from EPW Research Foundation (2003).

in their total economy may have been affected most because of the crisis as it was the industrial sector that saw the most effect at the national level. High rate of inflation, monetary policy measures to contain it, lack of resources to import inputs led to poor investment climate adversely impacting on industrial output. A second channel by which the crisis would lead to differential impact across the states is the fiscal process. As the fiscal imbalances were generally acute by the end of 1980s, the states with greater loss of revenues, as output growth declined, would be more affected by the crisis. This again implies that the sectors with higher levels of industrial output would be impacted more since industries provide a major source of revenues to the government. Finally, recovery from the crisis can be expected to be faster in those states that have adequate infrastructure for attracting new investments. These potential sources of differences in the way the crisis would have affected the states and the recovery from the crisis also point to the need for region-specific policies to influence economic growth.

A clear appreciation of the impact of, and recovery from, the economic crisis of 1991–92 at state level is obtained from the ratio of per capita non-agricultural GSDP from 1991–92 to 1995–96 as a percentage of its level in triennium ending (TE) 1990–91 (Table 2.4). Overall, in 1991–92, the 16 states recorded changes in per capita GSDP ranging from an increase of two per cent in the case of Gujarat to 13 per cent increase in Maharashtra. However, in comparison to the previous year, four states had recorded negative growth rates in the crisis year. Another five states had recorded growth of less than

Table 2.4 The impact of macroeconomic shock to state economies: Changes in non-agricultural GSDP (1993–94 prices)

	Ratio to TE 1990–91				*Year on Year % Change*	
State	*1991–92*	*1992–93*	*1993–94*	*1994–95*	*1991–92*	*1992–93*
Andhra Pradesh	1.09	1.09	1.18	1.28	3.94	0.57
Assam	1.11	1.13	1.17	1.22	5.25	1.52
Bihar (u)	1.07	1.05	1.09	1.13	1.68	–1.32
Gujarat	1.02	1.22	1.28	1.43	–2.74	20.34
Himachal Pradesh	1.07	1.15	1.22	1.39	1.29	8.21
Haryana	1.13	1.10	1.16	1.24	5.37	–2.49
Kerala	1.06	1.15	1.27	1.37	–0.98	8.69
Karnataka	1.14	1.17	1.25	1.36	8.99	2.18
Maharashtra	1.13	1.24	1.37	1.42	4.20	9.42
Madhya Pradesh (u)	1.08	1.14	1.20	1.25	–0.65	5.69
Orissa	1.08	1.13	1.19	1.30	7.24	4.24
Punjab	1.05	1.13	1.19	1.23	1.59	6.87
Rajasthan	1.09	1.19	1.23	1.40	0.23	9.07
Tamil Nadu	1.07	1.13	1.23	1.39	–0.09	5.98
Uttar Pradesh (u)	1.06	1.11	1.13	1.22	0.59	4.32
West Bengal	1.12	1.17	1.24	1.31	5.21	4.13

Source: Authors' calculations based on data from RBI (2007) and EPW Research Foundation (2009).

Note: In the case of Bihar, Madhya Pradesh and Uttar Pradesh we have combined data for the new states comprising the states before their division in 2000. Data for Bihar includes data for Jharkhand, Madhya Pradesh includes data for Chhattisgarh and Uttar Pradesh includes data for Uttarakhand.

two per cent. Although all the 16 states continued to expend their non-agricultural output throughout the next four years following the crisis year of 1991–92, the pace was uneven. Bihar, Assam and Uttar Pradesh remained the slowest to expand with Gujarat and Maharashtra registering the largest gains.

Two major states which recorded negative growth in 1991–92 in non-agricultural output were Gujarat and Tamil Nadu. Growth decelerated in Karnataka in the following year but a major state that did not record slowdown was Maharashtra. The differences in growth experience show that the extent of specialisation of output may have influenced the impact of the macro level output shock. Specialisation may have led to faster growth during expansion but diversification may have helped absorb intensity of the shock.

Variation in the Performance of the State Economies after the Economic Reforms

An understanding of the regional patterns of growth within India is of concern for several reasons. First, central importance in policy continues to be the objective of achieving and sustaining a higher overall growth rate in the Indian economy. Policy makers need insights on past performance at state level in order to formulate future policy directions more effectively. Second, high levels of foreign and domestic investment are needed to reach the growth target. Foreign and domestic investors need information on state level performance and prospects to guide their choice of location between states. Third, fiscal problems in the states may exacerbate those at the centre, and the issue of overall fiscal stability requires problems at state level also to be addressed. Finally, with greater decentralisation of policy making process consequent to the economic reforms in the 1990s, information on the state's performance is important for the policy makers at the state level also. Policies will be based on such assessments in each state.

The economic reforms that began in the early 1990s brought to the fore the role of state governments in attracting new investments from the private sector needed for growth. In the previous regime of

centralised planning, the states' role was largely one of lobbying for public sector investment. Private investment was influenced by the incentives offered by the states for such investments, but the centralised planning process laid down the criteria for new investments. In the new environment of liberalised economic policies, state governments have recognised the need for a more competitive approach to attracting new investments in their own states.

This change in the perception on the part of the state governments is also due to the emergence, and frequent election, of regional level political parties at the state level and their need to improve economic performance as an important electoral appeal. The industrial policies announced by the various states in the mid-1990s reflect the recognition at state level of the need for a proactive policy towards attracting private investment.

While there is evidence of changes in perception of the role of the states among the policy makers in the various policy statements, actual implementation of the new policies was slow. In an assessment made after nearly a decade of economic reforms, Lahiri and Fardoust (2000) commented:

> As a direct consequence of…economic and political developments of the past decade, appropriate policy responses, expenditure allocations and revenue efforts of the Indian State governments have become very important for growth and welfare. Perhaps, most States have lagged behind the central government in introducing economic reforms in the post 1991 period. This relative lack of progress is evident in the areas of tax reforms, disinvestment and liberalisation of rules and procedures. A large majority of the States has followed short-sighted, populist policies that have harmed their economic and social development. The composition of expenditures as well as the stock of infrastructure assets has deteriorated with the neglect of cost recovery mechanism for maintaining public assets. Reform at the State level is critical for the country.

Nearly one decade since this critical assessment of the performance of the states, there have been some positive developments, particularly on the fiscal front. The tax reforms first in the form of adoption 'Value Added Tax' in place of sales tax and now in moving towards a national Goods and Services Tax (GST) have been a significant achievement.

There have been some institutional reforms in the electricity sector with the setting up the state level regulators and unbundling of the stet utilities in a number of cases.

Clearly a large part of the onus for stimulating economic development and attracting the necessary investment resources lies with the states. Their capacity to rise to this challenge is central to the theme of this chapter. States 'will be competing more intensely than before, in market place for resources in future and, States may find it somewhat difficult to place a significant responsibility on the Centre for their relative performance' (Reddy, 2000).

In this section, we profile India's states, with reference to recent growth. We first provide an overview of the present size and average income levels of the states. Table 2.5 provides a snap shot of the state economies which shows their diversity.

Growth Rates of Gross State Domestic Product (GSDP)

The 1990s began with the economic crisis for India and the decade also represents a period of major economic reforms. The economic crisis occurred in 1990–91 with its major impact in 1991–92. The economy recovered from the crisis in 1992–93, so both the years 1991–92 and 1992–93 show the impact of the crisis and do not fully reflect the impact of reforms on overall growth performance. With this in view, in our review of the economic performance of the states we consider the 'reform period' to have commenced in 1993–94 and examine the growth performance from 1993 to 2000 (that is, FY1993–94 to FY1999–2000) in terms of average annual growth rates of GSDP compared with the pre-reform period of 1981–82 to 1990–91.

The pattern of growth exhibited by the states also points to some differentiation of their experience. Categorisation of the states based on their growth experience helps in further analysis of state level characteristics which influence growth performance. Accordingly, we have grouped the states into three categories of 'High growth', 'Medium growth' and 'Low growth' based on their performance during the years during 1981–82 to 1990–91 and 1993–94 to 1999–2000.

Table 2.5 Size and income of India's states and union territories (2005–06)

		Population	*GSDP*		*Per Capita GSDP*	
Sl. No.	*State/UT*	*Million*	*Rs Billion*	*USD*	*Rs*	*USD*
1	Andhra Pradesh	80.4	2360	53.32	29369	663
2	Arunachal Pradesh	1.2	29	0.66	25086	567
3	Assam	28.5	575	13.00	20186	456
4	Bihar	90.2	802	18.11	8891	201
5	Jharkhand	29.1	622	14.06	21377	483
6	Goa	1.6	124	2.80	79389	1793
7	Gujarat	54.6	2198	49.65	40221	909
8	Haryana	23.1	1064	24.03	45974	1038
9	Himachal Pradesh	6.6	255	5.75	38457	869
10	Jammu & Kashmir	10.9	265	5.99	24397	551
11	Karnataka	56.0	1680	37.94	29999	678
12	Kerala	33.4	1190	26.88	35601	804
13	Madhya Pradesh	65.9	1163	26.28	17649	399
14	Chhattisgarh	22.7	519	11.73	22873	517
15	Maharashtra	104.2	4381	98.95	42056	950
16	Manipur	2.5	57	1.29	22684	512
17	Meghalaya	2.5	63	1.43	25699	581
18	Mizoram	1.0	27	0.61	27027	610
19	Nagaland	2.5	57	1.28	22736	514
20	Orissa	38.8	785	17.74	20251	457
21	Punjab	26.5	1097	24.79	41420	936
22	Rajasthan	61.8	1242	28.06	20095	454
23	Sikkim	0.6	18	0.41	31186	704
24	Tamil Nadu	64.9	2235	50.49	34424	778
25	Tripura	3.4	94	2.12	27694	626
26	Uttar Pradesh	181.9	2798	63.19	15382	347
27	Uttaranchal	9.2	262	5.91	28572	645
28	West Bengal	84.8	2347	53.02	27668	625
29	Andaman Nicobar	0.4	17	0.38	40945	925
30	Chandigarh	1.1	99	2.23	90738	2050
31	Delhi	15.8	1018	23.00	64305	1453
32	Pondicherry	1.1	57	1.29	53685	1213
33	All India	1116.1	32757	739.93	29350	663

Source: Authors' calculations based on data from RBI (2007) and EPW Research Foundation (2009).

The present analysis of the growth experience of the states is based on the performance of only 14 states.[1]

Tables 2.6 and 2.7 point to the differences in the growth experience of the states. The all India average growth rate (GDP) for 1993–99 was 6.6 per cent per annum, a significant increase on the average of 5.7 per cent for 1981–90. The four states with the most improvement in growth rates over the 1980s comprised Karnataka, Maharashtra, Tamil Nadu and Gujarat. All four showed a marked acceleration in growth,

Table 2.6 Average annual growth rates of GSDP (constant prices) (%)

State	*1981–90*	*1993–99*	*1996–99*	*2000–04*
High Growth				
Karnataka	4.7	7.6	8.5	5.5
Maharashtra	5.9	6.8	5.9	4.4
Tamil Nadu	5.4	6.9	6.0	8.4
Gujarat	5.6	6.5	6.1	11.3
Medium Growth				
West Bengal	4.3	7.1	7.1	5.5
Andhra Pradesh	4.7	6.0	5.4	6.4
Kerala	2.5	6.1	5.3	6.1
Haryana	6.2	5.8	6.6	7.6
Madhya Pradesh	4.1	5.9	6.1	4.6
Rajasthan	7.8	6.4	7.2	5.0
Low Growth				
Orissa	3.1	5.0	4.0	7.1
Punjab	5.0	4.8	5.4	7.8
Uttar Pradesh	4.4	4.1	4.6	3.2
Bihar	4.9	4.4	6.7	7.6
India	5.6	6.7	6.6	5.8

Source: Authors' calculations based on data from RBI (2007) and EPW Research Foundation (2009).

[1] While the choice is arbitrary the selected states do represent a large variation in their level of development.

Table 2.7 Average annual growth rates of per capita GSDP (constant prices) (%)

State	*1981–90*	*1993–99*	*1996–99*	*2000–04*
High Growth				
Karnataka	2.7	5.9	6.7	3.8
Maharashtra	3.5	4.6	3.8	2.3
Tamil Nadu	3.9	5.7	4.8	7.2
Gujarat	3.5	4.3	4.0	9.0
Medium Growth				
West Bengal	2.0	5.4	5.4	3.8
Andhra Pradesh	2.4	4.5	4.0	4.9
Kerala	1.1	5.1	4.4	5.2
Haryana	3.6	3.1	3.9	4.9
Madhya Pradesh	1.7	3.8	4.0	2.5
Rajasthan	5.1	3.8	4.5	2.4
Low Growth				
Orissa	1.3	3.4	2.4	5.5
Punjab	3.0	2.9	3.5	5.9
Uttar Pradesh	2.1	1.8	2.2	0.8
Bihar	2.7	1.9	4.1	5.0
India	3.4	4.7	4.6	3.7

Source: Authors' calculations based on data from RBI (2007) and EPW Research Foundation (2009).

particularly Karnataka (5.7 per cent to 8.1 per cent) and Tamil Nadu (5.6 per cent to 7.4 per cent).

A second group of six states recorded average growth rates around the 14-state average of 6.1 per cent per annum in 1993–99 and were grouped as medium performing state economies (MPSEs). These comprised West Bengal, Andhra Pradesh, Kerala, Haryana, Madhya Pradesh and Rajasthan. In this group, there was no consistent improvement in growth rates over the 1980s. While there were significant increases for West Bengal, Kerala and Madhya Pradesh, there were decreases for Andhra Pradesh, Haryana and Rajasthan.

The remaining four states were grouped as low performing state economies (LPSEs). Their reform period growth rates were well below

the all India and 14 state averages, in the range of 5.1 per cent down to 4 per cent. The group, which comprised Orissa, Punjab, Uttar Pradesh and Bihar, all recorded low growth rates in the 1990s well below those in the 1980s (4.9 per cent down to 4.4 per cent).

Growth in Per Capita Incomes

Reflecting the basis of classification of the states, a comparison of growth rates of average per capita incomes (GSDP) for the three performance groups in 1981–90 and 1993–99 (Table 2.7) shows substantial increase for the HPSEs (from 3.9 per cent to 5.9 per cent) and MPSEs (from 2.9 per cent to 4.1 per cent), while in the LPSE group, there was a reduction in the growth rate from 2.7 per cent to 2.5 per cent.

In 1980–90, the range in growth rates of per capita incomes over the three groups was quite narrow. In 1993–94 to 1999–2000, it had increased substantially, which indicates widening disparities between the three groups and reflects the relatively rapid increase in average per capita income in the HPSEs and the lack of improvement in the LPSEs.

Within the HPSEs, increases in per capita growth rates occurred for all four states but particularly for Karnataka, Maharashtra and Tamil Nadu. In the MPSE group, increases in growth rates were most notable for West Bengal and Kerala and less so for Andhra Pradesh and Madhya Pradesh, while Haryana and Rajasthan showed reductions. In the LPSEs, Orissa and Bihar showed slight increase, but Punjab and Uttar Pradesh experienced reduction in per capita growth rates.

Sectoral Growth Rates

A sectoral breakdown of growth rates of GSDP for the three state performance groups provides further evidence on the origin of shifts in growth rates from pre-reform 1980s to reform period 1990s (Table 2.8).

In the industrial sector, there were increases in average growth rates in the 1990s over the 1980s for the HPSE and MPSE groups but a reduction for the LPSE group. In the HPSE group, average

Table 2.8 Average annual growth rates of GSDP (constant prices) (%)

State	*1981–90*			*1993–99*			*2000–04*		
	Agriculture and Allied	*Industry*	*Services*	*Agriculture and Allied*	*Industry*	*Services*	*Agriculture and Allied*	*Industry*	*Services*
High Growth									
Karnataka	2.2	5.7	6.9	4.6	8.1	10.3	–0.8	7.1	8.3
Maharashtra	4.5	6.2	6.9	3.5	6.5	7.9	0.9	2.4	6.6
Tamil Nadu	5.0	5.4	6.3	2.8	6.8	9.2	3.3	9.0	10.0
Gujarat	8.8	7.5	6.2	1.3	8.3	9.0	10.7	12.5	11.0
Medium Growth									
West Bengal	4.2	3.5	5.0	4.8	6.2	9.9	2.4	7.7	6.0
Andhra Pradesh	3.5	5.9	5.2	3.9	6.9	7.4	4.7	6.0	7.6
Kerala	–0.1	3.2	4.6	2.3	6.9	8.5	2.4	5.4	7.8
Haryana	5.3	6.8	7.7	2.3	7.0	10.9	2.7	9.0	10.4
Madhya Pradesh	2.0	5.8	5.8	3.7	8.1	7.1	3.5	7.3	4.6
Rajasthan	9.4	8.2	7.8	2.1	10.8	8.7	10.9	3.4	5.0
Low Growth									
Orissa	0.6	7.1	5.4	2.0	6.0	6.8	3.4	10.5	7.7
Punjab	5.0	6.7	4.1	2.7	6.6	8.0	4.4	8.4	10.9
Uttar Pradesh	2.1	7.3	5.9	2.8	5.3	5.6	1.2	5.7	3.4
Bihar	3.6	7.2	6.2	3.1	7.0	7.8	5.9	8.8	9.1
India	3.5	7.1	6.7	3.8	7.5	9.0	1.8	5.6	7.9

Source: Authors' calculations based on data from RBI (2007) and EPW Research Foundation (2009).

growth rates increased impressively in Karnataka and Maharashtra and slightly in Gujarat, but fell in Tamil Nadu. In the MPSE group there was increase for two of the six states and reduction in three giving a marginal increase overall. In case of the LPSE group, there was decrease in growth rate in all the four states.

In the services sector, average growth rates rose from 7 per cent in the 1980s to 8.9 per cent in the 1990s in the HPSE and increase was recorded in all the four states. Average growth rates held almost steady in the MPSE group but fell in the LPSE group. In the MPSEs, the increases matched the reductions. In the LPSEs, lower growth rates were recorded by Uttar Pradesh, Orissa and Bihar and only Punjab gained.

Overall, the better growth performance during the reform period of 1993–2000 over the 1980s was principally due to higher growth rates of both industry and services. This in turn was due almost wholly to the improved performance of the HPSEs in these sectors. For the MPSE group, only agricultural growth was significantly higher. In the LPSE group, growth declined in all the three sectors.

Overall, the shifts in average growth rates in the industrial and services sectors from the 1980s to the 1990s were driven mainly by the changes in the high performing state economies of Karnataka, Maharashtra, Tamil Nadu and Gujarat. The dominant impact of the HPSE group was due to the acceleration in growth reinforced by the relatively large shares of the industrial and services sectors in these states (Table 2.9).

CONVERGENCE OR DIVERGENCE OF PER CAPITA INCOME

A major concern in development economics is to find a satisfactory answer to a basic question as to why different countries or different states within a country grow differently, leading to different degrees of income inequalities and poverty. Several researchers have identified different factors as responsible for suppressing or accelerating the economic growth rate of countries. There is no single answer to the

Table 2.9 Shares of sectors in GSDP (%)

	Agriculture and Allied		*Industry*		*Services*	
State	*1993–95*	*2002–04*	*1993–95*	*2002–04*	*1993–95*	*2002–04*
High Growth						
Karnataka	33.7	20.3	26.7	30.0	39.6	49.6
Maharashtra	18.5	14.6	33.8	29.9	47.6	55.5
Tamil Nadu	22.5	13.0	35.7	34.2	41.8	52.9
Gujarat	23.7	15.8	39.1	42.2	37.2	42.0
Medium Growth						
West Bengal	32.1	24.3	24.4	26.0	43.6	49.7
Andhra Pradesh	31.8	24.8	25.4	25.9	42.9	49.3
Kerala	30.0	20.8	21.3	19.8	48.7	59.4
Haryana	41.2	27.5	27.3	29.9	31.5	42.6
Madhya Pradesh	36.2	25.5	29.5	37.0	34.3	37.5
Rajasthan	34.6	27.8	28.1	31.6	37.3	40.6
Low Growth						
Orissa	37.7	25.5	26.2	30.4	36.1	44.1
Punjab	45.2	34.9	22.4	23.5	32.4	41.6
Uttar Pradesh	38.1	33.4	23.7	25.5	38.2	41.1
Bihar	38.0	32.5	25.9	25.8	36.1	41.6
India	30.3	21.9	27.0	27.6	42.7	50.5

Source: Authors' calculations based on data from RBI (2007) and EPW Research Foundation (2009).

main question. In a recent book, Hayami (1997) discusses intensively the question of how the countries become rich. With cross-country comparisons and historical data, he concludes that those country-specific factors such as governance, institutions and culture play a dominant role in determining the growth path of a country.[2] Even countries with similar resource endowments have experienced sharply different economic growth because of country-specific governance

[2] Institutions are rules that influence the behaviour of economic decision-making units and their performances.

and organisations. Examples are Kenya versus Tanzania, North Korea versus South Korea and India versus Pakistan.

The inference is that unless poor countries are able to adapt their country-specific institutions for suitable application of the models of success, improvements in their economic performance cannot be guaranteed. A distinct example of success in this approach in recent times is that of China. Researchers have argued that the salient feature of the success of the East Asian countries is the better utilisation of their comparative advantage at each stage of their development (Lin, Cai and Li, 1996). But as Hayami has argued, what is more important is to create and nurture appropriate institutions and organisations to reap the benefits of the comparative advantage. In the Chinese case, the growth of 'township and village enterprises' (TVEs) has been the institutional framework that has facilitated China's entry into the international arena of trade and investment. Hayami's arguments about creating the right institutions to achieve technological progress and overall growth, therefore, are valuable insights.

Knack and Keefer (1995) provide empirical evidence to show specifically that a country's economic performance is positively related to the quality of that country's institutions. Recently, Chong and Calderon (2000) show that a country's institutional framework is an important determinant of not only its economic performance but also the way income is distributed among its population. They used information about the quality of institutions mainly from the International Country Risk Guide (ICRG) and the Business Environment Risk Intelligence (BERI). In the absence of such data and particularly when researchers want to study the dynamic link between institutions and interregional inequalities within a federal economy, what is an alternative methodology?

Following the analysis presented by Kalirajan and Akita (2003), we examine an indirect method of examining the dynamic link between the quality of institutions and interregional inequalities in per capita income. The following section describes an alternative (indirect) method to examine the link between institutions and income inequalities. The next section discusses the relationship between institutions and economic performance in India.

Institutions and Income Inequalities

A direct method of examining the link between the quality of institutions and income inequalities is to run a regression with a measure of income inequality as the dependent variable and variables explaining the quality of institutions as independent variables. A simple correlation analysis can also be used, if one is not interested in finding the relative importance of the determining variables on income inequality. However, such data are not available easily for cross-regional analysis within an economy either in a static sense or in a dynamic framework. In this context, is there any valid alternative method?

Several answers to the question of how the other country becomes so rich have been put forward by both quantitative and qualitative analyses. Of these, a notable one is the 'convergence hypothesis' of income. What is convergence? It is argued that convergence of per capita income between countries will take place in the long run regardless of their initial economic conditions even in the absence of international trade, provided that different countries share the same technology with constant returns to scale, and investment is a constant fraction of output. This type of convergence is called the 'absolute convergence'. The convergence occurs as further accumulation of capital is accompanied by declining marginal product of capital. The hypothesis offers the prospect that less developed economies of today would some day in the future catch up with the average income level of the advanced economies.

If per capita income of countries converges after controlling for initial conditions that would characterise the economies, such as the patterns of consumption and savings, and the rate of population growth, this type of convergence is called 'conditional convergence'. Does the convergence hypothesis contradict Hayami's thesis of the importance of country-specific institutions and organisations in determining the growth process? No. Both theories insist that different countries should have the same technology and thus highlight the importance of developing countries borrowing technology from the more advanced nations. But, Hayami adds a caveat that developing countries should have proper institutions and organisations not only to borrow technology, but also to adapt the technology to suit their

country-specific comparative advantages in order to sustain technological progress and growth.

The principal force driving convergence in the neoclassical growth model is diminishing returns to reproducible capital. Thus economies with lower initial values of capital–labour ratio will have high marginal product of capital and, therefore, will tend to grow at higher rates (Evans and Karras, 1996). But, inefficient and poor-quality institutions and organisations could lead to violation of the critical assumption of diminishing returns to reproducible capital. In an economy with large unutilised resources and a poor state of social and physical infrastructure, there will be increasing returns to reproducible capital. In terms of the Kuznet's (1955) paradigm of development, this situation will accentuate inequality in the rising part of the inverted 'U'. This means there will be divergence of income for a considerable period of time in the development process. Thus, it is logical to argue that the convergence hypothesis will hold only when country-specific institutions and organisations do not intervene adversely to delay or constrain the convergence process. The higher the quality of institutions, the lower will be the inequality and, therefore, the quicker will be the convergence. On the other hand, if there is divergence in per capita income across regions, this means that institutions contribute to widening income inequalities. Thus, drawing on Hayami's framework, testing the convergence hypothesis of income provides an alternative method of examining the link between institutions and inequalities.

Institutions and Economic Performance in India

There are numerous studies on income inequality and poverty in India and it will be difficult to summarise them all. Some of the important studies that are relevant to this chapter include, Mathur (1983), Nair (1983), Sen (1992), Datta Roy Choudhury (1993), Bhalla (1995), Ravallion and Datt (1996) and Das and Barua (1996). However, empirical studies directly linking income inequality and institutions in India are rare. The aim of this study is to provide a simple empirical method that explores this link.

To place in context the link between interregional income inequality and institutions in India, it becomes necessary to study first the link between institutions and economic performance. Here, it is useful to understand the growth path chosen by India over a number of years since Independence. The Harrod–Domar model of growth underlies its basic strategy (Srinivasan, 1990). The basic characteristic of the model is that economic growth is determined by investment in tangible capital. When combined with population theory, this model produces a vicious circle between low per capita income and low savings in low-income countries. This concept is popularly known as the 'low-equilibrium' trap in the literature. Low income growth coupled with relatively high population growth will contribute to widening of income inequalities. But it is possible for a country to remain above the 'low-equilibrium' level, at the threshold level where the population growth rate and the income growth rate coincide, by applying production techniques efficiently and controlling population growth effectively. This latter point may be named 'pseudo-equilibrium'. But a lack of proper institutions, organisations and community involvement can constrain the economy from using production techniques efficiently and controlling population growth effectively. This, in turn, would force the country to remain in the 'low-equilibrium' trap with low per capita income for a long time, which was the case in India until recently (Drèze and Sen, 1997).

This argument raises several interesting questions about India's productive efficiency, technological progress and overall growth process during the pre-reform period of 1991. First, it is clear that the government's economic policy towards industrialisation did not yield the anticipated results of increasing employment and reducing interregional income inequality, though industrial output increased (Rosen, 1992). In the late 1980s, employment in manufacturing was only 11 per cent while employment in agriculture was over 60 per cent of the total employed workforce (Papola, 1992). What types of institutions and organisations were responsible for such slow growth in employment in the industrial sector? The organisational framework that India followed in its industrialisation process has heavy reliance on public sector enterprises with an elaborate network of controls on the private sector to limit entry of new firms and also to stop expansion

of existing firms in the production of low priority areas. Capital goods and basic goods such as cement and steel were assigned to public sector enterprises, while consumer goods and other 'low priority' products were given to the private sector. Public sector industries accumulated substantial losses over the years. As a consequence, instead of being a source of re-investible surplus, they became a source of liability to the economy. Lack of profitability was partly the result of a low rate of capacity utilisation. The rate of profit in the public sector industries has been highly sensitive to the rate of capacity utilisation, given the high ratio of fixed to variable costs. It is the government's inability to maintain a high rate of public investment and tendency to shift its pattern of expenditure away from development-oriented projects that has had adverse effects on the profitability of these industries. The industrial structure and organisation also protected the internal market from competition between public and private sectors and discouraged technological change in both public and private sectors (Bhagwati and Srinivasan, 1975).

Lack of technological progress resulted in low growth rates in industrial production and a shortage of consumer goods. The rapid population growth coupled with the slow growth of industrial production did not allow industry to absorb the unemployed labour force (Inoue, 1992). Further, the then financial sector policies did not leave much leeway for business enterprises to choose their capital structure. As Inoue (1992) has argued, the inference is that entrepreneurship in India did not develop significantly relative to the size of its population.[3] Importantly, small private enterprises lacked efficiency in manufacturing. Also, it may be argued that the linkage between small businesses, medium-size enterprises and large-scale enterprises has not been strong. Integration from the production of raw materials up to the assembly of final products in the form of sub-contracting that one can see in the Japanese growth process has been missing in the Indian growth process. Another unfavourable aspect of the industrial structure has been the imbalance that exists in the industrial

[3] Inoue (1992) has presented a comprehensive review of industrial development policy of India.

development of different regions. As argued by Elizondo and Krugman (1992), this type of industrial development leads to concentration of production and trading activities in states which have traditionally developed infrastructural facilities for large-scale production, manpower training and financial transaction. This type of industrial development has largely aggravated interregional income inequalities in India. It is logical to argue that institutions that produce such industrial structures and performance may have the potential to contribute considerably to per capita income inequalities across states.

Second, the dynamism that was generated by the Green Revolution had exhausted itself by working its way fully into agricultural production in the 1980s, and there was no alternative source of strong productivity growth (Bhalla, 1995). Lack of infrastructure and various policy constraints affecting agricultural productivity and trade have been major constraints on any technological breakthrough in agriculture, as discussed by Vaidyanathan (1995). Though the Green Revolution increased food production dramatically from 95 million tonnes in 1967–68 to 130 million tonnes in 1980–81, the per capita availability of food grains in India, which from 1956 to 1960 stood at about 161 kilograms per year, was unchanged from 1976 to 1980 due to population growth and inefficient organisation of distribution system (Rao, 1996). Though the agricultural sector did receive input subsidies, other constraints such as low infrastructure development affected its growth tremendously. In this context, an important question is whether farmers have been able to achieve the best practice potential of the chosen technology without wasting resources. Kalirajan and Shand (1997) provide a decomposition of total output growth in agriculture into technical efficiency change, technological progress and input growth to explain these changes in the agricultural sector (Table 2.10).

The preceding analysis shows that output growth came increasingly from input growth during 1985–90. Input growth contributed more than 50 per cent of the output growth in seven states in 1985–90. The share of fertiliser and electricity in the consumption of core inputs, which enjoy heavy subsidies in Indian agriculture, increased from 16.8 per cent in the 1970s to 29.2 per cent in the 1980s (Misra and Hazell, 1996). An average of only around 18 per cent could be attributed to technological change in the pre-reform period but more to gains in

Table 2.10 Decomposition of output growth in Indian agriculture, 1985–90

		Output Growth (%) due to	
States	*Input Growth*	*Technology Change*	*Technical Efficiency Change*
Andhra Pradesh	50.21	13.60	36.19
Bihar	145.26	–2.88	–42.38
Gujarat	65.16	13.01	21.83
Haryana	57.35	14.56	28.09
Karnataka	58.44	13.24	28.32
Kerala	73.22	6.25	20.53
Madhya Pradesh	126.72	–2.21	–24.51
Maharashtra	72.06	12.42	15.52
Orissa	128.33	–2.11	–26.22
Punjab	52.72	18.85	28.43
Rajasthan	50.03	12.54	37.43
Tamil Nadu	55.28	12.85	31.87
Uttar Pradesh	52.32	12.24	35.44
West Bengal	54.09	13.20	32.71

Source: Kalirajan and Shand (1997: 703).

technical efficiency. Importantly, the contribution of increasing technical efficiency to output growth remained at more or less the same levels in most states in the pre-reform period. Thus, after the introduction of the High Yielding Varieties Programme (HYVP), Indian agriculture experienced low rates of technological progress together with negligible improvements in technical efficiency, and output growth in the sector became increasingly dependent on input growth.

There are at least two explanations for the slow technical progress in agriculture in India. First, throughout 1985–90, government intervention in the market and production intensified, which resulted in deterioration in the terms of trade (ratio of prices received to prices paid by the agricultural sector), touching their lowest point in 1986–87. Lower real procurement prices appear to have had a negative effect on technological innovations in the pre-1991 period. Second, the deterioration of infrastructure, particularly the existing water conservation systems,

exerted a constraint on research that is generally irrigation-oriented. Growth rate of gross fixed capital formation in agriculture, which is driven by irrigation development sharply declined during 1980–90 from a corresponding growth rate of 5 per cent in 1970–80. Thus the inference is that the agricultural institutions across states would have significantly contributed to widening regional income inequality over and above the existing inequality due to initial differences in factor endowments across these states.

While the spectacular growth of rural industries in China has attracted significant physical and human capital from agriculture, why did it not happen in India? Though India has institutional frameworks such as the policies for the development of small-scale sector and village industries engaged in the production of consumer goods, the performance of these sectors has not been impressive (Inoue, 1992). As Hayami has argued, capital accumulation on a large scale requires institutional innovations in various areas such as taxation, the financial system, education and research organisation. Unfortunately, during the pre-reform period, India's potential strength in these areas could not be realised. Rao and Vaillancourt (1994) point out that interstate exportation of taxes from the consuming to the producing states on account of the central sales tax worked against the poorer states. Thus, the existing institutions could not promote spatially even industrial development effectively.[4] An interesting question is why the policy makers in India continued with such inefficient institutional and organisational frameworks for a long time. One explanation that is sometimes offered to the above question is the lack of effective community involvement in questioning and changing the institutional and organisational structures adopted by India for economic growth.

Generally, in democratic countries such as India, community involvement in governance is through voting. Decisions on institutional and organisational structures taken in Parliament or state assemblies

[4] However, in states like Punjab and Haryana the number of rural industries supplying agricultural implements and related products has been very high compared to other states mainly because these two states did not have major heavy industries and historically they were considered by policy makers as are as suitable for food grain production (Zarkovic, 1987).

are based on the majority of the votes cast. Drawing on the 'median voter theorem', it may be concluded that no matter how many voters there are, majority voting tends to produce an outcome in line with the preferences of the median voter who may be the 'middle income class' voter who benefitted from the slow pace of change in the economy. There is no guarantee that the preference of the median voter would be optimal and the inference is that normal voting procedures usually do not allow adequate expression of intensities of preferences.[5] Further, the existing political competition has been a major source of increase in government expenditures, particularly subsidies, since the mid-1960s. The ruling parties use state resources to gain support for themselves, as political parties often do in competitive electoral democracies, so reducing resources available for development-related expenditures (Chhibber, 1995). As a consequence, the squeeze on capital and maintenance expenditure has been severe in poorer states and this has considerably contributed to interstate growth disparities (Rao and Sen, 1995).

With this brief discussion of the link between economic performance and institutions in India, we now focus on how seriously these ineffective institutions and governance affected interregional inequalities in per capita income in the pre-reform period of the 1980s and the subsequent period.

Analysis of Disparities

The analysis in this chapter is based on state-level data. We examine the pattern of changes in income inequality across states over time. Where possible, we draw attention to the role of institutions in influencing the spatial income inequality.

We adopt two approaches to analysis. First, interregional income inequalities and the contribution of the primary, secondary and tertiary

[5] The disintegration of the Soviet Union (exogenous), and the mounting fiscal deficit pressure (endogenous) in India finally paved the way for institutional innovations through the introduction of the 1991 economic reform in India.

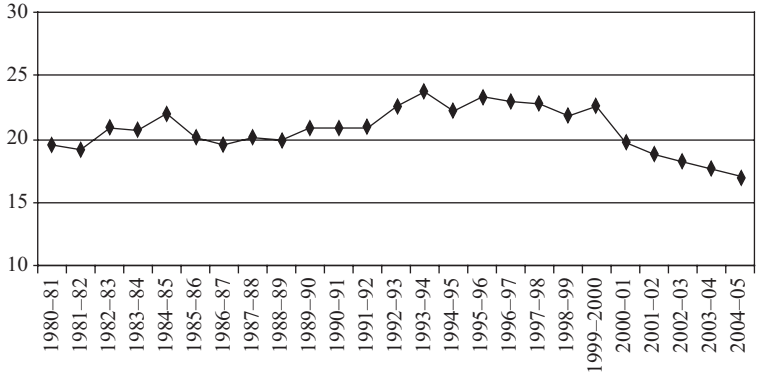
sectors to these inequalities are examined using Williamson's weighted coefficient of variation and its decomposition. Second, convergence of per capita income across states is examined using the Barro and Sala-i-Martin (1991) approach. Our analysis concerns 16 major states in the Indian Union. These 16 major states account for more than 90 per cent of the population and gross domestic product in the country. It should also be noted that the concept of gross state domestic product (NSDP) only indicates the income originating in different states and does not represent total income accruing to them. Unfortunately, there are no estimates of net factor income accruing to a state from outside its boundaries, and therefore it is not possible to take these into account.

Changes in Interregional Income Inequalities in India

We first present the pattern of disparity in average income levels across the states over the period of a decade preceding the economic crisis and a period of another decade or so after the crisis using some simple measures of dispersion. Figure 2.3 presents the ratio of maximum per capita GSDP among the 16 states used in the analysis to the minimum per capita GSDP over the years. Consistent with the various analysis including the one in Kalirajan and Akita (2003) the ratio rises from mid-1980s to 1993–94 and then remains at this high level upto 1999–2000. It then declines from 22.5 in 1999–2000 steadily to 17.1 in 2004–05. This is a pattern that has not received much attention so far. A somewhat more comprehensive measure than the ratio of maximum to minimum GSDP is the coefficient of variation. When we estimate this measure for the three main sectors of the economy at the aggregate level as in Figure 2.4 we again find that the dispersion of income across the states decreases in the period after 2000–01. These patterns suggest that some states which had lower per capita GSDP are now growing faster and reducing the difference relative to the higher income states. Of course the higher income states may be growing slower than before to give the same result.

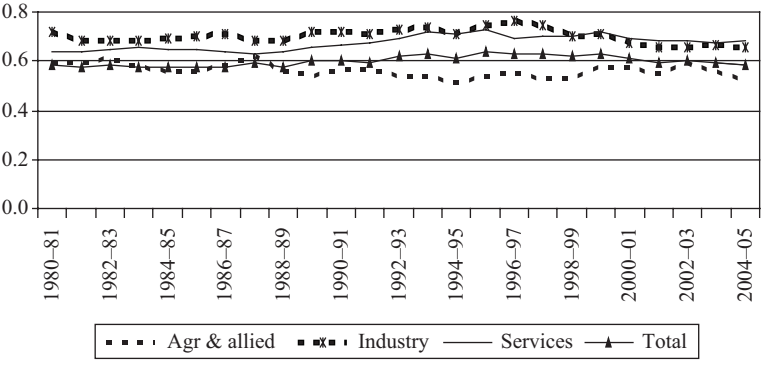
A somewhat more comprehensive measure of dispersion is the weighted coefficient of variation. Williamson (1965) presented the

Figure 2.3 Ratio of maximum to minimum per capita GSDP across states



Source: Authors' calculations based on data from EPW Research Foundation (2009) and RBI (2007).

Figure 2.4 The coefficient of variation in per capita GSDP at the sectoral and overall levels



Source: Authors' calculations based on data from EPW Research Foundation (2009) and RBI (2007).

weighted coefficient of variation (CV_w) as a measure of measure of interregional income inequality.[6]

[6] For example, Green (1969), Gilbert and Goodman (1976), Mathur (1983), Akita (1988) and Akita and Lukman (1995).

$$CV_w = \frac{1}{Y^*}\sqrt{(1/n)^* \sum_{i=1}^{n} (Y_i - Y^*)^2 \frac{P_i}{P}}$$

where P_i = population of the ith state,
P = population of the country,
Y_i = per capita income of the ith state,
Y^* = per capita national income = $1/P\ \Sigma Y_i P_i$ and
n = number of states.

As pointed out by Metawally and Jensen (1973), the weighted coefficient of variation based on regional per capita income fails to explain either the dispersion of incomes nationally or the dispersion of incomes within regions. It is quite possible for the coefficient to decrease over time (that is, a convergence in regional mean incomes), while the dispersion of *actual incomes* (individual incomes) could show an opposite trend. Despite this technical problem, we use Williamson's coefficient, since reliable time series of individual income data are not yet available within the states.[7]

This study uses GSDP as a substitute for income at state level. Since GSDP is equal to the sum of sectoral GSDPs, the squared weighted coefficient of variation can be decomposed as follows:

$$CV_w^2 = \sum_{j=1}^{m} z_j^2 CV_{wj}^2 + \sum_{j \neq k} z_j z_k COV_w(j,k) \qquad (2.1)$$

where z_j = the share of the jth sector in NSDP,
CV_{wj} = weighted coefficient of variation of the jth sector and
$CV_w(j, k)$ = weighted coefficient of variation between sector j and sector k.

[7] It should be noted at this point that the coefficient could take on different values depending on how a country is divided into regions (Parr, 1976). Whether the nation's metropolitan region is treated as a separate region or not affects the coefficient greatly (Gilbert and Goodman, 1976). Thus comparisons with other countries are not very meaningful.

Now, CV_{wj} and $CV_w(j, k)$ are calculated as follows:

$$CV_{wj} = \frac{1}{Y_j^*}\sqrt{(1/n)^* \sum_{i=1}^{n}\left(Y_{ji} - Y_j^*\right)^2 \frac{P_i}{P}}$$

$$COV_w(j,k) = \frac{1}{Y_j^*}\frac{1}{Y_k^*}\sum_{i=1}^{n}\left(Y_{ji} - Y_j^*\right)\left(Y_{ki} - Y_k^*\right)\frac{P_i}{P}$$

where, Y_j^* and Y_k^* are the national NSDP per capita of sectors j and k respectively,

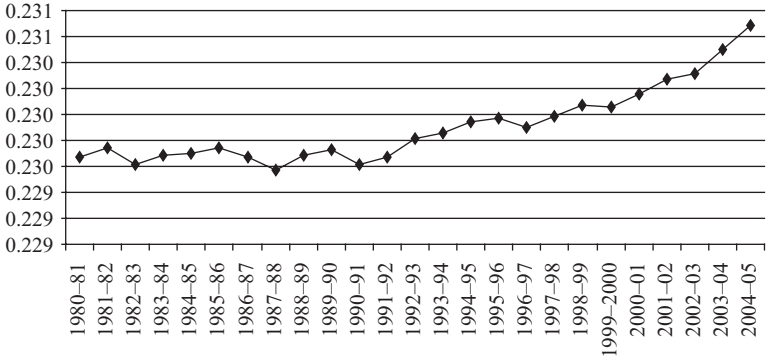
Y_{ji}, Y_{ki} are the per capita NSDP of sectors j and k in the ith state respectively and

m = the number of sectors, which is three in this study.

Thus equation (2.1) allows us to examine the extent to which each sector contributes to the overall weighted coefficient of variation of per capita NSDP. Since it includes covariance terms, it can also account for the magnitude and direction of covariations between sectors in the overall weighted coefficient of variation.

Figure 2.5 presents the weighted coefficient of variation in per capita GSDP across the 16 states. It clearly shows that the dispersion is steadily rising. The contrast between the simpler measures of dispersion

Figure 2.5 The weighted coefficient of variation in per capita GSDP



Source: Authors' calculations based on data from EPW Research Foundation (2009) and RBI (2007).

and the weighted coefficient of variation clearly shows that when we consider the size of the state in terms of its population, then the mere difference in trends in per capita GSDP are not enough to change the overall dispersion of income in the economy as a whole. Table 2.11 shows the weighted coefficient of variation in per capita GSDP at constant prices (1993–94 prices). The results show that the weighted coefficient of variation has increased throughout the period but only very slightly. The rising inequality is not sharp if we look at state level per capita GSDP after the economic reforms.

Sectoral GSDP per capita is used to estimate the weighted coefficient of variation for each sector and the weighted coefficient of variation between sectors. These results are given in Table 2.12. As noted earlier, coeffient of variation (CV) has increased at the aggregate GSDP level, between 1981–82 to 2004–05, although only slightly. Much of the increase in CV appears to be due to the rise in dispersion of GSDP from the non-agricultural sectors. The weighted coefficient of variation for the agricultural sector remained nearly stagnant throughout the period. The CV for industry and services has shown an increasing tendency during the period. The CV for the secondary sector (industry) has been slightly higher than that of both agricultural and services sectors.

In general, there has been an increase in the disparity in income through the 1980s as well as 1990s, that is, during the pre-reform and post-reform period. However, in the more recent years, there is a tendency for some lower income states to grow faster than before but perhaps slow growing and more populous states are offsetting this positive trend. As a result disparity continues to persist. The per capita GSDP in the 'richest state' is more than 15 times the per capita GSDP of the 'poorest state'.

The decomposition of the weighted coefficient of variation between sectors provides some interesting results. There is relatively similar covariance across sectors. Decomposition of CV shows (Table 2.12) that contribution of agriculture to disparity in income across states has come down sharply over the years as its share in GSDP also declined. Now it is the services sector which has the major impact on the extent of disparity.

Table 2.11 Weighted coefficient of variation of per capita GSDP

Year	*Total*	*Agricul-ture*	*Industry*	*Services*	*Covaria-nce (Agr., Industry)*	*Covaria-nce (Agr., Services)*	*Covariance (Industry, Services)*
1980–81	0.2297	0.2294	0.2302	0.2297	0.0527	0.0527	0.0529
1981–82	0.2297	0.2295	0.2302	0.2298	0.0528	0.0527	0.0529
1982–83	0.2296	0.2294	0.2300	0.2297	0.0527	0.0527	0.0528
1983–84	0.2297	0.2295	0.2301	0.2297	0.0528	0.0527	0.0528
1984–85	0.2297	0.2296	0.2301	0.2297	0.0528	0.0527	0.0528
1985–86	0.2297	0.2296	0.2302	0.2297	0.0528	0.0527	0.0529
1986–87	0.2297	0.2295	0.2301	0.2297	0.0527	0.0527	0.0529
1987–88	0.2296	0.2291	0.2301	0.2297	0.0527	0.0526	0.0529
1988–89	0.2297	0.2296	0.2300	0.2297	0.0528	0.0527	0.0528
1989–90	0.2297	0.2297	0.2300	0.2296	0.0528	0.0527	0.0528
1990–91	0.2296	0.2295	0.2300	0.2296	0.0527	0.0527	0.0528
1991–92	0.2297	0.2296	0.2299	0.2297	0.0527	0.0527	0.0528
1992–93	0.2298	0.2298	0.2302	0.2296	0.0529	0.0527	0.0529
1993–94	0.2299	0.2298	0.2303	0.2297	0.0529	0.0528	0.0529
1994–95	0.2299	0.2299	0.2303	0.2298	0.0529	0.0528	0.0529
1995–96	0.2300	0.2298	0.2304	0.2299	0.0529	0.0528	0.0530
1996–97	0.2299	0.2297	0.2302	0.2299	0.0528	0.0528	0.0529
1997–98	0.2300	0.2299	0.2302	0.2300	0.0529	0.0528	0.0529
1998–99	0.2301	0.2298	0.2304	0.2301	0.0529	0.0528	0.0530
1999–2000	0.2301	0.2295	0.2305	0.2302	0.0528	0.0528	0.0531
2000–01	0.2302	0.2294	0.2307	0.2303	0.0529	0.0528	0.0531
2001–02	0.2303	0.2295	0.2308	0.2304	0.0529	0.0528	0.0532
2002–03	0.2303	0.2292	0.2309	0.2306	0.0529	0.0528	0.0532
2003–04	0.2305	0.2296	0.2311	0.2307	0.0530	0.0529	0.0533
2004–05	0.2307	0.2298	0.2311	0.2309	0.0531	0.0530	0.0534

Source: Authors' calculations based on data from RBI (2007) and EPW Research Foundation (2009).

Table 2.12 Decomposition of weighted coefficient of variation

Year	Agriculture	Industry	Services	Covariance between Agriculture and Industry	Covariance between Agriculture and Services	Covariance between Industry and Services	Total
1980–81	24.43	9.30	17.65	15.05	20.76	12.81	100.00
1981–82	24.42	9.12	17.89	14.91	20.89	12.77	100.00
1982–83	22.15	9.68	19.26	14.62	20.64	13.65	100.00
1983–84	23.26	9.56	18.37	14.89	20.66	13.25	100.00
1984–85	22.07	9.66	19.36	14.59	20.66	13.67	100.00
1985–86	20.21	10.27	20.38	14.39	20.28	14.47	100.00
1986–87	18.73	10.48	21.64	13.99	20.11	15.06	100.00
1987–88	16.95	11.05	22.81	13.67	19.65	15.87	100.00
1988–89	18.62	11.10	20.95	14.36	19.74	15.24	100.00
1989–90	17.60	11.01	22.13	13.91	19.73	15.61	100.00
1990–91	16.73	11.74	22.17	14.00	19.24	16.13	100.00
1991–92	15.91	11.42	23.51	13.46	19.32	16.38	100.00
1992–93	15.89	11.57	23.33	13.55	19.24	16.43	100.00
1993–94	15.18	11.67	24.02	13.30	19.08	16.74	100.00
1994–95	14.99	12.14	23.64	13.48	18.81	16.94	100.00
1995–96	13.08	13.07	24.79	13.06	17.99	18.00	100.00
1996–97	13.62	12.51	24.83	13.04	18.38	17.62	100.00
1997–98	11.34	13.48	26.56	12.35	17.35	18.92	100.00
1998–99	11.28	12.96	27.33	12.08	17.54	18.82	100.00
1999–2000	10.05	13.04	28.99	11.43	17.05	19.44	100.00
2000–01	9.62	12.37	30.55	10.90	17.13	19.44	100.00
2001–02	9.68	11.43	31.79	10.51	17.52	19.06	100.00
2002–03	7.75	12.90	32.83	9.99	15.94	20.58	100.00
2003–04	8.12	13.04	32.02	10.28	16.11	20.43	100.00
2004–05	7.17	13.92	32.45	9.98	15.23	21.25	100.00

Source: Authors' calculations based on data from RBI (2007) and EPW Research Foundation (2009).

The contribution of secondary and tertiary sectors to the disparity in overall per capita GSDP is also rising because of their positive covariance. GSDP from these sectors is growing relatively in the same direction unlike the pattern of growth of agriculture.

Convergence of Per Capita Income and Economic Institutions

Using the neoclassical growth model, Barro and Sala-i-Martin (1991) showed clear evidence of absolute convergence for the 48 contiguous US states for the period 1840–1988. By assuming consumers maximise their utility and firms maximise their profits, a general equilibrium for the growth rates of income, capital and consumption of the economy can be derived from which steady-state levels of income, capital and consumption can be calculated. Then the questions are as to whether the economy is converging to the steady-state, and what is the speed of convergence.

Drawing on Barro and Sala-i-Martin (1995), the following regression model is given in which the current level of income depends on the initial level:

$$1/T.\ln [y_{it}/y_{i,t-T}] = \alpha - [\ln (y_{i,t-T}) (1- e^{-\beta T})] (1/T) + \delta S_{it-T} + u_i \qquad (2.2)$$

where y_{it} refers to per capita NSDP in the ith state at constant (1980–81) prices,

$y_{i,t-T}$ denotes per capita NSDP in the ith state in the beginning of the period,

T is the length of the time period and

S_{it} is the vector of other variables to control for variations in the steady-state values of x_i^* and y_i^*, across the states.

Given the correlation between sectoral growth and poverty, the share of the primary sector in total NSDP (S_{it-T}) in the initial period is included to minimise interstate differences in the steady-state values x_i^* and y_i^*. Inclusion of S_{it-T} also facilitates examining whether there is any conditional convergence. Testing for absolute convergence is done by dropping the variable S_{it-T} from equation (2.2).

Equation (2.2) implies that absolute convergence exists when β, the speed of convergence, is positive and significant. If β is negative, it means divergence.[8] The non-linear least squares estimates of equation (2.2) with and without the variable S_{it-T} (Table 2.5) for the periods of 1970–75, 1976–80, 1981–85 and 1986–90 reveal a number of interesting features of the interstate growth process in India in the pre-reform periods in the 1970s and 1980s (Table 2.13). The estimates of β are negative and significant in the pre-reform periods, showing a divergent trend in incomes over the years. Thus there is no evidence of either absolute or conditional convergence of per capita income across states in these periods. In other words, states with initially high per capita NSDP tended to grow faster than those with lower per capita NSDP. These findings are contrary to the predictions of the neoclassical growth models and the empirical findings for cross-sections of countries as well as different states within the USA. But these results confirm the proposition of Elizondo and Krugman (1992) that interregional income inequalities, given the degree of government intervention, would increase as an economy moves away from a liberalised regime to a restricted regime, with several controls on economic activities and inefficient institutions. Thus the strong influence on income inequalities of country-specific institutions and organisations and the economic policies pursued by India becomes clearly evident. The coefficient of the initial share of income from the primary sector is positive and significant, which means that states with an initially high share of income from the primary sector tended to grow faster than those with a lower share. In the absence of technological progress, this characteristic of growth does not have the potential to contribute further to inequality.

Nevertheless, the finding of divergence, which is contrary to the prediction of neoclassical growth theory, casts doubts on the validity of the critical assumption of diminishing returns to reproducible capital. The positive association of growth rates with the initial level

[8] The conditional convergence hypothesis assumes a single steady-state equilibrium. But, as discussed by Galor (1996), an economic system may be characterised by multiple steady-state equilibria and may thus lead to 'club convergence' even in neoclassical growth models that exhibit diminishing marginal productivity of capital and constant returns to scale. A testing of a club convergence hypothesis with these data will be attempted in a subsequent study.

Table 2.13 Non-linear least squares estimates of β (convergence) coefficients (per capita NSDP)

Period	*Absolute Convergence*	*Conditional Convergence*
Pre-reform (1970–75)	–0.0287 (–2.5562)	–0.0298 (–2.6755)
Pre-reform (1976–80)	–0.0301 (–2.6752)	–0.0306 (–2.3345)
Pre-reform (1981–85)	–0.0276 (–2.9113)	–0.0281 (–2.8922)
Pre-reform (1986–90)	–0.0272 (–2.1456)	–0.0278 (–2.3118)

Source: Kalirajan and Sankar (2004).

Notes: Years represent fiscal years, that is, 1985 refers to 1985–86.
Figures in parentheses are *t*-ratios.
All the coefficients are significant at the 5 per cent level.

of incomes probably shows that, in an economy with large unutilised resources and a poor state of social and physical infrastructure due to the poor quality of institutions, there will be increasing returns to reproducible capital in the initial stage of development. Thus, combining the inequality measures and the speed of divergence during this period, we may postulate that there is an inverted U-shaped relationship between the quality of institutions and income inequalities, as argued by Chong and Calderon (2000), though their cross-section data did not allow them to establish this dynamic relationship empirically. Thus a lack of both absolute and conditional convergence in the pre-reform periods indicates the need for changes in domestic institutions and policies in the form of more reforms to boost economic growth (for further discussion on this see Rao, Shand and Kalirajan, 1998). The post-reform average annual growth rate of 6 per cent clearly indicates that with appropriate institutional and organisational changes it is possible to achieve sustained economic growth.

Spillover Effects of Growth across States

Variations in economic growth of regions within any national boundaries have been significant across different types of economies around the world. Natural endowments and constraints, initial stages of development, mobility of resources, scale economies leading to specialisation

and a host of such factors influence the pattern of development of regions in the national economies. The pattern of growth across the states within India has been a subject of interest both to the academics as well as policy makers. Balanced regional development has been a 'touch-stone' for policy evaluation in India in a number of instances (Chelliah, 1996). In the context of 'balanced development', trickling down of growth in region one to the growth in another has generally been implicit. Relatively the large size of the state economies may indeed have led to an assumption that such interstate trickling down effects of growth are small. Conceptually, however, linkages between the economies of different states can be diverse. The input–output linkages, linkages between supply and demand centres for consumption, linkages between sources of savings and investment are obvious (Krugman, 2000; Schmitz, 2000; Porter, 2001). Nevertheless, testing of the trickling down hypothesis is important because there are studies in the literature, which have raised doubts about the existence of spillover or trickling down effects from one region to another (see for example, Gaile, 1980; Higgins, 1983; Hansen, 1990). However, drawing on Hayami's (1997) discussion of international development process, it may be inferred that unless states are able to adapt their state-specific institutions for suitable transmission and receipt of the growth impulses, the linkages between states cannot be sustained.

Bhide, Chadha and Kalirajan (2005) provided an assessment of the extent of interdependency between states in output growth. In this section we provide a summary of their findings in the context of highlighting the regional dimension of the national economy. Does growth in one state trickle down to growth in another state? Bhide, Chadha and Kalirajan (2005) examine this issue using the statistical tests of 'causality'. Their analysis goes beyond assessing the presence of causality into trying to understand determinants of such interdependency.

The growth performance of 15 major states[9] during 1970–71 to 1999–2000 was been analysed on the basis of time series of Net State

[9] Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu and West Bengal.

Domestic Product (NSDP) at factor cost at 1980–81 prices based on the CSO estimates. The presence of causality was tested using the standard econometric tool of the Granger (1969) Test. The ideas of causation should be based on some *a priori* theoretical considerations. In fact, there may be diverse economic linkages across the different states.

The results of causality tests do not show a wide spread causation of growth across states. As we noted earlier, the analysis has permitted identification of factors that influence interdependency or the spillover effects.

The broad set of factors likely to lead the growth of the economy of one state into resulting in an impulse to the growth of another state's economy noted previously include: input–output linkages, mobility of factors, exposure to rest of the world and relative size of the economies. In the theoretical literature on regional development, the centre–periphery models (Hirschman, 1958; Myrdal, 1959), dependency model (Frank, 1978) cumulative causation model (Myrdal, 1959; Renaud, 1979) and the neoclassical model of factor mobility (Harris–Todaro model) are used to explain patterns of development. The 'new economic geography' literature has introduced elements of increasing returns to scale and imperfect competition to explain wider set of outcomes that emerge from interregional linkages (Gallup, Sachs and Mellinger, 1998; Krugman, 2000). There are also policy related factors that encourage strengthening of impulses or that may blunt the responses (Rabellotti and Schmitz, 1999). For example, erecting barriers to trade in the form of border taxes can be an effective means of reducing interregional linkages. Policies in a region may also be influenced by the policies elsewhere: governments may imitate each other in supporting or discouraging sectors (for instance the IT sectors) that do not reflect linkages through trade or transfer of resources. In this context, Hayami's (1997) institutional model of development process indicates that the quality of institutions is crucial in sustaining interregional linkages of growth.

Based on the aforementioned theoretical models, the factors that enable the exploitation of the potential linkages can be hypothesised as adequate infrastructure, suitable human capital resources, quality of state-specific institutions and access to markets, communication and transportation.

In an attempt to examine if the estimated pattern of 'causality' relationships can be explained in terms of any plausible hypotheses that link the different state economies some regression models were also estimated. The results of the regression analysis suggest some interesting relationships between the features of the 'caused' state and the probability of a 'causal' relationship with another state. Coastal access, initial share of agriculture as well as industry in a state's gross state domestic product (GSDP) and growth rate of GSDP were found to be significant influences on causality. Literacy and infrastructure, when tried earlier, did not appear as significant variables. Thus, it is the structure of the state economy and its growth performance that are relevant variables in leading to a significant growth spillover effect from one state to another. The variables such as literacy and infrastructure may of course be closely related to the structure of the economy and its growth. While the coastal access increases the probability of growth spillover effects, higher shares of agriculture and industry in the initial stages also improve the probability of spillover effects of growth in another state. Further, industry is likely to have greater degree of linkages across regions than agriculture.

The negative relationship between causality (or the presence of the trickling down effects) and growth rate of GSDP of the state suggests that a state that has relatively faster growing economy is less likely to be influenced by the growth of another state economy.

The variables relating to the differences in the structure of the economy and the growth rate appear to be relevant features of the causing state as well. If the causing state has larger agricultural share or larger industrial share in GSDP than in the 'caused' state, the probability of a 'causal' relationship increases. This reinforces the earlier finding that the structures of the economies are important factors influencing spillover effects. The coefficient of the difference between growth rates, which is a proxy for the difference in quality of institutions, is negative and significant. This means that the potential for significant growth spillover effects is reduced with the increase in the difference in quality of institutions between states. This result corroborates Hayami's arguments about the importance of nurturing appropriate institutions in promoting economic growth. In other words, differential between caused and causing state is an important factor

influencing growth spillover effects. This is an important finding that would seem to support the trends that may counteract to some extent the divergence in growth rates between states. The only factor to be considered as the 'common' factor is whether the two states considered share a common border or not. The variable did not turn out to be significant. This result may reflect that common borders alone do not lead to significant spillovers. Improved transportation and communication appear to overcome the disadvantage of not having physical proximity for transmission of growth impulses.

CONCLUSIONS

Combining Hayami's findings of the importance of country-specific institutions for promoting sustained economic growth with the convergence of income hypothesis, an indirect method to examine the link between the quality of institutions and interregional income inequalities in India is worked out. The principal force driving convergence in the neoclassical growth model is diminishing returns to reproducible capital. Thus economies with lower initial values of capital–labour ratios will have high marginal products of capital and, therefore, will tend to grow at higher rates. But inefficient and poor-quality institutions and organisations could lead to violation of the critical assumption of diminishing returns to reproducible capital. This means divergence of income for a considerable period of time in the development process. Thus it is logical to argue that the convergence hypothesis will hold only when country-specific institutions and organisations do not intervene in the process negatively to delay or constrain the convergence process. Thus, drawing on Hayami's findings, testing the convergence hypothesis of income provides an alternative method of examining the link between institutions and inequalities.

First, using Williamson's weighted coefficient of variation and covariation across sectors, the degree of interregional income inequalities is examined from 1970 to 1992. The results show that interregional income inequality increased over time, which indicates the inefficient functioning of the institutions in India during the period. The growth of

the tertiary sector has contributed more than the growth of the primary and secondary sectors to interregional inequality. Per capita incomes across states over the pre-reform period have shown divergence, indicating the accentuation of interstate disparities in the pre-reform periods. This result is contrary to the predictions of the neoclassical growth models and the empirical findings for different states within the USA. However, this result confirms our earlier argument based on Hayami's thesis that country-specific institutions and their economic policies would influence the convergence process and that with prolonged inappropriate policies there would be divergence. This result also supports the arguments of Elizondo and Krugman (1992). Further, the results indicate an inverted U-shaped relationship between the quality of institutions and inequality.

The policy implications of the foregoing analysis are as follows. The results are consistent with the recent view that greater equality can be positively associated with growth (Birdsall et al., 1995). The link is provided by the quality of institutions. Thus primary importance in the governance should be given to improving and sustaining the quality of country-specific institutions.

The accelerated acceptance of better technologies and best techniques depends on sustained investment in agricultural infrastructure, including agricultural credit. Central and state government expenditures on subsidising inputs such as power and fertilisers would be better spent on infrastructure. Relaxing government regulations and promoting competition from enterprises within and outside India would improve the performance of the secondary sector, particularly manufacturing. Accountability and not paternalism should be the driving force for public sector enterprises. The recent economic reform appears to be working in these directions to improve the overall performance of the Indian economy.

The analysis of spillover effects provides some useful perspectives and policy implications. The most important perspectives are that there had been high growth rate states before and after the implementation of economic reforms that performed well above average. A second is that these performances were achieved with high growth rates in all three sectors: agriculture, industry and services. These performances set high norms for state level performance.

There are important policy implications concerning the importance of agriculture in the development process. The combination of the close association of high and sustained growth rates of GSDP with high growth rates of GSDP from agriculture, and the positive and significant relationship between the growth rate of agriculture and of the industrial and service sectors, clearly demand that growth strategy in all states should assign a high priority to implementing measures for achieving a high growth rate of GSDP from agriculture.

Second, this can be best achieved through increases in agricultural productivity. The lack of such priority in the past in all but a few states has been the principal cause of weak growth performance of overall and state growth performance in the past. It has also slowed the transition process from agrarian based state economies to industrial and service industry dominance and has slowed the rate of reduction of poverty. Given that investors tend to favour faster growing states, it has also severely reduced the number of states that are able to attract investors and large scale investment. The association of a number of other policy-related variables with high growth rates of GSDP also provides guidance.

The association of high growth rates of GSDP with low population growth rates, higher life expectancy and literacy rates provides support for policies of population control, and enhanced programmes of public health and primary education. This argument also applies to provision of better transport and communications infrastructure, such as railways and roads, and provision of expanded services such as power, gas and water. The analysis also gives a clear signal of the importance in policy of improving financial services, particularly the expansion and modernisation of the banking and insurance sectors.

The ordering of the 14 major states into three performance groups based on their rates of growth of GSDP in the reform period of 1993–99 has been fruitful in a number of ways. First, the ordering suggests some geographical dimensions. The four HPSEs are maritime states and the three states thought to have most potential to become HPSEs (West Bengal, Andhra Pradesh and Kerala) are also maritime. Only one coastal state, Orissa, is excluded from this pattern. By contrast, states in the LPSE group, together with the relatively low performers in the MPSE group, are all northern hinterland states.

This chapter has also reviewed results of an analysis to examine if there are significant trickling down effects of economic growth in one state over the growth in another state in India. The attempt has been mainly to look at the statistically significant impulses. These results suggest that the growth impulses have been limited. A more accurate interpretation of the results, however, would be that the spillover effect has been prominent in only a small proportion of the potential cases. Thus, the results appear to be supporting the views expressed by earlier researchers including Higgins (1983) and Hansen (1990) that the existence of spillover effects across regions may not be significant, particularly in developing countries and one of the reasons appears to be the existence of poor economic institutions across several states.

3

Learning from Sectoral Linkages: Agriculture and the Economy

THE AGRICULTURE–INDUSTRY NEXUS

The macroeconomic and microeconomic reforms introduced in India since the middle of 1991 have raised the growth momentum that was seen prior to the economic crisis of the early 1990s. In this sense the reforms ushered in an era of sustained high growth rates. This phase of growth and the current global financial and economic crisis have highlighted both the opportunities and vulnerabilities of the economy to the globalising market economies. The structural reforms were introduced in industrial, trade and financial sectors to increase productivity by improving efficiency and to increase the competitiveness of the Indian manufacturing sector. One criticism that has continued to be made on the range of reforms is that agriculture and allied sectors which provide livelihood for the majority of the population, have largely been left untouched by reform measures. There are several measures that have influenced the course of agriculture, these have relied on government investments.

It is argued that agriculture should be globalised and given a wider and stronger commercial orientation through diversification and value addition, which, with its low import intensity and its general competitiveness in exports and import substitutability, would then encourage

both public and private investment in the sector. In return, the profitability in agriculture would induce further technological progress and rising productivity. Such improvement in output, productivity and income would further fuel manufacturing sector growth through increased demand for inputs and consumer goods. This process would strengthen the agriculture-to-manufacturing relationship. It is also argued that improvements in agricultural productivity would induce resource flows from agriculture to the manufacturing sector, thereby stimulating its growth.

These arguments are based on the assumption that a two-way relationship exists between agriculture and manufacturing sectors in India, and that the initial stimulus for accelerated growth should be initiated within the agricultural sector. If these assumptions are valid, then the government's approach of concentrating on the industrial sector is not wrongly focused, as suggested by some critics, but rather should be balanced with a higher priority for agriculture.

This ongoing debate hinges on empirical questions as to whether a significant interrelationship does exist between the two sectors, and if it does, what form does it take. These questions are addressed in this chapter, together with their implications for reform and liberalisation policy.

In this chapter we examine the question of how interlinked are agriculture and the other sectors of the economy? We first consider the linkages between agriculture and industry and in the latter part of the chapter examine whether agriculture has remained isolated from the overall growth experience of the economy.

Agriculture and Industry in Development Theory

There is much controversy in the literature and in policy-making circles over the relative emphasis that should be given to the agricultural and industrial sectors in development policy of less developed countries. This has been influenced heavily by disparate and changing perceptions as to the potential for growth and flow-on effects that exists in the two sectors.

The conventional wisdom in favour of pro-industry development strategy is based on the following assumptions: *(a)* agricultural production exhibits diminishing returns to scale because the supply of land is inelastic whereas manufacturing exhibits constant returns to scale and many infrastructural activities (for example public utilities) exhibit increasing returns to scale; *(b)* low income elasticites of demand for agricultural products particularly food items and high income elasticities of demand for most non-agricultural products providing an explanation for the declining share of agricultural sector output in GDP as the country develops; *(c)* alleged low supply response to price and other incentives in traditional agriculture; and *(d)* adverse terms of trade for countries relying mainly on exports of primary products. These assumptions are explicit or implicit in the development strategies adopted by many developing countries.

In the East European socialist model, which has influenced policy in both China and India, primacy was given to industry, at least partly because, until recently, there was little faith in the capacity of agriculture to generate self-sustaining growth for the whole economy. Agriculture was seen simply as a source of wage goods (food) and inputs (raw materials, labour and capital) for a growing industrial sector. In this vision, linkages between the two sectors are supply-side and unidirectional, from agriculture to industry.

Saith (1992) commented that mainstream development strategy of the Third World as a whole accorded primacy to modern import-substituting industrialisation, but with few exceptions, this path has failed to transform the economic structures of the developing countries. India is considered to be a 'moderately good performer' but the 'industrial-primacy strategy has failed to generate employment; the relative neglect of agriculture has further reduced the labour absorptive capacity of the economy, especially when compared to the rate of expansion of the population at working age' (Saith, 1992: 102).

A widely cited World Bank study on the political economy of agricultural price policies in 18 representative developing countries in Africa, Asia and South America by Kruger, Schiff and Valdes (1991) showed that most of the less developed countries in the sub-Saharan region of Africa and Asia discriminated against agriculture. These

countries taxed agriculture directly (measured as wedges between domestic and border prices) and indirectly (via industrial protection and overvalued exchange rates). Schiff and Valdes (1992) report that the average total nominal rate of protection for industrial products in these countries was 30.3 per cent. During the period 1960–84, the average rate of protection for agriculture in the sub-Saharan African countries of Cote d'Ivore, Ghana and Zambia was 51.6 per cent implying extreme discrimination agrainst agriculture.

The findings of Kruger, Schiff and Valdes (1991) are in sharp contrast to the findings of an earlier study of the OECD countries plus Korea by Anderson and Hayami (1986) which found that protection for the agricultural sector was generally positive and that it increased between 1950 and 1980. A recent OECD (1994) publication estimates the Producer Subsidy Equivalent (PSE) in the OECD countries in 1993 at USD139.3 billion or 42 per cent of the total value of agricultural output. It also estimates the average Nominal Assistance Coefficient (ratio of border plus Producer Subsidy Equivalent to border price) at 1.69 for OECD as a whole, the figure varying from 1.10 in Australia to 2.93 in Japan. This suggests that today's advanced economies have provided heavy protection to their agricultural sector while the industrial sector was exposed to greater international competition. The developing economies were least equipped to compete in the industrial sphere with the advanced economies and where they were competitive, they had deliberately chosen to strengthen the handicap originating from the protection in the advanced economies.

Several economists have advocated an agriculture-first strategy based on the confidence that agriculture has the capacity for technological dynamism (Schultz, 1964 and 1978; Mellor, 1976; Adelman, 1984; Oshima, 1993). According to Schultz (1978: 4), '…farmers the world over, in dealing with costs, revenues and risks, are calculating economic agents. Within their small individual allocative domain they are fine-tuning entrepreneurs, turning so subtly that many experts fail to see how efficient they are.' If this vision of farmers is correct then, not only could agriculture supply wage goods and inputs but also, through technological modernisation, rising productivity, incomes and rural prosperity, the sector will stimulate growth in industry. For its

part, industry cannot only supply agriculture with modern production inputs, but also consumer goods to satisfy expanding consumer horizons. This perception of the intersectoral relation amounts to a dynamic two-way relationship between agriculture and industry. Support for this approach is drawn from recent experience in East Asia, particularly post-war Japan and Taiwan and the recent post-1978 reform experience in China. But is this the full measure of the relationship?

Agriculture and Industry in India's Development

The Indian planning strategy from the early 1950s assigned a catalytic role for the industrial sector particularly capital goods industries. Little faith in the capacity of agriculture to generate self-sustaining growth, export pessimism and the desire to create a self-reliant and diversified industrial structure motivated the planners to adopt an inward looking import substitution development strategy. By the early 1960s it was observed that the actual rate of population growth of 2.3 per cent per annum during the 1950s was far above the assumed growth rate of 1.4 per cent per annum and that the realised growth rate in GDP was only 3.9 per cent against the target of 5.0 per cent per annum. As a result the food situation had worsened in 1965–66. India had to spend 28 per cent of her export earnings on import of cereals. The trade deficit as a percentage of export earnings reached an unsustainable figure of 75 given the fact that there was very little surplus on the invisibles external account. These events necessitated a policy shift in favour of agriculture.

The main objectives were self-sufficiency in food grains, reasonable prices of food grains to farmers and affordable prices to consumers particularly the poor. The policy package consisted of introduction of high yielding varieties of rice and wheat along with provision of irrigation facilities, fertilisers and extension of services, and announcement of minimum support prices for selected crops, creation of food bufferstock and strengthening of public distribution system. The 'green revolution' was successful in reducing India's dependence on food and ensuring stability in food prices. In 1972–73, net food imports amounted to only 1.9 per cent of India's export earnings. But, the

benefits of green revolution accrued to farmers in regions with assured irrigation facilities growing paddy and wheat. The input subsidies for irrigation, electricity, and fertilisers and food subsidy accentuated the fiscal deficits of central and state governments.

Even though India has a comparative advantage in the production of rice, cotton, vegetables and fruits, agro-based industries and animal products, this advantage was not exploited because of restrictions on exports of agricultural goods, industrial protection and overvalued exchange rate affecting the terms of trade for agriculture, and lack of policies for promotion of non-farm rural incomes and agro-based industries.

The process of direct economic reforms that was launched in 1991 has focussed on the industrial sector, with dismantling of industrial licensing, removal of import licensing from nearly all manufactured intermediate and capital goods, tariff reductions and relaxation of rules for foreign investment. Agriculture was bypassed in terms of direct reforms, except with trade liberalisation, there was relaxation of some export controls over agricultural products. But any benefits that have accrued to the sector have largely been indirect, for example, with currency devaluation and a shift towards market-determined exchange rates, and reduction in industrial protection.

The history of industrial primacy in policy thinking may help to explain why an industry-first approach was chosen for reform as well and could imply that there has been no shift in strategic thinking away from the sectoral priorities established in the early 1950s. The prevailing view appears to be that the desired objective of higher and sustained GDP growth rates can be achieved by reversing the balance between public and private ownership or management of productive resources, and by opening up industry to foreign investment, international trade and competition so that industry can perform its expected role as the leading sector. In this scenario, the notion that the agricultural or rural sector can play the leading role is not entertained. While the significance of this sector is not ignored, it is seen as playing second fiddle to industry, as it has since the Second Five Year Plan.

At this crucial juncture in Indian economic history, it seems a fair question to ask as to whether the sectoral priorities of the past should still persist, or in other words, can the pace of economic growth be

lifted to a higher plane simply by unleashing the private sector, reducing the public sector to an essentially supportive role, and globalising the economy by freeing the channels of international trade and investment.

Despite the long period over which the industry-first strategy has been pursued in India, and while a substantial body of literature exists on the agriculture-first strategy, there has been surprisingly few studies of the interrelationships between agriculture and industry under the industry-first strategy that has held sway for so long.

There are a number of studies that examine the relationship between agriculture and industrial sectors. A study by Rangarajan (1982), using a macroeconomic model, showed that agriculture and industries were interrelated, but with low intensity during the period 1961–76. Using simulation analysis over the period, he found that agriculture exercises a reasonably strong influence on the growth of industry with agricultural performance affecting consumer goods industries (directly) and basic and capital goods industries (through savings and investment). This one-way relationship was evident on the supply side (raw materials for industry) and on the demand side (consumer goods from industry). A study by Ahluwalia (1985), using regression analysis, found no interrelationship between agriculture and industrial sectors over the period 1965 to 1982. A recent study by Shand and Kalirajan (1994), using Granger's and Sims' causality tests, found neither unidirectional nor bi-directional relationships between agriculture and industries over the period 1950–89.

Utilising information gathered from India's National Accounts Statistics (Government of India), Input–Output Transactions Tables (Government of India, 1982 and 1993) prepared by the Central Statistical Organisation, New Delhi for the years 1978–79 and 1989–90 and a few other sources Kalirajan and Sankar (2003) analyse the nature, direction and extent of linkages between agriculture and other sectors of the Indian economy.

In the manufacturing sector, we can expect forward linkage between agriculture and agro-based industries and backward linkages between agriculture and non-agro-based manufacturing. The linkage between agriculture and the last group consisting of mining, petroleum and tertiary sector can be in both directions.

The input–output matrices for 1978–79 and 1989–90, show that the shares of intermediate inputs in the value of food and non-food crops increased from 30.8 per cent to 36.6 per cent, and 16.5 per cent to 21.6 per cent respectively between the two years (Kalirajan and Sankar, 2003). Almost all the increases are due to increases in the contributions of non-agricultural sectors' outputs to the production of the crop outputs. The National Accounts Statistics also confirm the increasing dependence of the agricultural sector for its critical inputs from the non-agricultural sector. At 1980–81 prices, the shares of agricultural inputs bought from the non-agricultural sector in the total value of intermediate inputs in agriculture increased from 7.4 per cent in 1960–61 to 50.7 per cent in 1995–96; the share of chemical fertilisers alone increased from 2.2 per cent in 1960–61 to 25.6 per cent in 1995–96. The green revolution has necessitated the observed change in the input mix in agriculture.

As for uses of the agricultural sector outputs by the non-agricultural sector, the extent of increases in the linkages is small and in some instances in the negative direction. The input–output coefficient giving the food crop output used as an input in agro-based manufacturing decreased over time. The National Accounts Statistics time series data on the value of output from agro-based industries in total value of output of registered manufacturing shows that the share fell from 52.5 per cent in 1960–61 to 27.1 per cent in 1992–93. It may be noted that this share in India is smaller than the corresponding shares in industrialised countries (31.4 per cent), Eastern Europe (40.3 per cent) and developing countries (37.6 per cent) (FAO, 1997). These findings indicate that the Indian agricultural policy, while successful in achieving self-sufficiency in food, had failed to exploit its comparative advantage (in terms of availability of raw materials and cheap labour) in the development of agro-based industries. The green revolution was also responsible for some adverse consequences. For example, subsidised supply of chemical fertilisers encouraged farmers to substitute chemical fertilisers for organic manures; as a result the share of organic manure in the value of intermediate inputs, at 1980–81 prices, fell from 8.7 per cent in 1960–61 to 3.1 per cent in 1995–96. This substitution along with over use of well water for irrigation (because of extremely low price for electricity with zero

marginal price for kilowatt hour of energy in many states) accentuated the environmental problems.

Based on the inverse matrices of (I-A) backward linkages and forward linkages of industries can be estimated (Table 3.1). These results show that the backward linkages for the food and non-food crop groups and the two manufacturing subgroups had increased over time while for the other groups the values had fallen.

Table 3.1 Rasmussen measures of backward and forward linkages of sectors

	Backward Linkages		*Forward Linkage*	
Commodity Group	*1978–79*	*1989–90*	*1978–79*	*1989–90*
1. Food crops	0.9235	0.9572	0.7492	0.6963
2. Non-food crops	0.7790	0.7965	1.0206	0.9887
3. Animal husbandry	0.9715	0.9368	0.7443	0.7063
4. Forestry and fishery	0.6941	0.6931	0.6284	0.6041
5. Agro-based manufacturing	1.3054	1.3272	0.8756	0.8182
6. Other manufacturing	1.3269	1.3290	1.4389	1.5081
7. Other industries	0.9993	0.9602	1.5429	1.6783

Source: Kalirajan and Sankar (2003).

Note: The Rasmussen measure of backward linkage for the *j*th sector is:

$$u_j = \left(1/n\right)\Sigma_i A^*_{ij} \Big/ \left(1/n^2\right)\Sigma_j \Sigma_i A^*_{ij}$$

The measure of forward linkage for the *i*th sector is:

$$u_i = \left(1/n\right)\Sigma_j A^*_{ij} \Big/ \left(1/n^2\right)\Sigma_i \Sigma_j A^*_{ij}$$

where A^*_{ij} are the elements of (I-A) inverse.

As for the forward linkages, except in non-agro-based manufacturing and the last group consisting mainly of the tertiary sector, the magnitudes of the linkages were not only l ess than one in both the years, but their values had declined from 1978–79 to 1989–90.

How does one measure the importance of agricultural sector in an economy? The popular measure is the share of agricultural GDP in total GDP.

Based on this measure, the share of agriculture in India's GDP had fallen from 48.7 per cent in 1950–51 to less than 20 per cent in 1996–97, but in terms of employment agriculture still accounts for 60 per cent of the working force. Based on the National Accounts Statistics, the share of food in total personal final consumption expenditure in current prices is currently at less than 40 per cent. If we add the consumption of agro-based products such as clothing and footwear, the share increases to 43 per cent. The agro-processing group and the tertiary sector account for most of the gap (that is, agriculture's share in GDP and agricultural products share in personal consumption expenditure).

We can also infer about the extent of the linkages on the demand side from estimates of expenditure elasticities and household purchases of goods and services. Using the Natinal Sample Survey data for nine periods during 1970–89, Radhakrishna and Ravi (1992) provide estimates of expenditure and price elasticities for rural and urban areas. The expenditure elasticities for rice and wheat are 0.4, for pulses 0.6, for fruits, vegetables, sugar, meat, eggs, and milk and milk products are in the range 0.8 to 1.0. These estimates are relatively larger than the ones for the developing countries. The expenditure elasticities for non-food in rural and urban areas are 1.6 and 1.5, respectively.

The basic argument underlying the industry-to-agriculture linkages on the demand side is that the availability of consumer goods in rural areas acts as a stimulus to rural households by raising their aspirations. These aspirations can only be satisfied by increasing farm household output and incomes which enable purchase of these consumer goods. On the one hand, this presupposes that marketeers of consumer goods are targeting and penetrating rural mass markets increasingly with goods that match buyers' demands in terms of range (consumables and durables), quality (performance) suitability and prices. Evidence suggests that these conditions have been increasingly met. Rural marketing has become progressively easier with improved rural market connectivity. With burgeoning road transport services, a wider range of consumer goods has become available in rural markets at more competitive prices. As radio and television have spread to the villages, modern advertising techniques are enticing households to purchase a

widening range of mechanical and electrical goods. The surveys of household consumption of manufactured goods undertaken between 1985 and 1990 by the National Council of Applied Economic Research (Rao, 1994) provide strong evidence of the growing importance of rural consumer markets and of their further potential.

Rao (1994) argues that rural population has a large share of total all India purchases in many basic consumer products and in some consumer durables (Table 3.2). Such rising aspirations, however, must be matched by expanding economic opportunities to raise production in rural incomes. Dynamism in the agricultural sector is required to provide profitable opportunities. These opportunities have indeed become widely available with the spread of modern production technologies for food grains, particularly wheat and rice, since the mid-1960s, so it can be argued that there has been some match of aspirations and the means of satisfying them.

The basic premise in this analysis is that the choice of development strategy and sectoral priorities, and more specifically, the selection of reform and liberalisation measures should be informed and guided by the causal interrelationships between agriculture and industry.

Table 3.2 Rural consumption of consumer products and consumer durables

Item	*Ratio of Rural Purchases to Total All India Purchases (%)*	*Rural Purchases per 1000 Population (number)*
Bicycles	Above 70%	Above 300
Portable radios	Above 70%	Above 300
Footwear and tooth powder	60%–70%	Above 300
Motorcycles and scooters	50%–60%	Below 25
Sewing machines	50%–60%	50–100
Black and white TVs	40%–50%	25–50
Electric stoves	30%–40%	50–100
Pressure cookers	30%–40%	50–100
Vanishing cream	20%–30%	50–100
Refrigerators	10%–20%	Below 25
Colour TVs	10%–20%	Below 25

Source: Rao (1994).

Testing for Intersectoral Linkages

There are several methods to test the hypotheses concerning intersectoral linkages. One direct method is to examine whether it is possible to use the growth rate of one sector as an exogenous variable in the equation explaining the growth rate of the other sector. This is equivalent to testing the Granger causality between agricultural and industrial growth rates because Granger causality is necessary for strong exogeneity as defined by Engle, Hendry and Richard (1983). A direct test for uni-directional causality in the Granger's sense can be formulated using the autoregressive equation involving both the growth rates. Based on Granger's definition of causality, given two time series $x(t)$ and $y(t)$ which are assumed to be covariance stationary, '$x(t)$ causes $y(t)$' means that the past values of x can predict y more accurately than the past values of y. The testing procedure reported in the paper by Kalirajan and Sankar (2003) can be symbolically described as follows.
When:

$$\sigma_a^2(y_t : y_{t-j}) > \sigma_b^2(y_t : y_{t-i}, x_{t-j})$$

this means that x causes y, where σ^2 is the variance of the prediction error, and $i, j = 1, 2, ..., m$.
When:

$$\sigma_a^2(y_t : y_{t-j}) < \sigma_b^2(y_t : y_{t-i}, x_{t-j})$$

this implies that x does not cause y.

Similar analyses can be done with appropriate modifications to examine whether y causes x. The interesting question is how many lags should be used in these estimations. Following Akaike (1970), the optimal lag length is chosen at a particular level for which the final prediction error is the minimum. Each time a lag is introduced in the equation, the final prediction error is calculated as follows:

$$\text{(Mean residual sum of squares)} * (T + k + 1)/(T - k - 1)$$

where T refers to the number of observations and k refers to the number of parameters estimated.

The empirical evaluation of causality is dependent on certain data characteristics. In particular, the autocorrelation in time series, or the interdependency among individual observations, when not accounted for may complicate the causality test. Although sectoral growth rates are used in order to induce stationarity, it is still important to evaluate the autocorrelation properties of these series. Since the non-stationarity of time series may contribute to the problem of spurious regression (Engle and Granger, 1987), it can significantly alter tests of hypotheses concerning the causal relationships between the macroeconomic sectors. As noted by Iwamoto and Kobayashi (1989), series which are stationary after differencing permanently preserve a current shock. Under such circumstances structural changes between sectors can significantly alter the relationships between the growth rates of the individual sectors. However, if two series exhibit identical orders of stationarity one may inquire whether such series are linked by some long-run equilibrium relationship, or are cointegrated.

The application of this procedure can assist in evaluating the causal relationships between the growth rates of the major macroeconomic aggregates. In particular, series that display different stationarity properties cannot possibly be cointegrated which implies that the long-term trends of the growth rates cannot be related by any equilibrium constraint, while their short-run components could only produce spurious regression results. The economic interpretation of the different stationarity properties would mean that distinct and separate factors independently influence the development of each sector.

To evaluate the stationarity of each of the growth rate series, the three statistics proposed by Dickey and Fuller (1979, 1981) have been used. The test statistics are based on the following regression which is known as the Augmented Dickey Fuller (ADF) regression:

$$\Delta x_j(t) = \alpha + \beta t + \delta x_j(t-1) + \Sigma \gamma_k \Delta x_j(t-k) + \varepsilon_j(t)$$

where j is either agricultural or industrial growth rate, and $\varepsilon_j(t)$ is a serially uncorrelated noise process.

Lagged first-difference terms are included in the model to achieve empirical white noise. The quality of inference from tests is conditional upon the absence of systematic patterns in the errors, and this clearly applies here as in other contexts. As a result, the testing for stationarity is to use regressions augmented with as many such lags as are necessary to eliminate serial correlations in the residuals.

The test statistics, t, Φ_3 and Φ_2 are used for the following null hypotheses:

i) Test 1. H_O: $\delta = 0$,

ii) Test 2. H_O: $\delta = \beta = 0$ (i.e. random walk with drift),

iii) Test 3. H_O: $\delta = \beta = \alpha = 0$ (i.e. random walk with no drift),

with the alternative in each case being the stationarity of the $x_j(t)$ series (i.e. $\delta < 0$).

Empirically, Test 1 would be applied, which is conditional upon β being 0. The conditionality can be checked by carrying out Test 2.[1] If the interest is in checking whether the series also has 0 drift, then Test 3 is applied.

In Test 1, null of unit root is not rejected, if the t statistic exceeds the tabulated chosen critical value, that is, if the statistic is a 'less big' negative number than the (negative) critical values given in the table. But, finding a unit root is not sufficient for stationarity of the first difference series. If the coefficient on time differs from 0, the first difference will be time-dependent (its mean with vary with T) and so the series cannot be I(1).

Further, the inference from the test is valid only if the time coefficient is 0. This necessitates doing a joint testing of the hypothesis that $\delta = \beta = 0$ by means of the Φ_3 statistic. The F-statistic, computed in the usual way from imposing the restrictions in the null hypothesis on the ADF regression, should be compared with the critical values of the Φ_3 statistic as given in Dickey and Fuller (1981). Provided the value of the statistic is less than the tabulated critical value, the null hypothesis cannot be rejected. This means that the series has a unit

[1] If the coefficient on time cannot be restricted to 0, then the series contains a trend that should be removed prior to further modelling, or a time trend should be included in subsequent regression analysis.

root, and is non-stationary, but its first difference is stationary, implying that $x_t \sim I(1)$.[2] However, it is important to examine the ADF statistics for higher differences to confirm that the series in question is I(1) and not I(2) series. This involves estimating the following ADF regression to test a null hypothesis that $\delta = 0$:

$$\Delta^2 x_j(t) = \alpha + \beta t + \delta \Delta x_j(t-1) + \Sigma \gamma_k \Delta^2 x_j(t-k) + \varepsilon_j(t)$$

It is argued that the power of the ADF tests is likely to be low for series where moving-average terms are present or where the disturbances are heterogeneously distributed (Phillips and Perron, 1988). In such cases, ADF tests should be supplemented by some additional tests suggested by Phillips and Perron (1988). If normality, autocorrelation or heterogeneity statistics are significant, then the Phillips and Perron approach should be followed. The program MICROFIT provides all the above testing procedures and the causality regressions.

Empirical Results

First, to ensure that $\varepsilon_j(t)$ is uncorrelated, k was selected by searching over $k \in [0, 6]$ for the specification which minimises the Akaike Information Criterion (AIC). The lag was chosen as $k = 1$ for both agricultural growth rate (AGR) and manufacturing growth rate (MGR) series. In addition, the autocorrelation functions of the residuals of the optimal specification confirm the white noise assumption. As reported in Kalirajan and Sankar (2003) both AGR and MGR series at the all-India and state levels appear to have no unit roots.

Now, to test for causality between AGR and MGR, linear equations described above were estimated by the ordinary least squares method with appropriate lags of variables. Akaike's (1970) Final Prediction Error (FPE), which is equivalent to Amemiya's (1980) prediction criterion, is used in the literature. The optimal lag lengths for each state and also all-India level equations are given in Table 3.3. All estimated

[2] This conclusion is not affected by the presence or absence of a significant intercept term in the ADF regression.

Table 3.3 Results of the causality tests between agriculture and manufacturing growth rates

Sl. No.	State	Regression of Y on X			Regression of X on Y			Causality
		Optimal Lags	FPE1	FPE2	Optimal Lags	FPE3	FPE4	
1	Andhra Pradesh	$Y=3, X=1$	0.0063	0.0065	$X=1, Y=4$	0.0373	0.0216	Manufacturing to agriculture
2	Bihar	$Y=1, X=1$	0.0921	0.0682	$X=2, Y=2$	0.0195	0.0202	Agriculture to manufacturing
3	Gujarat	$Y=5, X=1$	0.029	0.0283	$X=5, Y=5$	0.0843	0.0301	Bidirectional
4	Haryana	$Y=3, X=1$	0.0072	0.008	$X=1, Y=1$	0.0304	0.024	Manufacturing to agriculture
5	Karnataka	$Y=5, X=4$	0.0069	0.0073	$X=1, Y=3$	0.0175	0.0066	Manufacturing to agriculture
6	Kerala	$Y=5, X=3$	0.0122	0.0014	$X=1, Y=2$	0.0087	0.0084	Bidirectional
7	Madhya Pradesh	$Y=1, X=1$	0.0165	0.0065	$X=1, Y=4$	0.0299	0.0113	Bidirectional
8	Maharashtra	$Y=5, X=5$	0.005	0.0002	$X=1, Y=2$	0.0153	0.0124	Bidirectional
9	Orissa	$Y=3, X=4$	0.023	0.0068	$X=1, Y=5$	0.014	0.0023	Bidirectional
10	Punjab	$Y=3, X=4$	0.0034	0.0009	$X=2, Y=3$	0.0016	0.001	Bidirectional
11	Rajasthan	$Y=1, X=1$	0.0249	0.026	$X=1, Y=5$	0.0203	0.0155	Manufacturing to agriculture
12	Tamil Nadu	$Y=5, X=3$	0.004	0.0021	$X=3, Y=4$	0.0146	0.0063	Bidirectional
13	Uttar Pradesh	$Y=1, X=5$	0.0039	0.0017	$X=1, Y=3$	0.0085	0.0065	Bidirectional
14	West Bengal	$Y=2, X=1$	0.005	0.0074	$X=2, Y=5$	0.0137	0.0055	Manufacturing to agriculture
15	All India	$Y=1, X=5$	0.0021	0.0015	$X=3, Y=1$	0.0058	0.0032	Bidirectional

Source: Based on Kalirajan and Sankar (2003).

Notes: Data are for 1960–61 to 1988–89; in the case of Haryana and Punjab, data are for 1967–68 to 1988–89.
X = Agriculture, Y = Manufacturing.

regression equations had R^2 higher than 0.73. For brevity, only the test statistics which indicate the results of causality tests, are reported.

when $FPE_2 > FPE_1$: *X* does not cause *Y*
when $FPE_2 < FPE_1$: *X* causes *Y*
when $FPE_4 > FPE_3$: *Y* does not cause *X*
when $FPE_4 < FPE_3$: *Y* causes *X*

The results of causality tests indicate that a significant link exists between agriculture and manufacturing at the all-India level and that there is bi-directional causality running from agriculture to manufacturing, and from manufacturing to agriculture at this level. In noting that earlier studies failed to find a significant intersectoral relationship, these studies studied agriculture and industrial sectors (NIC 3 to 5 = manufacturing + electricity, gas and water supply + construction) (Ahluwalia, 1985; Shand and Kalirajan, 1994). It is only when the manufacturing sector (NIC 3) rather than the industrial sector (NIC 3 to 5) is considered with the agricultural sector that the sectoral links become significant.

In demonstrating the extent and nature of these intersectoral relationships at the national level this study indicates India's 'industry-first' and consequent growth of manufacturing was not inimical to the growth of the agricultural sector but has established significant positive linkages. This has occurred despite the shortcomings of this policy in relation to its own sectoral targets.

The findings on the status of sectoral links at the state level are also of significance. For the present analysis, the following 14 major states were considered: Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. These 14 major states account for 93 per cent of population and 91.5 per cent of net domestic product in the country and are therefore representative. The mountainous states of the north and north-eastern part of India, which are considered 'special category' by the Planning Commission, and the small state of Goa have been excluded from the analysis because of the significant differences in the structure of their economies from the rest of the states.

The results presented in Table 3.3 may be summarised as:

- *Uni-directional from agriculture to manufacturing*:
  Bihar.
- *Uni-directional from manufacturing to agriculture*:
  Andhra Pradesh, Haryana, Karnataka, Rajasthan and West Bengal.
- *Bi-directional*:
  Gujarat, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Tamil Nadu and Uttar Pradesh.

Broadly, these findings indicate a strong integration and interdependency of the agricultural sector and manufacturing sector in most states. The bi-directional causality that exists in the states of Gujarat, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Tamil Nadu and Uttar Pradesh may reflect the linkage effects of the Green Revolution in food grains, in terms of stimulating downstream processing, in input supplying industries such as tractors and diesel pump sets and through expansion of consumer demand or in terms of some combination of the three.

The prevalence and dominance of the bi-directional interdependence between agriculture and manufacturing suggests that India is well poised to attain higher growth rates because of the sectoral interdependence and the flow-on effects that will follow further growth in these two sectors of the economy. The Granger tests do not show how strong the relationships are, but their significance suggests that reform measures that directly stimulate either sector do have a flow-on effect to the other sector. Given that manufacturing growth stimulates agricultural growth, which in turn stimulates manufacturing, it follows that reform policies which remove constraints on agriculture and increase its profitability can enhance the stimulus from manufacturing. For example, past trade and exchange rate policies have discriminated against agriculture. Recent macro level changes have influenced the structure of effective incentives in different sub-sectors and agriculture is one which has gained (Pursell and Gulati, 1993). Gulati and Chadha (1994) have reported that Indian agricultural commodities, excluding oilseeds, have become more efficient exportables or efficient

import substitutes. With a more liberalised regime, there would be an expectation of an expansion in agro-exports. This would stimulate investment in agriculture to produce the surpluses. Higher exports would demand new infrastructure facilities, for example, cold storage facilities at ports for fruits and vegetables and marine products. This in turn would expand demand for a variety of industrial goods such as cement and machinery. On-farm investments to raise output would raise demand for key inputs such as irrigation and fertilisers, which again rises demand for industrial goods.

PATTERNS OF AGRICULTURAL GROWTH

We now turn to the second major theme of this chapter, whether agriculture has remained insulated from India's growth experience? This section is based on the work previously reported in Bhide, Kalirajan and Shand (1998). The debate on agriculture's role in overall development has been ongoing. Development effort has traditionally involved industrialisation. The 'industry-first' approach was also chosen for the economic reforms of 1991. The economic reforms of the 1990s appeared to be based on the premise that higher and sustained GDP growth rates may be achieved by reversing the balance between public and private ownership, and by opening up industry to foreign investment, international trade and competition to enable industry to perform its expected role as the leading sector.

In this scenario, the notion that the agricultural or rural sector can also simultaneously play a leading role is not entertained. Agriculture is assigned only a secondary role to industry.

The important objectives for agriculture have been:

1. Food security and self-sufficiency. This has been pursued by:
   i) extending the frontier of cultivation,
   ii) increasing productivity through technological change, especially in food grains (Green Revolution) and
   iii) intensification of input use with irrigation and other inputs.

2. Reduction of inequalities in agricultural income. This was primarily attempted through:

    i) development programmes targeted at small farmers, tenancy reforms, land ceiling regulations, some focus on least and less developed areas (programmes relating to dryland farming, hill areas, drought prone areas) and providing employment opportunities for under-employed agricultural (rural) labour through rural employment programmes, and
    ii) the public distribution system for food, although the impact of the programme on the demand side was mainly in urban areas.

There has been significant success in meeting these goals over the years. However, agriculture has not provided prosperity to rural India on a widespread basis. Spread of irrigation has helped raise productivity of land and improved income of the farmers who have access to irrigation. But irrigated area covers hardly 40 per cent of total corp area in the country. Moreover, over time, the size of landholdings has continued to decline and the improvement in productivity would have to keep pace with this reduction in land area per person in rural areas to provide higher income levels.

In this sense, accelerating agricultural growth is critical for the prosperity of rural population, which even today amounts to about 70 per cent of the country's total population.

We now provide a brief review of the trends in India's agricultural production in the two decades leading up to the early years of reforms of the 1990s and analyse the interstate variations in agricultural growth.

Trends

In a closed economy, output growth of any sector is constrained by overall growth of the domestic economy. In a sector such as agriculture

where income elasticity of demand is low compared to manufacturing or services output, output growth would remain relatively low. There are also strong cyclical features in agricultural growth performance that should be taken into account in projecting future trends based on current or recent performance.

For the period from 1950–51 to 1990–91, India's real GDP growth averaged 4.1 per cent per year as compared to an annual growth rate of 2.8 per cent for GDP from agriculture and allied activities. During the period 1993–94 to 2006–07, the overall GDP growth was 6.7 per cent per year whereas agriculture and allied sectors grew at less than half this rate of 2.9 per cent. The decadal rates of growth for the three main sectors of the economy and also their shares in overall GDP are shown in Table 3.4. All sectors including agriculture fared better in the 1980s as compared to the previous three decades, barring the better performance of industry in the 1960s. While the average growth rate of the Indian economy remained nearly the same in the1990s, there was acceleration during the next six years up to 2006–07. Agricultural

Table 3.4 The shares (%) and growth rates (% per year) of GDP from major sectors of the economy (1999–2000 prices)

Item	*1950s*	*1960s*	*1970s*	*1980s*	*1990s*	*2000–01 to 2006–07*	*1950–51 to 1990–91*	*1993–94 to 2006–07*
				Shares				
Agriculture and allied	54.0	45.9	41.1	35.1	28.4	21.3	43.7	24.4
Industry	16.3	21.4	23.1	24.6	25.9	25.9	21.5	25.9
Services	29.7	32.7	35.8	40.3	45.7	52.8	34.8	49.7
				Growth rates				
Agriculture and allied	2.7	2.5	1.3	4.4	3.2	2.5	2.75	2.94
Industry	5.7	6.5	3.6	6.0	5.6	7.7	5.48	7.11
Services	4.0	4.8	4.4	6.5	7.3	8.4	4.98	8.32
Total	3.6	4.0	2.9	5.6	5.7	6.9	4.06	6.65

Source: Authors' calculations based on Central Statistics Organisation (2009).

output growth rates, however, were disappointingly low during this period.

The performance of the economy varies with growth rates of its components, both sectorally and regionally. An understanding of component-wise variations often leads to recognition of the imbalances in growth performance and design of policies to overcome imbalances. In either case, an assessment of the variations in performance of different sectors and regions is important. In this section, we summarise the findings of a previous paper by Bhide, Kalirajan and Shand (1998) on the pattern of variations in growth rates of the components of agriculture is examined, followed by an analysis of regional variations in agricultural growth rate. The analysis is limited to the period up to 1995–96 but provides highlights of the general pattern of slow growth of the sector relative to the other sectors.

National Level Patterns

Several researchers have examined the sectoral patterns of growth of Indian economy in the past [for example, Rao (1989) for agriculture, Ahluwalia (1991) for industry and Mathur (1987) for various sectors at the state level]. The question of changes in the pattern has been examined either by using the well-known 'dummy variables' approach or by using alternative functional forms such as polynomials in the time variable. In the case of dummy variables, the turning points have to be discerned by inspection of data or by known events of significance, such as a drought, the 'green revolution period' or the hike in petroleum price. The use of polynomials in time often cannot capture adequately cyclical patterns in growth rate, as the degree of the polynomial needed would be large. An alternative approach is to use the 'recursive residuals' of the growth rate equations and test for structural breaks in the pattern. Even here, results vary with the time period chosen for analysis, but the approach is more flexible than the 'dummy variables' or 'time-polynomial functions'. The approach utislises the 'recursive residuals' and carries out the 'CUSUM' and 'CUSUM Squared' tests of the residuals of growth rate equations (Kalirajan, 1995). Using these 'CUSUM' and 'CUSUM Squared

tests' Bhide, Kalirajan and Shand (1998) tested for structural breaks in the pattern of growth for different measures of economic output for selected sub-periods of time.[3] Sectoral growth is examined using real GDP originating from the various sectors as the output measure and the sub-components within agriculture in terms of value of output in constant prices. In this section of the chapter we have presented the main results from our earlier work (Bhide, Kalirajan and Shand, 1998) to illustrate the nature of agricultural growth in relation to the growth of the other sectors of the economy. The experience in the years subsequent to the period covered by the analysis has again shown relative sluggishness of agricultural growth with the Eleventh Five Year Plan again emphasising agriculture as a key to achieve 'inclusive growth'.

Output structure may change even though the overall growth rate may remain unchanged as there can be offsetting structural changes. For instance, growth rate of wheat may increase and that of rice may decrease leaving the overall food grain output growth rate unchanged. To assess the changes in output structure, Spearman rank correlation coefficients (r) for growth rates of different crops can be estimated between any two selected periods.[4] If 'r' is positive and significant, then the output structure (or growth pattern) is the same between the two periods, whereas if 'r' is negative or not significant, then there is a significant change in output structure.

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[3] The statistic used for CUSUM test is,

$$W(t) = \Sigma_{(s=k+1,\, t)} \quad r(s)/\sigma \qquad t = k+1, k+2, \ldots, T$$

where k is the number of observations, starting from the first, used to estimate the recursive residuals, $r(s)$; σ is the estimated standard deviation of the recursive residuals; and T is the total number of observations. The statistic for CUSUM squared test is

$$S(t) = \{\Sigma_{(s=k+1,\, t)} \quad r^2(s)\}/\{\Sigma_{(s=k+1,\, T)} \quad r^2(s)\} \qquad t = k+1, k+2, \ldots, T$$

The bounds for both $W(t)$ and $S(t)$ for specified levels of probability are available in econometric packages such as SHAZAM. For details, see Kalirajan (1995).

[4] The rank correlation coefficient is calculated as

$$r = 1 - \{6\Sigma_{(i=1,\, n)}\, di^2/n(n2-1)\}$$

The National Accounts Statistics (various issues) provide data on real GDP originating from 10 broad sub-sectors.[5] Table 3.5 captures the pattern of growth of real GDP for 5-year and 10-year sub-periods starting from 1951–52 to 1993–94. From the 5-year trends, the jump in growth rate is discernible in the first half of the 1980s in all the sub-sectors with the exception of *(a)* construction, *(b)* electricity, gas and water supply (EGW) and *(c)* trade, hotels and restaurants (THR). The average growth rates of EGW and THR also increased in the second half of the 1980s. Thus, acceleration in average growth rate in the 1980s was quite broad based. The results also suggest that there was first a decline in growth rates for several sectors in the 1970s, particularly in the first half, which then recovered in the 1980s.

The 10-year trends (Table 3.5) suggest that agriculture and construction grew at rates lower than the overall rate of real GDP growth in the 1980s. In other words, even though there may have been some improvement in the growth rates of output of these two sectors, it was far less than the growth in the other sectors.

Changes in Growth Patterns The differences in average growth rates over time point to the need to assess the significance of the differences, as often the future trends in output growth are extrapolated from the perspective of more recent experience. As noted earlier, the CUSUM and CUSUM-Squared tests can be used to examine if growth rates changed significantly during the periods under consideration. The results in Table 3.6 show that when the entire period from 1950–51 to 1993–94 is considered, breaks in the pattern of growth are observed for all major non-agricultural sectors, with the exception of the group THR. A break in pattern is observed around mid-1960s in the case

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where di is the difference between the ranks of the ith pair and n is the number of pairs included. The t-statistic for r is calculated as

$$t = r \,.\, \{(n-2)/(1-r^2)^{1/2}$$

with $n - 2$ degrees of freedom (Chao, 1969).

[5] The data are available in EPW Research Foundation (October 1997).

Table 3.5 Trends in the growth of real GDP by sectors and sub-periods (% per year)

Period	*Agriculture*	*Agriculture and Allied*	*Mining*	*Manufacturing*	*EGW*	*Construction*	*THR*	*TRST*	*FNRE*	*PA*	*Total*
Five Year Periods											
1951 to 1954	4.40	3.82	5.10	5.35	8.10	3.76	4.14	3.71	2.89	2.94	3.88
1955 to 1959	1.84	1.83	4.29	6.19	12.58	7.36	5.41	7.03	3.22	3.97	3.36
1960 to 1964	3.40	3.28	7.40	8.10	12.39	8.63	7.09	6.59	3.11	5.97	4.99
1965 to 1969	1.64	1.74	4.98	3.67	10.37	5.74	3.27	5.07	3.31	4.50	2.93
1970 to 1974	0.96	1.17	1.63	3.38	5.16	–1.42	3.30	5.58	3.07	4.13	2.28
1975 to 1979	1.85	1.34	4.52	5.25	8.69	5.33	5.32	6.10	5.55	4.13	3.61
1975 to 1980	3.95	3.26	5.80	4.40	8.19	6.64	5.30	6.21	4.95	4.12	4.20
1980 to 1984	6.20	5.67	8.25	6.23	7.90	4.96	5.38	6.38	5.33	5.17	5.68
1981 to 1984	4.14	3.87	7.26	7.74	8.46	2.90	5.42	6.29	6.18	5.44	5.30
1985 to 1989	3.57	3.39	8.96	7.75	9.50	5.23	6.79	7.87	8.28	7.26	6.04
1990 to 1993	2.89	2.38	5.37	2.42	7.35	4.00	4.24	5.49	6.89	4.38	4.06
1951 to 1993	2.94	2.72	5.63	5.44	9.18	4.89	5.03	6.04	4.62	4.76	4.10
Ten Year Periods											
1951 to 1959	2.98	2.72	4.65	5.81	10.59	5.76	4.85	5.55	3.07	3.51	3.59
1960 to 1969	2.52	2.51	6.19	5.89	11.38	7.18	5.18	5.83	3.21	5.24	3.96
1970 to 1979	1.41	1.26	3.08	4.31	6.93	1.95	4.31	5.84	4.31	4.13	2.94
1970 to 1980	2.59	2.31	3.90	3.94	6.81	2.97	4.39	5.92	4.09	4.12	3.33
1981 to 1990	3.82	3.60	8.20	7.75	9.03	4.20	6.18	7.17	7.35	6.45	5.72
1990 to 1993	2.89	2.38	5.37	2.42	7.35	4.00	4.24	5.49	6.89	4.38	4.06

Source: Bhide, Kalirajan and Shand (1998).

Notes: (1) Agriculture *r* = Crop and livestock; EGW = Electricity, Gas and Water supply; TRST = Transport, Storage and Communications; FNRE = Financial services and Real Estate; PA = Public administration.

(2) The years denoting periods are the financial years such that 1951 = 1951–52 etc.

(3) As 1979–80 was an abnormally poor growth year due to poor monsoon, we have estimated growth rates by extending the corresponding periods by one more year.

(4) The growth rates are derived as simple averages of year-to-year growth rates during the respective periods.

Table 3.6 Structural breaks in trend growth of real GDP

GDP at Factor Cost (1980–81 prices)	Growth Rate (%) Annual Average	Structural Break as per CUSUM Test	Structural Break as per CUSUM Square Test	Earliest Year of Break
1950–51 to 1993–94				
Agriculture	2.48	None	None	None
Agriculture and Allied	2.36	None	None	None
Mining	5.17	None	1967	1967
Manufacturing	5.20	1980	None	1980
Electricity, Gas and Water	8.70	1982	1965	1965
Construction	4.50	1982	1968	1968
Trade, Hotels, Restaurants	4.84	None	None	None
Transport and Storage	5.90	None	1979	1979
Financial Services and Real Estate	4.27	1989	1964	1964
Public Administration	4.69	1971	1971	1971
Total	3.85	None	1964	1964
1960–61 to 1993–94				
Agriculture	2.65	1990	None	None
Agriculture and Allied	2.47	None	None	None
Mining	5.24	1993	1974	1974
Manufacturing	5.01	None	1977	1977
Electricity, Gas and Water	7.92	1973	None	1973
Construction	3.81	1975	1975	1975
Trade, Hotels, Restaurants	4.74	None	1982	1982
Transport and Storage	5.94	1990	1973	1973
Financial Services and Real Estate	4.84	1989	1971	1971
Public Administration	4.81	None	1972	1972
Total	3.99	1990	1974	1974

(Table 3.6 continued)

(Table 3.6 continued)

GDP at Factor Cost (1980–81 prices)	*Growth Rate (%)* *Annual Average*	*Structural Break as per* *CUSUM Test*	*CUSUM Square Test*	*Earliest Year of Break*
1970–71 to 1993–94				
Agriculture	2.90	None	None	None
Agriculture and Allied	2.62	None	None	None
Mining	6.46	1989	None	1989
Manufacturing	5.47	1990	None	1990
Electricity, Gas and Water	7.66	1990	None	1990
Construction	3.99	1991	None	1991
Trade, Hotels, Restaurants	5.15	1978	None	1978
Transport and Storage	6.38	None	None	None
Financial Services and Real Estate	5.69	1990	1981	1981
Public Administration	5.11	1987	1980	1980
Total	4.42	1988	None	1988
1980–81 to 1993–94				
Agriculture	3.22	None	None	None
Agriculture and Allied	2.99	None	None	None
Mining	7.08	None	1987	1987
Manufacturing	6.18	None	None	None
Electricity, Gas and Water	8.42	None	None	None
Construction	4.56	None	None	None
Trade, Hotels, Restaurants	5.50	None	1987	1987
Transport and Storage	6.76	None	None	None
Financial Services and Real Estate	7.20	1990	None	1990
Public Administration	5.97	None	None	None
Total	5.17	None	None	None

Source: Bhide, Kalirajan and Shand (1998).

Notes: (1) Growth rate is the estimated b-coefficient from the regression Ln GDP = $a + b$ Time.

(2) CUSUM and CUSUM Square tests are at 5 per cent level of significance.

of mining, EGW, construction, and financial services and real estate (FSR). The growth pattern of public administration shows a break in 1971, transport and storage (TRST) in 1979 and manufacturing GDP in 1980.

Agriculture is the only case—whether alone (consisting of crop and livestock production) or including allied activities (inclusive of forestry and fisheries)—in which no significant change in the pattern of growth is observed. In other words, the acceleration in growth observed in the 1980s appears not to be statistically significantly different from the long-term trend when we take into account the entire period from 1950–51 onwards. One reason for this surprising result may lie in the earlier observation that in the 1970s, there was a decline in the growth rates for agriculture, which then recovered in the 1980s. A similar cyclical pattern is noticed in the earlier periods as well.

In order to assess the implications of shorter time periods, the tests for a structural break for selected sub-periods were also carried out (Bhide, Kalirajan and Shand, 1998). Analysis of the periods 1960–61 to 1993–94, 1970–71 to 1993–94 and 1980–81 to 1993–94 shows that breaks in the growth pattern are seen in all the major non-agricultural sectors at one time period or another, but not in agriculture. In other words, the growth rates of the 1980s are not significantly higher than the earlier record if we take a longer period into consideration. In the context of the decline in growth rates in the mid-1970s, the growth rates of 1980s turn out to be significant. The pattern of growth rates shown in Figure 3.1 clearly indicates the cyclical nature of the growth rates, for GDP from agriculture as well as for GDP from agriculture and allied activities.

In agriculture, it is well recognised that there has been a shift in the sources of growth from the 'extensive' factor of increasing crop area to the 'intensive' factor of increasing productivity per hectare of land. Analysis of the pattern of growth of per hectare output of agriculture using the statistical tests of CUSUM and CUSUM Squared shows that output per hectare cannot be modelled by a single growth rate during the entire period of 44 years from 1950–51 onwards (Table 3.7). The long-term trend has a break in 1990–91 based on the CUSUM test. When shorter stretches of time are considered, breaks are seen in the early 1960s as well as mid-1980s. Thus, productivity per hectare of

Figure 3.1 Pattern of growth of agriculture (real GDP)

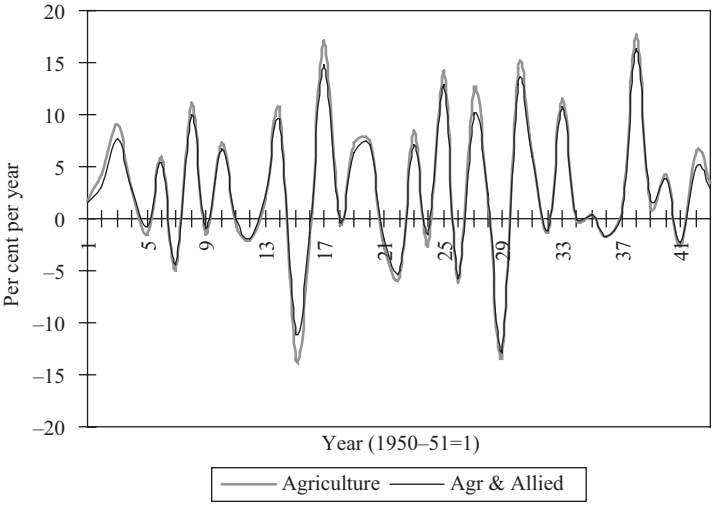


Table 3.7 Structural breaks in the growth pattern of real GDP per hectare

	GDP (real) from Agriculture per Hectare			*GDP (real) from Agriculture and Allied per Hectare*		
		Structural Breaks by			*Structural Breaks by*	
Period	*Growth Rate % per Year*	*CUSUM Test*	*CUSUM Square Test*	*Growth Rate % per Year*	*CUSUM Test*	*CUSUM Square Test*
1950–51 to 1992–93	1.78	1990–91	None	1.67	1989–90	None
1960–61 to 1992–93	2.05	1992–93	None	1.89	None	None
1970–71 to 1992–93	2.29	None	None	2.03	None	None
1980–81 to 1992–93	2.94	1986–87	None	2.71	1986–87	None
1950–51 to 1979–80	1.36	None	1963–64	1.35	None	1962–63

Source: Bhide, Kalirajan and Shand (1998).

land has been affected significantly by changes in technology (mid-1960s) as well as growth in input application (mid-1980s). The rise in productivity, however, was not sufficient to raise the output growth above the long-term trend in either instance.

Changes at Crop Level Within agriculture, during 1970–71 to 1993–94, average growth rate of the crop sector was lower than the non-crop sector (Bhide, Kalirajan and Shand, 1998). Thus, changes have taken place within agricultural output but agriculture's growth has been less spectacular than those of other non-agricultural sectors. The early 1980s proved to be a period of recovery of growth for agriculture, but the higher growth rate was not sustained in the crop sector.

Analysis of the changes in the pattern of output growth within agriculture, based on crop level data reported in Bhide, Kalirajan and Shand (1998), shows that:

1. there are pronounced cyclical features in growth rates particularly for groundnut, cotton, plantation crops (coffee and rubber) and spices (cardamom and chillies), and
2. there are significant variations in growth rates even for the major crops such as rice and wheat.

A more formal assessment of changes in the structure of output as reflected in the pattern of growth rates can be provided by the estimated rank correlation coefficients for the crop-wise growth rates in different periods. The estimated correlation coefficients (Table 3.8) are not statistically significant (at 5 per cent level of probability) when the successive 5-year intervals are compared except for the final two periods: 1980–81 to 1984–85 and 1985–86 to 1989–90. There is a strong positive correlation between the growth pattern of the final period and every other 5-year period. These results point to a strong cyclical pattern and a tendency to move towards a stable pattern of growth as seen in the final period. In every sub-period, the crops whose output grew at a high (low) rate are likely to experience a lower (higher) rate in the

Table 3.8 Spearman rank correlations of crop output

Growth Rates During Periods	*Correlation Coefficient*
I & II	0.033
I & III	0.116
I & IV	0.157
I & V	0.419**
II & III	0.262
II & IV	0.249
II & V	0.3748**
III & IV	0.046
III & V	0.314**
IV & V	0.270**
VI & VII	0.495**

Source: Bhide, Kalirajan and Shand (1998).

Notes: (1) ** indicates significance at 5 per cent.
(2) Periods: I = 1970–71 to 1974–75, II = 1975–76 to 1980–81, III = 1981–82 to 1984–85, IV = 1985–86 to 1989–90, V = 1990–91 to 1992–93, VI = 1970–71 to 1979–80, VII = 1980–81 to 1989–90.

subsequent period. But such changes are becoming less pronounced as we move towards more recent data of the 1990s.

The possible explanations for a relatively modest growth rate for the overall agricultural output lie in:

1. lower income elasticity of demand for agricultural products,
2. lack of external markets and
3. supply-side constraints of a limited land base and factors or policies restricting the flow of resources (capital) to agriculture.

At crop level, significant changes in growth rates may arise due to changes in relative prices of crops, technological changes (new varieties) and new marketing opportunities. There is thus sufficient evidence of adjustments in response to incentives and policies, but the overall performance is constrained by aggregate demand and supply constraints.

State Level Patterns in Output Performance of the States

The relatively stable rate of long-term growth for agriculture suggests a transition in output growth accompanied by changes in technology, input application and adjustments in crop- or output-mix in response to economic or policy incentives. This raises the issue of variations in the performance of different states over time. Have some states contributed to overall growth while others have continued to lag behind? Using the data from 1970–71 to 1992–93, the state-wise data on value of crop output and Net State Domestic Product (NSDP) from agriculture, Bhide, Kalirajan and Shand (1998) provide an assessment of the changes in the pattern of growth. The average annual growth rates were estimated for the entire period (1971–72 to 1992–93) and then for five sub-periods of *(a)* 1971–72 to 1975–76, *(b)* 1975–76 to 1980–81, *(c)* 1980–81 to 1985–86, *(d)* 1985–86 to 1989–90 and *(e)* 1985–86 to 1992–93 (Tables 3.9a–3.9d). The patterns of growth rates across states estimated by crop output or NSDP are fairly similar to each other.

The performance of the states has varied significantly over the time period considered. If we consider the value of crop output in the first three sub-periods, no state remains as in the top three positions in all the three sub-periods.

It is only when we consider the next sub-period that some repetitions are noticed. Among the top five states, Gujarat and Orissa appear in three out of four consecutive sub-periods; Punjab, Maharashtra, Rajasthan, Andhra Pradesh and Uttar Pradesh in two; and Karnataka, Bihar, Madhya Pradesh and Haryana figuring once in the four consecutive sub-periods. The state of Bihar, which is among the lowest three states in three out of four sub-periods also, becomes one of the top five in the remaining sub-period. Thus, there are significant changes in the performance of states over time. The states with higher rate of output growth experience lower growth subsequently and vice versa.

When the growth pattern of NSDP is considered the cyclical nature of growth is again in evidence. While Gujarat, Maharashtra and Rajasthan are among the more consistent performers (top three states), other states also make the group in one of the years. Kerala and Bihar figure more frequently among the slow growing states, Bihar enters the top five list during one of the sub-periods.

Table 3.9a Statewise growth performance: Annual per cent growth rates of value of crop output (1980–81 prices)

Sl. No.	State	*Growth Rate % per Year*					*Rank, Ascending Order of Growth Rate*				
		71–75	*76–80*	*80–84*	*85–89*	*85–92*	*71–75*	*76–80*	*80–84*	*85–89*	*85–92*
1	Andhra Pradesh	3.58	5.82	2.62	7.06	4.66	9	14	3	11	11
2	Assam	3.64	2.51	5.37	1.91	2.04	10	5	6	1	3
3	Bihar	2.23	–0.64	7.93	3.18	–0.55	3	3	11	3	1
4	Gujarat	14.39	4.29	5.85	33.87	25.16	15	11	8	15	15
5	Haryana	3.04	2.77	6.62	7.99	7.02	7	6	9	13	13
6	Karnataka	5.46	3.30	3.10	3.04	3.95	13	8	5	2	7
7	Kerala	1.24	–0.73	1.77	3.54	3.87	2	2	2	6	6
8	Madhya Pradesh	3.31	4.10	13.97	3.24	4.64	8	9	15	4	10
9	Maharashtra	11.22	4.26	1.53	7.73	5.81	14	10	1	12	12
10	Orissa	4.02	6.45	12.90	6.23	1.18	11	15	13	10	2
11	Punjab	4.73	4.80	5.47	4.88	4.41	12	12	7	8	9
12	Rajasthan	2.79	2.17	13.46	12.10	11.82	5	4	14	14	14
13	Tamil Nadu	2.79	3.06	2.71	3.41	3.48	5	7	4	5	5
14	Uttar Pradesh	0.59	5.19	11.18	3.61	2.92	1	13	12	7	4
15	West Bengal	2.23	–1.30	7.35	5.41	4.03	3	1	10	9	8
	India	2.50	2.73	6.03	4.19	3.42	NA	NA	NA	NA	NA

Source: Based on Bhide, Kalirajan and Shand (1998).

Table 3.9b Statewise growth performance: Annual per cent growth rates of NSDP from agriculture (1980–81 prices)

Sl.		*Growth Rates % per Year*					*Rank, Ascending Order of Growth Rate*				
No.	*State*	*71–75*	*76–80*	*80–84*	*85–89*	*85–92*	*71–75*	*76–80*	*80–84*	*85–89*	*85–92*
1	Andhra Pradesh	3.45	4.79	3.92	5.2	2.28	11	13	4	9	4
2	Assam	4.62	2.63	6.42	2.12	1.68	13	6	9	3	3
3	Bihar	1.034	1.56	9.05	–0.92	–0.58	3	3	12	1	1
4	Gujarat	10.86	5.23	6.35	19.47	15.77	15	14	8	15	15
5	Haryana	2.41	2.73	6.25	7.34	6.39	6	7	7	11	12
6	Karnataka	3.12	3.03	3.37	2.16	2.63	9	8	3	4	5
7	Kerala	0.95	–0.65	0.35	3.45	6.13	2	1	1	7	11
8	Madhya Pradesh	2.11	5.38	14.97	3.21	3.91	5	15	15	6	8
9	Maharashtra	9.68	2.54	0.53	8.23	6.54	14	5	2	13	13
10	Orissa	3.12	3.25	7.13	7.63	1.06	9	10	10	12	2
11	Punjab	3.06	4.47	4.81	5.97	5.6	8	11	5	10	10
12	Rajasthan	0.1	2.36	9.28	8.37	8.84	1	4	13	14	14
13	Tamil Nadu	4.02	1.01	5.57	1.39	2.75	12	2	6	2	7
14	Uttar Pradesh	1.44	4.63	10.34	2.86	2.73	4	12	14	5	6
15	West Bengal	2.66	3.07	8.5	5.13	4.87	7	9	11	8	9

Source: Based on Bhide, Kalirajan and Shand (1998).

Table 3.9c Statewise growth performance: Annual per cent growth rates of real value of crop output per hectare

Sl. No.	*State*	*71–75*	*76–80*	*80–84*	*85–89*	*85–92*	*71–75*	*76–80*	*80–84*	*85–89*	*85–92*
1	Andhra Pradesh	4.45	4.99	2.46	5.19	4.10	11	15	3	11	11
2	Assam	2.90	1.16	2.25	1.79	1.88	9	5	2	2	4
3	Bihar	2.41	–0.32	7.30	2.83	1.52	8	1	10	4	3
4	Gujarat	10.82	3.54	4.79	10.31	4.07	15	13	8	14	10
5	Haryana	7.07	1.41	7.03	11.14	10.47	13	6	9	15	15
6	Karnataka	6.08	1.00	2.51	1.54	2.86	12	4	4	1	6
7	Kerala	0.53	1.63	2.57	3.74	2.89	2	7	5	7	7
8	Madhya Pradesh	3.47	3.10	11.99	2.98	2.46	10	10	14	5	5
9	Maharashtra	9.74	3.37	0.87	6.66	1.34	14	11	1	13	1
10	Orissa	1.85	3.69	12.25	2.47	1.51	6	14	15	3	2
11	Punjab	1.96	2.78	4.04	3.79	4.76	7	9	7	8	13
12	Rajasthan	1.41	0.56	10.59	5.51	4.89	5	3	12	12	14
13	Tamil Nadu	1.06	2.55	3.21	4.32	4.69	4	8	6	10	12
14	Uttar Pradesh	–0.60	3.39	11.42	3.46	3.92	1	12	13	6	8
15	West Bengal	1.03	0.20	7.76	4.27	3.97	3	2	11	9	9
	India	1.65	1.99	5.10	3.30	2.66	NA	NA	NA	NA	NA

Source: Based on Bhide, Kalirajan and Shand (1998).

Table 3.9d Statewise growth performance: Annual per cent growth rates of real agricultural NSDP per hectare

Sl. No.	*State*	*Growth Rate % per Year*					*Rank, Ascending Order of Growth Rate*				
		71–75	*76–80*	*80–84*	*85–89*	*85–92*	*71–75*	*76–80*	*80–84*	*85–89*	*85–92*
1	Andhra Pradesh	4.37	4.03	3.88	3.36	1.73	12	12	6	8	6
2	Assam	3.86	1.29	3.23	2.11	1.32	10	3	4	3	4
3	Bihar	1.16	2.07	8.70	–1.26	–0.66	6	9	12	1	2
4	Gujarat	8.04	4.52	5.28	2.53	–2.22	14	14	7	5	1
5	Haryana	5.93	1.43	6.79	10.00	9.01	13	5	11	15	15
6	Karnataka	3.88	1.54	3.12	0.66	1.61	11	6	3	2	5
7	Kerala	0.24	1.72	1.16	3.69	5.52	2	8	2	10	14
8	Madhya Pradesh	2.26	4.30	12.93	2.93	2.79	9	13	15	7	7
9	Maharashtra	8.68	1.67	–0.15	7.21	2.80	15	7	1	14	8
10	Orissa	0.95	0.87	6.74	3.84	–0.41	5	2	10	11	3
11	Punjab	0.39	2.48	3.39	4.85	5.45	4	10	5	13	13
12	Rajasthan	0.01	1.36	6.66	3.40	3.00	1	4	9	9	9
13	Tamil Nadu	2.06	0.65	5.86	2.51	3.87	8	1	8	4	12
14	Uttar Pradesh	0.25	2.86	10.61	2.69	3.70	3	11	14	6	11
15	West Bengal	1.43	4.66	9.05	3.96	3.60	7	15	13	12	10

Source: Based on Bhide, Kalirajan and Shand (1998).

There is no consistent pattern in growth of output per hectare (gross crop output or NSDP) over the years. Out of the 15 states considered, 12 are among the top five states in at least one of the five sub-periods considered for gross crop output per hectare and 13 out of 15 for NSDP per hectare.

Convergence of Growth Rates What are the implications of current trends in state level output for the future? Do they show a tendency to 'diverge' or to 'converge'? A tendency to converge would imply that policy measures have tended to remedy regional imbalances in growth performance. However, in the context of a 'closed economy', such a result also implies that the states which grew faster in the past may experience slower growth as markets for the output do not rise as fast. Thus, achieving 'regional balance' may mean reducing opportunities for better performing states, unless there is an expansion of markets. We also note that convergence in growth rates does not necessarily imply that there is 'convergence' in per capita incomes, or in the case of agriculture, of 'per farm' output. It only implies that 'divergence' in the output shares of states would be slower or diminish depending upon the type of 'convergence'.

A comprehensive measure of the changes in growth rates can be obtained by adapting the tests developed for the convergence of incomes across regions (Barro and Sala-i-Martin, 1995). We have applied this measure of convergence of regional performance with a slight modification to the data on agricultural output for the Indian states. The test is based on the following equation:

$$\text{Log}\,(Y_{it}/Y_{it-1}) = a - (1 - e^{-b}).\ \text{Log}\,(Y_{it-1}) \qquad (3.1)$$

where Log is the natural logarithmic operator, Y_{it} is the growth rate of value of output (or NSDP) in year t and the coefficients a and b are to be estimated. If the coefficient b is positive then the growth rates converge to $[a/(1 - e^{-b})]$. If b is negative then the growth rates of the states diverge from each other over time. However, note that the term $(1 - e^{-b})$ should be positive and less than 1 to be able to estimate the value of b. When $(1 - e^{-b})$ is greater than 1, estimation of b is not

possible but we can still assess the pattern of output growth. For $0 < (1 - e^{-b}) < 1$, the growth rate Y_{it} converges uniformly to a steady state, for $0 < (1 - e^{-b}) < 2$ convergence is cyclical and in all other cases, there is no convergence. The equation (3.1) captures the basic form of growth pattern. For tests of specific time periods, the following equation is estimated:

$$(1/T)\ \text{Log}\ (Y_{iT}/Y_{i0}) = a - (1 - e^{-bT}).\ \text{Log}\ (Y_{i0}).\ (1/T) \qquad (3.2)$$

where T is the number of years between the two periods in which the changes in growth pattern are to be tested. The inference of convergence is the same as for equation (3.1). The simple annual average steady state growth rate, Y^*, can be computed as,

$$Y^* = (1/T).\ \text{Exp}\{aT/(1 - e^{-bT})\} \qquad (3.3)$$

If there were additional explanatory variables in equation (3.2), then the steady-state growth rate would be affected by the assumed levels of the additional explanatory variables. In the studies of income convergence, the coefficient b is important as a measure of speed of convergence. In the present application the coefficient $(1 - e^{-bT})$ is adequate to assess the nature of dynamics of output growth and hence, we will estimate only the latter expression.

The estimated equations of growth dynamics of agricultural output are summarised in Tables 3.10a–3.10c. Average growth rates of output were examined for four sub-periods: *(a)* 1970–71 to 1974–75, *(b)* 1975–76 to 1980–81, *(c)* 1981–82 to 1985–86 and *(d)* 1986–87 to 1990–91. Rather than selecting specific single year, we have chosen averages for the five-year period for comparison of growth pattern. This approach allows comparison of change in growth rates between period 2 and period 3; between period 3 and period 4; and between period 2 and period 4. The results shown in Tables 3.10a–3.10c point to the convergence of growth rates over time. The auxiliary variables turn out to be significant only when we compare the long-term trend from period 2 to period 4. Therefore, generally, there is a tendency for the growth rates to converge to a single rate of output growth. On

Table 3.10a Tests of convergence of growth rates of agricultural output (real NSDP): Average of 1980–81 to 1984–85 over 1975–76 to 1979–80

	Dependent Variable: Ratio of Growth Rates of Period III to II					
	Equation (1)		*Equation (2)*		*Equation (3)*	
Explanatory Variables	*Coefficient*	*t-Ratio*	*Coefficient*	*t-Ratio*	*Coefficient*	*t-Ratio*
(1/*T*). Ln *Y*(*t* – *T*)	–1.2205	4.70**	–1.3394	5.31**	–1.3173	5.02**
(1/*T*). Ln RG(*t* – *T*)			0.1931	1.72	0.2452	1.67
(IA/GA)(*t* – *T*)					–0.0229	0.58
(1/*T*). [(IA/GA) (*t*) – (IA/GA) (*t* – *T*)]						
Constant	0.0282	4.53**	0.0270	4.67**	0.0326	2.88**
R square (Adjusted)	0.6005		0.6524		0.6320	
	Equation (4)		*Equation (5)*		*Equation (6)*	
	Coefficient	*t-Ratio*	*Coefficient*	*t-Ratio*	*Coefficient*	*t-Ratio*
(1/*T*). Ln *Y*(*t* – *T*)	–1.2628	4.53**	–1.2444	4.67**	–1.3935	5.56**
(1/*T*). Ln RG(*t* – *T*)					0.2224	1.97*
(IA/GA)(*t* – *T*)	0.0178	0.53				
(1/*T*). [(IA/GA) (*t*) – (IA/GA) (*t* – *T*)]			0.6353	0.75	0.9590	1.23
Constant	0.0236	2.22**	0.0249	3.24**	0.0219	3.10**
R square (Adjusted)	0.5771		0.5886		0.6669	

Source: Bhide, Kalirajan and Shand (1998).

Notes: Number of observations = 15 in all the regressions and method of estimation is OLS; Ln = Natural logarithm; *Y* = Annual average growth rate of real NSDP; RG = Ratio of percentage; Changes in the rainfall index in current and previous periods; IA/GA = Ratio of irrigated to total crop area; *T* = 5.

Table 3.10b Tests of convergence of growth rates of agricultural output (real NSDP): Average of 1985–86 to 1989–90 over 1980–81 to 1984–85

	Dependent Variable: Ratio of Growth Rates of Period III to II					
	Equation (1)		*Equation (2)*		*Equation (3)*	
Explanatory Variables	*Coefficient*	*t-Ratio*	*Coefficient*	*t-Ratio*	*Coefficient*	*t-Ratio*
(1/*T*). Ln *Y*(*t* – *T*)	–0.8945	4.03**	–0.9675	3.72**	–0.8783	3.18**
(1/*T*). Ln RG(*t* – *T*)			–0.0749	0.58	0.0495	0.27
(IA/GA)(*t* – *T*)					0.0339	0.97
(1/*T*). [(IA/GA)(*t*) – (IA/GA) (*t* – *T*)]						
Constant	0.0242	3.61**	0.0251	3.56**	0.0134	0.96
R square (Adjusted)	0.5212		0.4957		0.4932	
	Equation (4)		*Equation (5)*		*Equation (6)*	
	Coefficient	*t-Ratio*	*Coefficient*	*t-Ratio*	*Coefficient*	*t-Ratio*
(1/*T*). Ln *Y*(*t* – *T*)	–0.9202	4.17**	–1.1139	4.58**	–1.1475	4.24**
(1/*T*). Ln RG(*t* – *T*)					0.0425	0.35
(IA/GA)(*t* – *T*)	0.0271	1.14				
(1/*T*). [(IA/GA)(*t*) – (IA/GA) (*t* – *T*)]			1.2703	1.71	1.2248	1.57
Constant	0.0161	1.66**	0.0216	3.37**	0.0222	3.22**
R square (Adjusted)	0.5323		0.5834		0.5504	

Source: Bhide, Kalirajan and Shand (1998).

Notes: Number of observations = 15 in all the regressions and method of estimation is OLS; Ln = Natural logarithm; *Y* = Annual average growth rate of real NSDP; RG = Ratio of percentage; Changes in the rainfall index in current and previous periods; IA/GA = Ratio of irrigated to total crop area; *T* = 5.

Table 3.10c Tests of convergence of growth rates of agricultural output (real NSDP): Average of 1990–91 to 1992–93 over 1975–76 to 1979–80

	Dependent Variable: Ratio of Growth Rates of Period III to II					
	Equation (1)		*Equation (2)*		*Equation (3)*	
Explanatory Variables	*Coefficient*	*t-Ratio*	*Coefficient*	*t-Ratio*	*Coefficient*	*t-Ratio*
(1/*T*). Ln *Y*(*t* – *T*)	–1.3480	6.99**	–1.3725	7.97**	–1.4951	10.81**
(1/*T*). Ln RG(*t* – *T*)			–0.2354	2.09	–0.2592	2.98
(IA/GA)(*t* – *T*)					0.0254	3.04
(1/*T*). [(IA/GA)(*t*) – (IA/GA) (*t* – *T*)]						
Constant	0.0161	7.04**	0.0168	8.14**	0.0104	3.94
R square (Adjusted)	0.7739		0.8205		0.8938	
	Equation (4)		*Equation (5)*		*Equation (6)*	
	Coefficient	*t-Ratio*	*Coefficient*	*t-Ratio*	*Coefficient*	*t-Ratio*
(1/*T*). Ln *Y*(*t* – *T*)	–1.4576	8.22**	–1.3287	6.90**	–1.3627	7.58**
(1/*T*). Ln RG(*t* – *T*)					–0.2152	1.71
(IA/GA)(*t* – *T*)	0.0231	2.17**				
(1/*T*). [(IA/GA)(*t*) – (IA/GA) (*t* – *T*)]			0.3650	1.07	0.1448	0.42
Constant	0.0102	3.01**	0.0137	4.35**	0.0158	4.98**
R square (Adjusted)	0.8239		0.7765		0.8073	

Source: Bhide, Kalirajan and Shand (1998).

Notes: Number of observations = 15 in all the regressions and method of estimation is OLS; Ln = Natural logarithm; *Y* = Annual average growth rate of real NSDP; RG = Ratio of percentage; Changes in the rainfall index in current and previous periods; IA/GA = Ratio of irrigated to total crop area; *T* = 10.

a longer term basis (comparison of periods IV and II), however, the states with higher proportion of irrigated land in the crop area are likely to grow at a higher rate than those with lower irrigation.

The results imply that those states that are growing more rapidly now are tending to a slower rate and those that are on a slower rate of growth are likely to accelerate their pace of growth. This chapter does not address the reasons behind this convergence with further empirical analysis, but the causes can be speculated upon. Policy related measures would clearly be one source of convergence: policies in the 'backward' states are showing some effect while the faster growing states are reaching the limits of markets offered by the 'closed economy' and the limits of available technology and institutions governing resource use. Measures aimed at increasing the size of the markets are more likely to raise the growth opportunities for Indian agriculture across states than mere changes in technology.

CONCLUSIONS

The analysis presented in this chapter supports the view that reforms should ideally be targeted at both sectors, agriculture and industry, given the bi-directional interdependency prevailing in most states and at the national economy level. Reforms that encourage investment in agriculture and raise incomes will effectively expand the market for manufactures. The fact that agriculture has relatively low import intensity makes the sector all the more attractive as a target for reform. Put another way, a reform process that ignores agriculture also ignores the sector's capacity to contribute to a more rapid overall rate of economic growth. Advantage should be taken of the fact that most agricultural commodities are efficient exportables or efficient import substitutes (Gulati and Chadha, 1994). Investment in agricultural diversification, for example, into higher value-added commodities such as fruit, vegetables, milk and milk products and into agro-processing, together with investment in neglected areas with unexploited agricultural potential, for example, the eastern region, could provide another surge in rural purchasing power which could in turn stimulate expansion in

a modernising manufacturing sector and inject further dynamism into the intersectoral relations which this study suggests can be the basis for the acceleration of India's growth rate which is the basic objective of the reform and liberalisation process.

There is no lack of recognition of the need for agricultural reforms in government. The Ministry of Finance's Discussion Paper on economic reforms (Government of India, 1993) proclaimed:

> No strategy of economic reform and regeneration in India can succeed without sustained and broad-based agricultural development.

It set out the critical areas for reform which include reduction of input subsidies, restructuring of public investment on agriculture, upgrading of quality of research and extension services, resurrection of private investment in the sector, strengthening of the institutional credit system and land reform in several states.

While the government gives this recognition of the need for agricultural reform, the lack of adequate success is evident in the renewed focus on agriculture even in the Eleventh Five Year Plan. We would argue that this bi-directional linkage gives added strength to the argument as it reveals the mechanism by which the pace of overall economic development can be accelerated. However, we realise the political economy issues involved in the reduction of input subsidies and food subsidy. Also, the prospects for developing countries like India in improving their shares in world exports in agricultural and agro-based products depend largely on the reduction in the extent of protection given to agriculture in developed countries. Regardless of the external situation, it would be in India's own interest to liberalise agricultural trade and reduce the input subsidies and contain the food subsidy to the deserving target group. The policies should quantify the financial burden, estimate the net welfare losses to society resulting from continuation of the policies, and implement a policy package which is fiscally feasible and not adverse to the farming sector as a whole.

The second strand of analysis in the chapter has shown that India's growth rate of 2.3 per cent per annum of GDP originating in agriculture over the two decades of Green Revolution (1968–88) compares very modestly with growth rate trends for paddy and wheat in most other

Asian countries over that period (Ahluwalia, 1992). China, Malaysia, Thailand and Burma each achieved 4 per cent per annum. Indonesia followed closely with 3.9 per cent, while the Philippines and Pakistan recorded between 3.5 per cent and 4 per cent, respectively.

International comparisons reveal the source of divergence of India's performance between achievements to be the differences in output per hectare. India performs poorly in terms of yield per hectare. The more recent performance in the 1990s also has caused concern as the output growth is slower than experienced in the second-half of 1980s.

Among the reasons for the slower growth of Indian agriculture are the policy choices that were made to promote industrialisation. The economic reforms of the early 1990s focussed on increasing competition in the industrial sector. This can indirectly affect resource flows in favour of agriculture. However, in terms of government policies and expenditures in agriculture, their impact appears to have been constrained by the rising input subsidies. These concerns have led to a discussion of the strategies for acceleration in growth and the need for appropriate central and state-level policies.

We have examined the patterns of agricultural growth at the national as well as state levels. The analysis brings out a number of interesting features of agricultural growth in India: *(a)* Unlike the non-agricultural sectors, growth in agriculture has been steady for almost four decades since 1950. The statistical tests show no structural break in the growth pattern of agriculture. *(b)* When growth trend in output per hectare is considered, structural breaks occur in the mid-1960s and in 1980s. *(c)* Growth rates in agriculture exhibit marked cyclical pattern at the crop as well as state levels. The crop level cycles may be attributed to movements in relative prices or other factors relating to market conditions, whereas the state-level cycles may be expected to be related to policies. *(d)* The pattern of growth rates of agricultural output of the states over short periods of five years indicate that all the 15 states are converging to one rate of growth; but over a longer time period of 10 years, the states with higher proportion of crop area under irrigation are converging to higher rates of growth, whereas the states with lower proportion of crop area under irrigation are converging to lower rate of growth.

The analysis shows that the long-term growth rate of agricultural output has been seen to remain below that of the non-agricultural

sectors. On the second issue of interest, whether the net effect of the agricultural policies has been to achieve an acceleration of the long-term growth trend in agricultural output as a whole at the national or state level, the analysis indicates there has been no acceleration. Output per hectare, however, has shown significant breaks in pattern during the period of 44 years since 1950–51. On the third issue as to whether the these policies have induced significant convergence of agricultural growth rates across states over time, the evidence points to the importance of irrigation as the factor enabling sustained higher rates of growth in the long term. In the short run, the states exhibit a tendency to converge to a single rate of growth but in the longer run, the states with better irrigation spread tend to converge to higher rates of agricultural growth.

The implications of the findings on the growth pattern are significant for policy. State-level policies can have a significant impact in raising the agricultural growth rates when they are low, leading to a convergence of growth rates in the short run. Supply side measures at the state level, such as increasing irrigation facilities, improve the ability of farmers to exploit the market opportunities leading to higher output growth by comparison with states in which such infrastructure is poor and growth rates are lower. However, neither state-level measures taken to date, nor policies that have led to increases in productivity in agriculture, have induced a sufficient impact in the aggregate to create a break in the overall growth rate for agricultural output. Thus, policies to date have been conducive only to the achievement of a steady but slow growth of agriculture at the national level and creation of regional imbalances in the long term.

In a future context, it is clear that a break is needed to a higher growth rate of agricultural output if the sector is to make a dynamic contribution to a higher overall growth rate of the economy. An important policy option is to substantially improve demand side opportunities through direct reforms to attract higher and sustained investment in improved technology and higher input levels that will create the break. In the process, care would be needed to ensure that such stimulus takes place in states with lower agricultural growth rates to avoid a widening of interstate disparities in agricultural development.

4

State Agriculture in the National Economy Setting

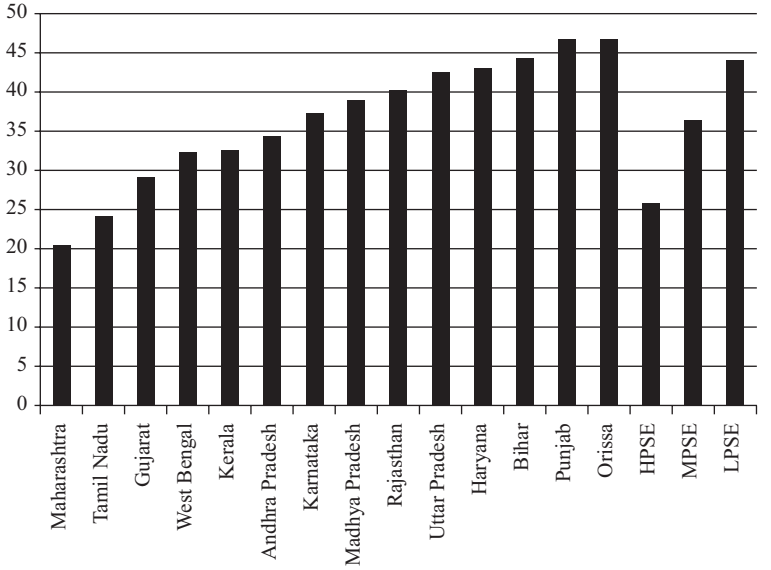
INTRODUCTION

Agriculture has played distinct roles in the Indian economy from several perspectives. Although its share in overall GDP has declined over the years, it still remains a source of livelihood for majority of rural population. Public policy initiatives have attempted to raise and sustain agricultural output. The sustainability of some of the past policies has been questioned particularly in relation to input subsidies and with respect to restrictions on international trade. The prospect of increasing liberalisation of trade in agricultural commodities around the world has required an examination of appropriate policies for agricultural growth.

Alternative policy measures influence agricultural output not merely in the aggregate but in terms of its composition as well. The composition of output in terms of food crops and non-food crops is of policy importance given the implications for food security. In a broader context, policies affect different sectors in an asymmetric manner: some sectors respond to policies more rapidly than the other sectors resulting in an asymmetric impact. An assessment of the impact of policy changes on different sectors of the economy is of importance because

of the potentially divergent effects across sectors or enterprises within a sector. Because both region-specific features influence composition of output and composition of output affects sensitivity of a region to policy impact, an understanding of the regional level implications of macro level policy changes becomes important for policy makers at the regional level. The extent of variation in the sectoral composition of state economies is illustrated in Figure 4.1. The share of agriculture and allied sectors is high in relatively low income states as well as in high income states. For example, in states like Haryana and Punjab, two high income states, the share of agriculture and allied sectors is above 40 per cent just as it is so in the case of low income states of Bihar, Uttar Pradesh and Orissa. In states such as Maharashtra and Tamil Nadu, the high income states, the share of agriculture and allied sectors in GSDP in recent years has been below 25 per cent. The

Figure 4.1 The share of agriculture and allied sectors in GSDP (%) across states: Average for 2000–01 to 2004–05



Source: Authors' calculations based on EPW Research Foundation (2009) and RBI (2007).

contrast in the composition of the economy is also reflected in the classification of states we have adopted in this analysis. The share of agriculture and allied sectors in GSDP in the HPSEs is the lowest followed by the MPSEs and then LPSEs.

MODELLING POLICY IMPACT ON AGRICULTURE

A number of policies influence agricultural production by impacting on input use, investment or demand for agricultural products. For instance, liberalisation of international trade has a direct effect on agricultural prices. Reduction in input subsidies implies higher price for agricultural inputs. Incentives for agro-based industries are expected to increase demand for agricultural commodities; improved input supply system or better research and extension system for agriculture would reduce the cost of agricultural production; improved terms of trade for agriculture would increase investment in agriculture leading to increased production capacity. In this sense, the policy choices influence either the supply of agricultural output or its demand. Effectiveness of the policies can be measured by the response of agricultural output to various policy changes.

Two important areas that have an influence on the performance of agriculture and consequences for policy that have received relatively less attention in the past studies relate to efficiency in the utilisation of inputs in agriculture and the interstate or interregional variations in agricultural production. While the implications of improvements in technical efficiency in agricultural production are the same as those of improvements in technology, interregional variations in performance draw attention to the need for region-specific policies. Efficiency in production also provides a linkage between human capital dimensions of agricultural production management and productivity. Regional variations in input use efficiency provide one link between policies at the national level and their regional impact.

A number of studies have examined the impact of alternative policy choices relating to the reforms of economic policies, on agricultural

production and inputs. However, in empirical evaluations of the impact of alternative policies, often, the economy-wide setting is not utilised and the regional differences in the impact within the national setting are also not considered. The studies relating to the role of input use efficiency and regional dimensions of the impact are few. In the present study, we focus on the role of input use and efficiency of input use in influencing agricultural output both at the national and state level in response to changes in policies at the national level.

In the model developed and analysed by Kalirajan and Bhide (2003), an attempt was made to capture these two dimensions of analytical framework. The regional variations in agricultural output performance are captured primarily through the 'efficiency' of the states in transforming the inputs into crop output. The regional or state-level differences are captured in the frontier production function model for crop production.

The general specification which captures the regional dimension in agricultural production is provided in the flowing set of equations:

$$\text{Ln } q_i = a_{0i} + \sum_k a_{ij} \text{ Ln } X_{ij} + u_i \tag{4.1}$$

$$e_{ij} = b_{0j} + \sum_l b_l Y_{il} + v_{ij} \tag{4.2}$$

where

$$e_{kij} = (a_{kij}/a_{kj}^{*}) \tag{4.3}$$

$$a_{kj}^{*} = \max(a_{kij}) \text{ over } I = 1 \text{ to } n \text{ states} \tag{4.4}$$

$$X_{ki} = f(P_k/P, V1, V2, \ldots, Vm) \tag{4.5}$$

Ln = natural logarithmic operator.

In the above specification, output of *j*th crop in *i*th state (q_{ij}) is a function of a number of input variables (X_{kij}) and a set of varying coefficients (a_{kij}). The random varying coefficient model (RCM) implicit in the above input–output relationship (equation 4.1) provides the underpinning of the stochastic production frontier as well as a link between policies at the national level to the state level or regional

economies. The 'technical efficiency' interpretation underlying equation (4.3) allows us to estimate the impact of various policies and other exogenous factors to the state level production performance. In the model estimated in Kalirajan and Bhide (2003), only 'intercept coefficient' in equation (4.1) was found to vary significantly across states and hence the second stage equation (4.2) was applied only for this coefficient.

Among the input variables that may be considered are fertilisers, irrigation, mechanisation and rainfall. In the model applications reported here, the output variable was gross value of output per hectare of gross cropped area and the input variables were the four mentioned here and in addition included labour and the ratio of rice and wheat in the output of food grains. In the second stage (equation 4.2), the explanatory variables for the intercept coefficient included rate of literacy in rural areas, per capita NSDP from transport, storage and communications, ratio of output of food grain to non-food grain output and size of farm holding. The output, thus, becomes sensitive to a range of factors some of which are directly within the agricultural sector and some others are outside the sector but embedded in the overall economy.

The 'input' variables are estimated through equation (4.5) so that at the state level, input levels can be specified and output can be estimated using the production relationships provided in equations (4.1–4.2). The input equations (4.5) capture the influence of a number of factors at the national and state levels. These factors include the relative prices of food grain and non-food grain crops, investment in agriculture, procurement prices of rice and wheat and so on.

The model has been used to assess the impact of number of alternative scenarios that are expected to be important in the design of policies to sustain and accelerate the growth of agricultural output. Bhide and Kalirajan (2003) present a wide range of simulations of the model. The full model has been described in Kalirajan and Bhide (2003). In this chapter, we present the analysis of three alternative simulations of the model to illustrate the regional level impact of macroeconomic policies.

The scenarios examined below can be grouped into two broad categories: (*a*) policy measures that seek to influence agricultural output

directly and (*b*) policy measures seek to affect agricultural output by providing a more favourable overall macroeconomic environment. The specific simulations carried out within the broad categories are as follows:

1. Measures influencing agricultural output directly: increase in agricultural prices as a result of liberalisation of agricultural trade.
2. Measures that affect agricultural output indirectly *(a)* depreciation of the exchange rate of the rupee and *(b)* reduction in trade protection to manufacturing sector.

The various simulations of the model capture the impact of selected policy measures on agricultural output in a variety of ways. First, they may affect the efficiency of input use. Second, they may affect input use by influencing the price of input relative to price of output. Third, they may affect 'terms of trade' and influence investment in irrigation leading to output effects. In an economy-wide setting there are also the effects due to the interaction of supply and demand for agricultural output. The increase in agricultural output would imply lower agricultural prices unless there is also a corresponding increase in demand for agricultural output. The overall impact of the selected policy measures on agricultural output would also be influenced by their impact on the composition of crop output in terms of food grain and non-food grain output and in terms of state level variations in crop output response.

MEASUREMENT OF THE IMPACT OF POLICIES

The impact of alternative policies can be measured by comparing the results of the model *with the policy change* relative to the model results *without the policy change*. The latter results are also termed conventionally, the 'base run' or 'reference run' results of the model. The model can be solved for the simulation analysis either for the

future periods or 'within sample' or past time period. The within sample analysis provides an estimate of the impact if policies were implemented in the specified time period. If the impact is expected to vary in different time periods, both the analyses would be useful. In the present study, we have restricted the analysis to the 'within sample' simulations. The base run scenario is the period 1975–76 to 1990–91. We have preferred the 'within sample' simulations as the values of exogenous variables for the in-sample simulations are readily available, whereas for the future projections, the exogenous variables would have to be separately projected. Secondly, a comparison of the impact for selected variables over a period of time does not indicate significant variation in the results for different time periods.

A second aspect of the measurement of the impact of policy changes is the dynamics of the impact. For instance, a specific policy change has an initial impact on a number of variables but these variables in turn may impact on each other or other variables to produce subsequent rounds of impact over time. Thus, there are the 'short-run' and the 'long-run' impacts. In the present study, the model is solved with the policy change in each of the years in the reference period 1975–76 to 1990–91. The 'average' impact for the entire period, thus, includes both the short-run and the long-run impacts.

The Initial Conditions

The simulations of the model provide an assessment of the impact of alternative scenarios of policy on the endogenous variables of the model. Due to the interaction between variables or non-linear relationships among the variables, the impact is a function of the levels of variables also. The main variables whose initial levels are of importance in assessing the impact of alternative simulations are *(a)* those affecting general efficiency in agricultural production and *(b)* the proportion of irrigated area out of gross crop area. Hence, the initial conditions of these variables are important in assessing the level of impact of alternative scenarios. With this in view, we discuss the initial conditions of selected variables that are useful in examining the model simulation results.

State-level variations in the levels of rural literacy are shown in Table 4.1 for the census years of 1971, 1981 and 1991. In 1971, the rural literacy rate was the lowest in Rajasthan (16.44 per cent) and the highest in Kerala (68.54 per cent). In 1991, the lowest rate of rural literacy was still in Rajasthan and the highest in Kerala (88.92 per cent) although, Rajasthan's rural literacy rate increased by about 85 per cent over the 20 year period. The bottom three states in terms of rural literacy rate were Rajasthan, Madhya Pradesh and Bihar in 1971. The top three states (in ascending order) were Maharashtra, Tamil Nadu and Kerala in 1971. The same pattern has continued in 1991 as well. The literacy rates have improved over the years but the difference across the states has widened.

Variations in transportation infrastructure (per capita NSDP from Transport, Storage and Communications in 1980–81 prices) across

Table 4.1 Rural literacy (%) across states

State	*1971*	*1981*	*1991*
Andhra Pradesh	22.3	26.5	35.7
Assam	31.3	38.7	49.3
Bihar	20.1	26.0	33.8
Gujarat	33.3	41.5	53.1
Haryana	25.9	35.1	49.9
Kerala	68.5	77.6	88.9
Karnataka	29.5	35.6	47.7
Madhya Pradesh	20.1	24.6	35.9
Maharashtra	36.1	43.5	55.5
Orissa	28.1	35.7	45.5
Punjab	32.0	39.9	52.8
Rajasthan	16.4	21.0	30.4
Tamil Nadu	37.0	43.5	54.6
Uttar Pradesh	21.3	26.7	36.7
West Bengal	30.6	37.9	50.5
State with maximum literacy	Kerala	Kerala	Kerala

Source: Based on Bhide and Kalirajan (2003).

Table 4.2 Per capita NSDP from transport, storage and communications (Rs, 1980–81 prices) across states

State	*1971*	*1981*	*1991*
Andhra Pradesh	44.0	63.0	79.5
Assam	24.9	33.3	64.3
Bihar	19.4	23.5	25.0
Gujarat	41.8	70.8	181.2
Haryana	44.8	73.4	148.0
Kerala	38.5	55.5	110.3
Karnataka	38.8	54.8	85.0
Madhya Pradesh	26.8	37.5	45.6
Maharashtra	89.4	116.6	176.8
Orissa	14.6	19.1	33.3
Punjab	23.2	38.1	60.1
Rajasthan	52.1	63.0	91.0
Tamil Nadu	123.9	131.3	189.3
Uttar Pradesh	52.5	75.6	106.6
West Bengal	22.2	26.0	43.0
State with maximum per capita NSDP from TSC	Tamil Nadu	Tamil Nadu	Tamil Nadu

Source: Based on Bhide and Kalirajan (2003).

the states are indicated in Table 4.2. As in the case of literacy the extent of variation in transportation infrastructure on per capita basis is significantly large across the states. The states of Orissa, Bihar and West Bengal had the lowest per capita TSC in 1971. In 1981 as well as in 1991, the same three states were at the bottom of the list of 15 states. Tamil Nadu, Maharashtra and Uttar Pradesh were the top three states in 1971 and 1981. But in 1991, Maharashtra, Gujarat and Tamil Nadu are the three top states in terms of per capita TSC.

The estimates of general efficiency in agricultural production for three periods at the state level are presented in Table 4.3. Averages for three years, rather than a specific year are presented for comparison. For the period TE 1972 (TE = three year period

ending in) Maharashtra has the lowest level of efficiency (63.58 per cent) whereas Tamil Nadu has the highest efficiency (97.54 per cent). The three states at the bottom of the list of 15 states in terms of general efficiency are Maharashtra, Bihar and West Bengal in TE 1972; Bihar, West Bengal and Madhya Pradesh in TE1982 and Bihar, Madhya Pradesh and Maharashtra in TE 1992.

The three states with the highest levels of general efficiency were Assam, Kerala and Tamil Nadu in TE 1972; Tamil Nadu, Kerala and Assam in TE 1982 and Tamil Nadu, Punjab and Kerala in TE 1992. Thus, the impact of factors influencing efficiency is likely to be greater in the states of Maharashtra, Bihar, West Bengal and Madhya Pradesh where the level of efficiency is relatively lower during the early years of the simulation period. However, it may be noted that general efficiency is lower in these states even in TE 1992 suggesting the general pattern would hold even for the more recent period.

Table 4.3 Estimated general efficiency (% to potential) across states

State	*TE 1972*	*TE 1982*	*TE 1992*
Andhra Pradesh	80.8	69.8	58.1
Assam	89.8	93.9	78.5
Bihar	73.8	61.1	61.3
Gujarat	77.7	79.2	72.5
Haryana	87.5	77.0	72.8
Kerala	95.4	91.4	93.7
Karnataka	81.4	74.8	71.0
Madhya Pradesh	78.2	67.7	72.7
Maharashtra	63.6	75.0	92.2
Orissa	77.1	79.5	81.1
Punjab	83.7	80.6	86.3
Rajasthan	81.9	70.6	74.9
Tamil Nadu	97.5	86.6	69.8
Uttar Pradesh	80.6	75.9	73.7
West Bengal	74.5	66.3	84.9
State with maximum general efficiency	Tamil Nadu	Assam	Kerala

Source: Based on Bhide and Kalirajan (2003).

Table 4.4 presents the percentage of irrigated area out of gross cropped area in the 15 states for three selected periods of TE 1975, TE 1980 and TE 1992. The initial level of the ratio of irrigated area to gross crop area affects the response of fertiliser consumption to changes in relative price of fertiliser: higher the irrigated area relative to total area, lower is the elasticity of fertiliser consumption with respect to price of fertiliser relative to output price.

The proportion of irrigated area is the lowest in Madhya Pradesh, Maharashtra and Karnataka in TE 1975 and TE 1980. The proportion is the lowest in Maharashtra, Kerala and Madhya Pradesh in TE 1992. The states of Uttar Pradesh, Punjab and Haryana are among the top four states in terms of irrigated area as a proportion of gross crop area in TE 1975, TE 1980 and TE 1992. In other words, the impact of a change in fertiliser price on fertiliser consumption is likely to be greater in

Table 4.4 Gross irrigated area as % of gross cropped area across states

State	*1971*	*1981*	*1991*
Andhra Pradesh	34.0	36.6	41.4
Assam	17.7	18.8	23.2
Bihar	28.5	33.5	42.0
Gujarat	17.5	23.1	30.9
Haryana	50.8	59.8	80.4
Kerala	23.2	16.6	18.7
Karnataka	14.8	16.6	24.6
Madhya Pradesh	8.7	11.9	22.1
Maharashtra	10.4	12.4	16.4
Orissa	18.5	21.1	28.2
Punjab	56.7	56.1	62.3
Rajasthan	18.4	24.2	29.3
Tamil Nadu	38.7	41.1	39.5
Uttar Pradesh	37.4	41.9	65.4
West Bengal	17.2	20.8	37.3
State with maximum gross irrigated area as % of gross cropped area	Punjab	Haryana	Haryana

Source: Based on Bhide and Kalirajan (2003).

the states of Maharashtra, Madhya Pradesh and Karnataka where the percentage of irrigated area out of gross cropped area is lower among the 15 states considered in this study. The impact is likely to be less in the states of Punjab, Haryana and Uttar Pradesh.

Agricultural Prices and Supply Response (Trade Liberalisation)

A number of previous studies in the context of liberalisation of agricultural trade policies have pointed to the 'disprotection' provided to Indian agriculture. The disprotection is, however, not uniform across the crops, and in some important cases, the studies have estimated positive rates of protection. In terms of broad implications of a more liberal trade regime for agriculture, this would imply higher domestic prices where there is disprotection and lower prices, where there is protection. The price changes in turn will induce changes in crop output and could increase aggregate crop output if agriculture is initially 'disprotected'. The model developed in the present study could be used to examine the extent of supply response if agricultural prices increase as a result of trade liberalisation in agriculture. As trade liberalisation at the crop level cannot be examined in the present model, we have considered only the impact of changes in overall crop prices. In Scenario 1, crop prices of all the three crop groups are increased by 5 per cent over the base run. In this sense, we are not considering any specific sequence of liberalisation but merely assessing the extent of supply response if agricultural prices were to increase as a result of trade liberalisation in agriculture.

The simulation Scenario 1 we recognise that the agricultural export supply functions incorporated in the model do not capture the trade environment resulting from trade liberalisation. In the case where the crops are 'disprotected', liberalisation would raise domestic prices. But, in the export market, the non-price restrictions would also be liberalised so that exports can increase at the prevailing export prices. As the implicit 'tax' on agricultural exports has not been incorporated in the estimation of the export functions, it is not possible to use the estimated export equations to simulate the effect of removal of an implicit 'export tax' on exports. Instead, we assume that the export market would absorb

the 'excess supply' of crop output at the higher prices. The crop prices are specified as exogenous variables (in effect determined in the world market). As we have not explicitly modelled exports, the impact on current account deficit has also not been modelled in this simulation. Secondly, the increased domestic crop prices would also mean higher prices for the grains procured by the government. Higher market prices also increase the demand for PDS sales increasing subsidies on PDS. The PDS is likely to require strengthening and improved targeting of population segments when agricultural prices, particularly food grain prices, increase. In general, food subsidies are expected to be higher with the extent of the increase depending on the targeting or coverage under the PDS. In the present analysis, we restrict the model such that the changes in subsidy levels do not affect the budgetary imbalance and hence in turn influence overall prices.

The main features in the current application of the model, thus, are: (*a*) crop prices are exogenously specified, (*b*) agricultural exports are determined as residuals or the excess supply at the prevailing domestic prices and (*c*) changes in current account deficit or subsidies do not affect money supply. The restrictions imply that the model simulates only the supply response of agriculture to changes in crop output prices.

The national level impact of the increase in agricultural prices by 5 per cent for all the crop groups is summarised in Table 4.5. The state level impact is summarised in Table 4.5a.

National Level Results

The increased agricultural price leads to a rise in the price of crop output relative to the inputs such as fertiliser and tractors, leading to increased application of fertilisers and tractors. Crop yields improve as fertiliser consumption and tractors per hectare of crop area increase. Higher crop prices and higher crop yields imply improved barter terms of trade in favour of agriculture and investments resulting in increased irrigated area. The rise in irrigated area leads to the second round effects on fertiliser consumption and purchase of tractors enhancing the previous increase in crop yields. The rise in irrigated area also leads to changes in the crop output mix by raising the ratio of rice and wheat within food grains. The ratio of non-food grain output to food grain output turns in

Table 4.5 Estimated national level impact of selected simulations

Variable	*Simulation 1: Increase in Crop Prices*	*Simulation 2: Depreciation of the Exchange Rate*	*Simulation 3: Reduction in Tariff on Manufactured Products*
	% Change Over the Base Level		
Crop output (quantity)			
Rice and wheat	2.17	0.02	0.38
Other food grain	1.59	−0.13	0.13
Total food grain	1.87	−0.03	0.27
Non-food grain	1.80	1.02	0.12
All crops	1.84	0.40	0.21
Value added from all crops	1.60	0.36	0.18
Prices			
Rice and wheat	5.00	0.23	−0.22
Other food grain	5.00	0.20	−0.15
Total food grain	5.00	0.22	−0.20
Non-food grain	5.00	0.95	−0.35
All crops	5.00	0.71	−0.30
Inputs			
Fertiliser (quantity)	4.86	0.60	−0.20
Tractor purchases (numbers)	28.27	1.86	12.69
Irrigated area	0.68	0.07	0.23
Gross cropped area	0.10	0.01	0.03
Crop yield per hectare	1.66	0.38	0.16
Government operations in food grains			
Procurement (quantity)	–	−0.21	0.23
Distribution (quantity)	1.53	0.09	−0.10
Stocks (quantity)	0.00	−0.81	0.39
Procurement price	0.00	0.11	−0.09
Trade			
Crop exports ($value)	–	8.48	0.47
Crop imports ($value)	–	4.82	−0.19

(Table 4.5 continued)

(Table 4.5 continued)

Macroeconomic indicators			
Overall GDP (real)	0.71	0.17	0.21
M3 (nominal)	0.00	0.40	−5.13
CPI based inflation rate	0.04	0.05	−0.35

Source: Bhide and Kalirajan (2003).

Table 4.5a State-level impact of increase in crop output prices by 5%: Percentage change in selected variables over the base, Simulation 1: Increase in crop prices

State	*Fertiliser Consumption (quantity)*	*Tractor Purchases (numbers)*	*Tractor Stock (number)*	*Efficiency (ratio)*	*Crop Yield (value per hectare)*	*Crop Output (value)*
Andhra Pradesh	4.48	27.90	9.59	–0.014	1.66	1.82
Assam	5.82	27.96	5.76	–0.003	1.70	1.89
Bihar	5.03	26.18	7.97	–0.019	1.66	1.80
Gujarat	5.17	27.89	6.54	–0.006	1.61	1.80
Haryana	3.99	29.33	9.76	–0.008	1.56	1.79
Karnataka	5.59	25.42	6.16	–0.008	1.68	1.85
Kerala	6.31	24.85	6.69	–0.006	1.86	1.95
Madhya Pradesh	6.46	28.06	9.62	–0.013	2.06	2.29
Maharashtra	6.35	26.62	7.24	–0.009	1.91	2.08
Orissa	5.44	27.10	7.71	–0.014	1.74	1.88
Punjab	3.70	29.52	8.49	–0.006	1.44	1.66
Rajasthan	5.02	29.04	7.85	–0.007	1.66	1.87
Tamil Nadu	3.93	25.36	7.30	–0.004	1.42	1.60
Uttar Pradesh	4.55	27.83	8.50	–0.017	1.59	1.76
West Bengal	5.65	26.90	4.48	–0.016	1.56	1.71
All 15 States	4.86	28.27	8.26	–0.009	1.66	1.84

Source: Bhide and Kalirajan (2003).

favour of food grain as their price ratio remains unchanged relative to the base run. Thus, although all crop prices rise by the same proportion, crop output composition changes because of the variation in the response of crop output to changes in agricultural investments (irrigation).

Crop yield increases by 1.66 per cent over the base run but general efficiency declines marginally (–.01 per cent) due to the adverse crop diversification effect. The decline in the ratio of non-food grain output to food grain output implies a reduction in value of output per hectare in constant prices.

The model does not estimate the impact of increased output on crop exports and imports but provides an estimate of the increase in demand for PDS issues of 1.53 per cent over the base run. As the PDS demand increases, with the selling prices for PDS constant, the subsidies on food are estimated to increase by 3.77 per cent. Fertiliser subsidy increases by 4.68 per cent as fertiliser consumption increases. The central government's budget and fiscal deficit increase.

The model simulation shows that for an increase in agricultural prices by 5 per cent crop output increases by 1.84 per cent. Nearly all the increase in crop output is from increased application of inputs, with a small proportion coming from increased crop area. The crop diversification effect is negative as the ratio of food grain output to non-food grain output increases. Impact on the other sectors in the economy is only partially covered in the present model. As crop prices increase, there is an increase in overall price level which depresses consumption demand and hence lower utilisation of capacity in the manufacturing sector. Impact of the rise in agricultural income on the demand for non-agricultural output is not captured in the present simulation. The overall real GDP increases by 0.71 per cent but real GDP from manufacturing is seen to decline by 0.01 per cent as a result of higher rate of inflation.

As demand for non-agricultural sectors may rise due to higher agricultural income the overall effect on GDP is underestimated in the present simulation. The simulation also does not allow for changes in the relative prices of different crops. If, for instance, crop prices change in favour of price of rice and wheat, the share of food grains in crop output would increase more than indicated in the present simulation.

State-level Results

The state-level variations in fertiliser consumption, purchase of tractors, general efficiency, crop yield and crop output, summarised

in Table 4.5a, show that the state where the increase in crop output is the highest is Madhya Pradesh followed by Maharashtra and Kerala. The impact is the lowest in Tamil Nadu followed by Punjab and West Bengal. This pattern is a reflection of the response of fertiliser consumption to changes in the price of fertiliser relative to crop prices. In other words, as crop prices increase relative to the fertiliser price, fertiliser consumption increases the most in the states with relatively lower irrigation coverage. Thus, fertiliser consumption increases in the states of Madhya Pradesh, Maharashtra and Assam relatively more than in the states of Tamil Nadu, Punjab and West Bengal.

The demand for the purchase of tractors increases sharply by 28.27 per cent over the base run at the national level. The rise in the purchase of tractors is the combined effect of the increase in the price of crop output relative to the price of tractors, increase in irrigated area and the increase in crop output due to the increase in fertiliser consumption. The sharp increase in tractor purchases is the result of highly price elastic demand. While the short-term price elasticity is 1.69, the long-term elasticity is about 6.0. The relatively large price elasticity is partly the result of sharp increase in the purchase of tractors from a low base. Increase in the percentage increase in the purchase of tractors under Scenario 1 is the largest in Bihar, Punjab and Haryana and the least in Kerala, Tamil Nadu and Karnataka. The larger increase in the case of Bihar, Punjab and Haryana is related to the higher proportion of irrigated area out of the gross cropped area. Over time, the shares of Punjab, Haryana and Bihar in the total irrigated area in the country as a whole are estimated to decrease, with the decline in the case of Bihar being slower than in the other two states. Hence the impact of relatively higher irrigated area in Bihar results in larger increase in demand for tractors.

The crop output increase is the largest in Madhya Pradesh, Maharashtra and Kerala largely following the pattern of fertiliser consumption increase. The impact on crop output is the least in Tamil Nadu, Punjab and West Bengal following the pattern of increase in crop yield per hectare. The impact of increase in crop prices at the state level is, therefore, affected by the variations in the production conditions at the state level. Variation in the response of input application to

changes in relative prices of inputs is a key factor in explaining the difference in the impact among the states. The present model does not imply differences in production response to input application but it does indicate differences in input use as a result of differences in production conditions. The increase in agricultural prices generally is seen to affect consumption of current inputs such as fertiliser more in the states with lower extent of irrigation but the demand for durable inputs such as tractors is affected more when the extent of irrigation is greater.

Policy Measures Influencing Agricultural Output Indirectly

Input use and the choice of output mix in agriculture are affected by a number of policy measures that may not be directly related to agriculture. Policies that affect terms of trade between agriculture and the other sectors can influence intersectoral flow of resources and hence, affect production. Some of the policies may have differential impact on different crops depending upon the variations in price-support mechanisms or trade policy variations across the crop groups. For example, considerations of food security may have led to more restrictive trade regime for food grains than in the case of non-food grains/crops. Similar considerations have also led to government operations in food grain procurement and distribution at prices that are fixed by policy, unlike the case of non-food grain crops. Thus, in a broad sense, the impact of policies at the macro level or outside of agriculture may affect agriculture differently from the other sectors and they may also affect food and non-food grain crops differentially. In simulation Scenario 2, we examine the impact of a depreciation of the rupee and in simulation Scenario 3, the impact of a reduction in tariff rate on the imports of manufactured products is examined.

Devaluation of the Rupee

The exchange rate variations affect agricultural sector through their impact on output prices and on the input prices. The transmission of the effect is, however, influenced by the restrictions on international

trade and by rigidities in price adjustments. For example, fixed fertiliser prices at the subsidised levels are not affected by exchange rate variations unless the fertiliser prices are varied through policy measures. The trade restrictions in the case of food grains imply that price response to exchange rate variations in the case of non-food grains is likely to be greater than in the food grains. The estimated price equation for non-food grains includes exchange rate as an explanatory variable, whereas in the equations for rice, wheat and 'other food grains', exchange rate is not included as an explanatory variable. Nominal exchange rate also influences price of the manufactured products such that a depreciation of the rupee increases the price of manufactured products (PM). Thus, a depreciation (or appreciation) of the nominal exchange rate produces asymmetric impact across sectors depending upon the trade regime faced by each sector. In the present model, price of non-food grain crops and price of manufactured products increase relative to the price of food grain as a result of a depreciation of the rupee. The resulting changes in crop output reflect the altered pattern of price incentives to the producers.

National Level Results The aggregate or national level results of the simulation SIMER, where exchange rate of the rupee is depreciated by Rs 0.5 per US dollar relative to the base run are summarised for the national level in Table 4.5. First consider the price scenario resulting from the exchange rate depreciation. Price of non-food grains increases by 0.95 per cent whereas the price of food grains increases by only 0.22 per cent. Price of manufactured products increases by 0.50 per cent. The changes in relative prices produce a corresponding output effect. Output of food grains decreases by 0.03 per cent on account of the decline in the output of 'other food grains' by 0.13 per cent. The non-food grain output increases by 1.02 per cent. The output of rice and wheat increases marginally (+.02 per cent) primarily due to the increase in irrigated area that raises the share of rice and wheat in food grain output. Although the rise in irrigated area relative to gross cropped area implies a reduction in the ratio of non-food grain to food grain output, the positive impact of the rise in non-food grain prices dominates the negative effect of irrigation expansion on non-food grain production.

Irrigated area increases by 0.07 per cent as compared to a smaller increase of 0.01 per cent in gross cropped area. Increase in irrigated area is a result of improved terms of trade as price of manufactured products increases by 0.50 per cent as compared to the increase in crop prices by 0.70 per cent. The relatively higher increase in crop prices also induces higher demand for tractors (+1.86 per cent) and fertiliser consumption (+0.60 per cent). Aggregate crop yield increases by 0.38 per cent and general efficiency increases by 0.14 per cent. The rise in efficiency is the 'crop diversification effect' as the ratio of non-food grain to food grain output increases.

Crop exports increase along with imports of agricultural commodities. Exports rise as price of exports in rupee terms increases relative to the domestic price. As domestic prices also increase, imports rise. Procurement of food grains by the government is projected to decrease, as the increase in procurement price (0.11 per cent) is lower relative to the increase in the market price of rice and wheat (0.23 per cent). Distribution through PDS increases by 0.09 per cent and the food grain stocks with the government decrease by 0.81 per cent. Thus, depreciation of the rupee is projected to result in higher agricultural prices and increased crop output. However, crop output mix is projected to change with larger proportion of non-food grain output than in the base run. With lower procurement and larger distribution through PDS, supplies of food grain with the government are likely to be smaller. Thus, in the longer run better targeting of PDS is important.

The manufacturing sector shows a marginal change in output as a result of depreciation of the rupee. Although fixed investment increases modestly, there is a drop in employment as nominal wage rate increases. Real GDP from manufacturing of the organised sector increases marginally by less than 0.01 per cent. The overall real GDP increases by 0.17 per cent.

The impact of rupee depreciation is projected to be favourable to the current account deficit, which is projected to decrease by about 7 per cent. Thus, although domestic prices increase, the rise in export prices is relatively larger leading to increase in export earnings. The overall results suggest that agricultural production is likely to benefit

from exchange rate depreciation more than the manufacturing sector especially when some of the input prices remain insulated from the effect of exchange rate changes.

State Level Results The state level results in Table 4.5b show that the crop diversification effect is the largest in Bihar (efficiency improves by 0.30 per cent), followed by Uttar Pradesh (0.28 per cent) and West Bengal (0.26 per cent). It is the least in the states of Assam (0.04 per cent), Tamil Nadu (0.06 per cent), Gujarat (0.09 per cent) and Kerala (0.09 per cent). The pattern across the states is a result

Table 4.5b State-level impact of depreciation of exchange rate by 5%: Percentage change in selected variables over the base, Simulation 2: Depreciation of the exchange rate

State	*Fertiliser Consumption (quantity)*	*Tractor Purchases (numbers)*	*Tractor Stock (number)*	*Efficiency (ratio)*	*Crop Yield (value per hectare)*	*Crop Output (value)*
Andhra Pradesh	0.55	1.92	0.85	0.22	0.43	0.45
Assam	0.73	1.67	0.45	0.04	0.26	0.27
Bihar	0.63	1.92	0.75	0.30	0.51	0.53
Gujarat	0.64	1.73	0.53	0.09	0.30	0.31
Haryana	0.47	1.87	0.81	0.13	0.31	0.34
Karnataka	0.73	1.67	0.52	0.12	0.34	0.35
Kerala	0.80	1.64	0.57	0.09	0.33	0.34
Madhya Pradesh	0.80	1.93	0.87	0.21	0.47	0.50
Maharashtra	0.82	1.78	0.63	0.14	0.39	0.41
Orissa	0.70	1.90	0.69	0.22	0.45	0.47
Punjab	0.42	1.82	0.68	0.10	0.26	0.28
Rajasthan	0.61	1.81	0.64	0.11	0.31	0.33
Tamil Nadu	0.47	1.56	0.59	0.06	0.22	0.24
Uttar Pradesh	0.54	1.99	0.77	0.28	0.47	0.50
West Bengal	0.71	1.91	0.40	0.26	0.47	0.49
All 15 States	0.59	1.86	0.70	0.14	0.38	0.40

Source: Bhide and Kalirajan (2003).

of the initially low levels of efficiency in Bihar, Uttar Pradesh and West Bengal and the relatively high levels of general efficiency in Assam, Tamil Nadu, Gujarat and Kerala. Thus, changes in cropping pattern are likely to result in greater impact on the crop output in those states where crop yield is relatively low for the same levels of input use. As level of efficiency is already at a high level in the states of Assam, Kerala, Tamil Nadu and Gujarat, the change in cropping pattern does not increase efficiency as much as in the states with lower initial levels of general efficiency.

The pattern of changes in fertiliser consumption and demand for tractors broadly follows the pattern noticed when all agricultural prices were increased under SIMPA. The percentage increase in fertiliser consumption is the highest in Maharashtra, Madhya Pradesh and Kerala where irrigated area as a proportion to gross cropped area is the least; the increase is the smallest in Punjab, Haryana and Tamil Nadu where the coverage of crop area under irrigation is greater. The rise in purchase of tractors is the highest in Uttar Pradesh, Madhya Pradesh and Andhra Pradesh and the least in Tamil Nadu, Kerala and Assam. A combination of patterns of initial levels of irrigation (which influence demand for tractors positively) and the changes in general efficiency produced by exchange rate depreciation influences state level variation in demand for tractors. The efficiency gains are among the largest in Uttar Pradesh and Andhra Pradesh. And they are among the least in the case of Tamil Nadu, Kerala and Assam. In the case of Madhya Pradesh and Andhra Pradesh, the ratio of irrigated area to total crop area is relatively higher than the states with similar increases in efficiency. Bihar, Madhya Pradesh and Uttar Pradesh are projected to record the largest percentage gains in crop output as a result of rupee depreciation. The impact is the smallest in percentage terms for Tamil Nadu, Assam and Punjab.

Reduction in Tariff Rate Manufacturing Imports

The package of economic reforms of the early 1990s saw sustained and significant decrease in the tariff rates on the manufactured products. The period also saw sharp devaluation of Indian rupee. The reduction in import tariffs reduced protection afforded by trade policy to the manufacturing sector. This has meant a cap on manufactured product

prices and hence improved terms of trade for agriculture. How strong could be this effect? The model developed in the present study was used to estimate the effect of lower import tariffs of manufacturing sector on agricultural sector's output and related variables. It should be noted at the outset that the actual reduction in tariff rates has followed a fairly complex selection, reclassification and sequencing of items and rates over a period of time. The simulation carried out here is at the aggregate level.

National Level Results Table 4.5 also provides the impact of simulation Scenario 3 on the national level aggregates. As noted earlier, reduction in import tariffs lowers the cap on the manufactured product prices. In terms of estimated equation for price of manufacture products, lower import tariff rate actually implies a reduction in the price of manufactured products. The manufactured product prices are estimated to decrease by 2.5 per cent when import tariff rate is reduced by 10 per cent. The lower manufacturing product prices lead to an improvement in terms of trade for agriculture which in turn causes rise in irrigated area. Demand for tractors is projected to rise by 12.69 per cent, as there is an increase in irrigated area as well as a rise in the relative price of crops vis-à-vis price of tractors. In the model, price of tractors is linked to the price of manufactured products and hence when price of manufactured products decreases, price of tractors also decline.

Crop prices, at the aggregate level, decrease by 0.30 per cent as crop output increases by 0.21 per cent. Crop output increases following the increased irrigated area and increased stock of tractors. Fertiliser consumption, however, decreases by 0.20 per cent over the base run as fertiliser price is held fixed while crop prices decrease. Increase in food grain output (0.27 per cent) is greater in percentage terms than in the non-food grain output (0.12 per cent). The differential impact on output is a result of the difference in the impact of higher irrigated area on the output of rice and wheat relative to other food grains and on food grain output relative to non-food grain output. Because of the decline in manufactured product price, the procurement price of rice and wheat is also projected to decline by 0.09 per cent over the base run scenario.

As the ratio of food grain output to non-food grain output increases, level of general efficiency decreases by 0.02 per cent. Crop yield increases by 0.16 per cent as irrigated area and tractor purchases increase. As a consequence of higher crop output, particularly of food grains, procurement of food grains by the government increases by 0.23 per cent and distribution through PDS decreases by 0.10 per cent leading to a rise in food grain stock with the government by 0.39 per cent. Agricultural exports increase by 0.47 per cent and imports decrease by 0.19 per cent.

The manufacturing sector output increases as a result of higher employment resulting from lower nominal wage rates. Investment demand is projected to be lower as the manufactured product prices decrease but output increases in the organised sector by 0.46 per cent over the base run. Overall real GDP is projected to increase by 0.21 per cent. Both food and fertiliser subsidies are projected to decrease. Thus, the reduction in trade protection given to the manufacturing sector can be beneficial to agriculture when it results in improved terms of trade for agriculture. The impact could be greater if the additional crop output could be absorbed without the adverse price effect which in turn limits the impact on input demand.

The State Level Results The state level results are summarised in Table 4.5c. The variation in the impact at the state level is related to the differences in the impact on demand for tractors, demand for fertilisers and on general efficiency. Fertiliser demand is projected to decrease the most in percentage terms in Madhya Pradesh, Maharashtra and Kerala as these are the states with relatively lower coverage of crop area under irrigation. The states where the decrease in fertiliser consumption is the least are Haryana, Punjab and Tamil Nadu where the coverage of crop area under irrigation is relatively high. In the case of fertiliser consumption, irrigated area is negatively related to the elasticity with respect to fertiliser price: higher the irrigation coverage, lower is the price elasticity. Although fertiliser consumption is positively related to irrigation, there is a negative relationship between price response and irrigated area. But in the case of demand for tractors, irrigated area is

Table 4.5c State-level impact of decrease in tariff rate of manufactured imports by 5% points: Percentage change in selected variables over the base, Simulation 3: Reduction in tariff on manufactured products

State	*Fertiliser Consumption (quantity)*	*Tractor Purchases (numbers)*	*Tractor Stock (number)*	*Efficiency (ratio)*	*Crop Yield (value per hectare)*	*Crop Output (value)*
Andhra Pradesh	–0.17	12.43	3.08	–0.03	0.20	0.24
Assam	–0.30	12.63	1.93	–0.01	0.12	0.17
Bihar	–0.20	11.54	2.56	–0.04	0.15	0.18
Gujarat	–0.24	12.61	2.18	–0.01	0.14	0.20
Haryana	–0.02	13.30	3.22	–0.02	0.24	0.32
Karnataka	–0.28	11.15	1.99	–0.02	0.11	0.16
Kerala	–0.34	10.60	2.08	–0.01	0.11	0.14
Madhya Pradesh	–0.39	12.33	3.04	–0.03	0.16	0.22
Maharashtra	–0.35	11.59	2.30	–0.02	0.12	0.17
Orissa	–0.25	11.87	2.48	–0.03	0.14	0.17
Punjab	–0.07	13.48	2.86	–0.01	0.22	0.29
Rajasthan	–0.26	13.21	2.63	–0.01	0.17	0.23
Tamil Nadu	–0.15	11.32	2.39	–0.01	0.17	0.23
Uttar Pradesh	–0.15	12.35	2.76	–0.04	0.17	0.22
West Bengal	–0.28	11.97	1.50	–0.04	0.06	0.10
All 15 States	–0.20	12.69	2.71	–0.02	0.16	0.21

Source: Bhide and Kalirajan (2003).

positively related to demand for tractors and does not influence price elasticity of tractor demand directly. Increase in the purchase of tractors is the steepest in percentage terms in Punjab, Haryana and Rajasthan.

The decline in general efficiency as a result of reduction in crop diversification is greater in the states with already lower levels of efficiency: Bihar, Uttar Pradesh and West Bengal. The decline is the least in the case of Assam, Tamil Nadu and Gujarat. Crop output increases the most in percentage terms in the states of Haryana, Punjab and Andhra Pradesh and the least in the states of West Bengal, Kerala and Karnataka.

IMPLICATIONS OF THE FINDINGS

The role of crop output prices in increasing agricultural output has been debated in the development literature extensively. More recent studies point to the impact of higher agricultural prices on investment in agriculture and the subsequent effects on agricultural growth. While higher agricultural prices induce higher output, they also have an adverse effect on consumption. The impact of initial increase in crop output prices on crop output may be reduced by lower consumption demand subsequently unless there are other sources of demand for the increased output.

Subsidised Public Distribution System props up consumption in the face of higher crop prices for selected crops. This is particularly so when higher crop prices result from increased support prices for agricultural products. However, the restrictions on agricultural trade which result in an implicit tax on agricultural output point to another source of improved price for agricultural output without the accompanying decline in consumption demand when trade restrictions are lowered. While domestic consumption demand may decrease as crop prices rise, it is important that export demand for agricultural output absorbs the increased output. The impact of lowering trade restrictions on agricultural output would depend on the extent of disprotection afforded to agriculture in the pre-liberalisation trade regime.

Macroeconomic policies such as those relating to exchange rate and fiscal balance influence different sectors in the economy differently depending on the flexibility for adjustment at the sector level. The flexibility of the sector is reflected in the variation in its price response to the overall shock. The differential impact on prices across sectors leads to the 'terms of trade' effect that influences the use of inputs in agriculture supplied by the manufacturing sector. As price of agricultural output varies relative to the price of manufactured products, input use in agriculture is affected. Improvement in terms of trade, thus, implies more intensive use of inputs and hence larger agricultural output. Intersectoral linkages, therefore, influence the transmission of changes in macroeconomic parameters to the sectoral level.

Results of the analysis presented here show that depreciation of the rupee is likely to benefit agriculture relative to manufacturing as crop exports respond to the rise in export price and non-food grain prices respond relatively more than the food grain prices. As the price of one of the key inputs, viz. fertiliser, remains fixed, higher crop prices result in more intensive use of inputs. In the case of manufacturing sector, depreciation implies higher input prices along with higher exports. The higher prices of manufactured products affect consumption demand adversely. However, the rise in manufactured products stimulates fixed investment leading to a marginal increase in the output of the manufacturing sector. Thus, while both agricultural and manufacturing outputs increase, the rise in agricultural output is relatively greater than in the case of manufacturing.

Reduction in the tariff rate for the imports of manufactured products results in a decrease in the domestic price of manufactured products. Reduction in the price of manufactured products implies lower price of inputs in agriculture that are produced in the manufacturing sector. As agricultural prices are unaffected, improved terms of trade lead to an increase in the use of inputs in agriculture and hence an increase in output.

Crop output composition is of policy relevance due to the issue of food security. How would different policies affect the composition of output? In the model outlined in this chapter, an attempt has been made to differentiate crop output in terms of three groups: rice and wheat, other food grains and non-food grains. There are two basic mechanisms by which the crop output composition is influenced in the present model: *(a)* by the difference in the response of prices of different crop groups to various shocks and the subsequent response of output ratios to price changes; *(b)* response of crop output composition to changes in the production conditions reflected in access to irrigation.

The pattern resulting from alternative policy changes is a complex one given the role of regional variations in output response and the variation in the price response of crops to output changes which in turn influence crop-mix. The ratio of rice and wheat increases relative to other food grains in all the simulations except in the case when there is an improvement only in physical infrastructure. The ratio of food

grain output to non-food grain output decreases in a number of cases both when total crop output increases and when it decreases.

The relative changes in output growth are a function of a number of factors. At the regional or state level, change in the relative price of crop groups is a critical determinant of crop mix. However, changes in irrigated area can also have a direct influence on crop mix apart from the influence induced through price changes. At the aggregate or national level, accumulation of the regional variations in output response to other factors becomes a significant channel of the impact.

When policy changes influence crop prices first, then the resulting pattern of output depends on how the prices are affected. That is, for instance, when there is exchange rate depreciation, the prices of non-food grain are affected more than the others.

Any generalisation of the impact of policy changes on the crop mix is difficult. For some specific policies, the model results indicate that *(a)* a depreciation of the exchange rate increase the ratio of non-food grains to food grain output while both the outputs increase, *(b)* for a cut in tariffs on manufacturing imports, the ratio of food grain output to non-food grains increases and *(c)* for a uniform rise in all the crop prices, the ratio of food grain to non-food grain output increases. In the other cases, the results are affected by the combination of related policies.

The government operations in the food grain sector to provide support prices to the farmers and subsidised food grains to selected consumer groups are affected by specific policy choices relating to agriculture. For instance, policies that result in a reduction in the prices of rice and wheat may decrease the demand for food grains distributed through the PDS. But the policies that increase food grain prices, increase the demand for food grains sold through PDS. When the prices increase, it is not the support price mechanism that is relevant but the coverage of PDS. In the various simulations carried out in this study, the demand for PDS sales is projected to decrease when tariff on manufacturing imports are reduced. Food grain output as well as price decrease when aggregate demand is reduced. The demand for PDS sales is projected to increase when *(a)* exchange rate is depreciated and *(b)* agricultural prices increase. In these cases the price of food

grain increases. The decline in demand for PDS sales when there is a decrease in the food grain price suggests increased access to the supply in the market relative to PDS. There is a need to strengthen PDS in all the cases where there is a likely increase in food grain prices or a decline in the supply of food grains.

Regional variations in the response of agricultural output arise due to differences in production conditions. Two channels through which crop output is influenced is the level of input application and the efficiency with which inputs are utilised. While production response to input use has been found to differ little across states, there is significant variation in the efficiency in production among the states.

When there is an increase in the proportion of non-food grain output relative to the output of food grains, there is an increase in efficiency in the sense that output per hectare is greater from the non-food grain crops. Thus, the policies which influence the composition of output mix produce variable impact at the state level in terms of efficiency, crop yield and crop output. A change in the relative price of crops will result in a greater change in total output in the states with relatively lower levels of efficiency.

5

Explaining Variations in Agricultural Productivity Across Indian States: The Role of Human Capital and Infrastructure

INTRODUCTION

The links between infrastructure and economic growth have been articulated extensively in literature. Much of the initial economic development effort around the world has indeed been towards establishing better economic infrastructure, both physical and social. The physical infrastructure comprises building electricity supply, transportation facilities such as road, rail and air transport and communication services covering post and telecom. The social infrastructure consists of education, health and to some extent housing. In the case of agriculture, focus on irrigation and research and development has also been prominent.

An important feature of infrastructure in the developing world has also been the prominence of public sector investments in its development. When public finances come under stress, it is generally the investment programmes that accommodate the contraction in government spending (Fan and Rao, 2003). It has, therefore, been important to demonstrate the links between infrastructure development and economic growth.

There have been attempts to demonstrate the links between infrastructure development and economic growth at the level of a sector such as agriculture. Fan, Hazell and Thorat (2000) showed that investments in irrigation have large productivity improvement effects but only marginal poverty reduction effects whereas investments in rural roads have the largest poverty reducing effects with significant productivity improvement effects as well. Thus, there are significant policy implications from analysis of experience in infrastructure development and attempts to understand these linkages between infrastructure development and economic growth are relevant.

Kalirajan and Bhide (2003, 2008) analysed the role of infrastructure and human capital in improving productivity of Indian agriculture. The analysis used state level variations in productivity, infrastructure and human capita indicators. We have presented this analysis here briefly to highlight the strategies that are important in accelerating economic growth at the state level. This analysis uses varying or random coefficient regression model (RCM) approach to the effects of infrastructure development on agricultural productivity as compared to directly introducing infrastructure variables as explanatory variables for growth or productivity. For example, Fan, Hazell and Thorat (2000) use road density, literacy and government spending on agricultural R&D as explanatory variables for Total Factor Productivity (TFP). This formulation essentially involves an implicit production function where all inputs are given the same weights. The RCM approach articulated in Kalirajan and Shand (1994), Kalirajan and Obwana (1994) and Kalirajan and Bhide (2003) provides an alternative formulation that clarifies the channel by which infrastructure development influences agricultural productivity.

FRAMEWORK OF ANALYSIS

Conceptually, agriculture development of physical infrastructure influences production either by improving access to markets and market information, improving processing opportunities or reducing cost of

marketing. Development of social infrastructure allows the firms to make better decisions or move up the value chain that requires greater skills. The effects may vary across sectors and across firms.

Such a specification at the aggregate level of a country (Fan, Hazell and Thorat, 2000) may be justified in view of the lack of more disaggregate data, say at the sub-national level. However, a more disaggregated analysis may show more clearly the effects of infrastructure in specific contexts of initial conditions, resource endowments or other socio-economic context of a region.

Zhang and Fan (2001) provide such an approach to analysing the impact of infrastructure development on TFP. They use panel data on outputs, inputs and infrastructure variables for districts in India over the years. The TFP is estimated as a Tornquist Index. An initial formulation used by the authors is as follows:

$$TFP_{it} = \beta 1\ (Road)_{it} + \beta 2\ (HYV)_{it} + \beta 3\ (RAIN)_{it} + \gamma_i + \eta_t + v_{it} \qquad (5.1)$$

where TFP, ROAD, HYV and RAIN refer to the logarithm of total factor productivity, road density, the proportion of cropped areas planted to high yield varieties and annual rainfall in district *i* at year *t*, respectively. The error term is represented as v_{it}.

The authors use Generalised Method of Moments (GMM) to estimate the parameters of the model in equation (5.1). Their approach is an improvement in the method of obtaining estimates of the impact of infrastructure development on productivity, an important regional dimension of such an impact is separated out through the fixed effects.

The above formulation (equation 5.1) assumes that all inputs have the same effect on output which may not be realistic. While it allows for shifts in the implicit production function due to infrastructure development (road density) it does not capture the differential effects infrastructure development may have on the use of specific inputs such as labour and capital.

The production frontier approach which uses the RCM formulation allows for more general treatment of the effects of factors operating at the firm level or broader level of policy environment. The RCM

approach can be illustrated with a two input case, in the context of panel data, as follows:

$$\mathrm{Ln}Y_{jt} = a0_{jt} + a1_{jt}\,\mathrm{Ln}X1_{jt} + a2_{jt}\,\mathrm{Ln}X2_{jt} + u_{jt} \qquad (5.2)$$

where Y is the output level, $X1$ and $X2$ are the input levels, u is the stochastic error term, and $a0$, $a1$ and $a2$ are the coefficients. To focus analysis on productivity, the dependent variable Y may be interpreted as output per unit of land and all other inputs also defined in the same normalised way. The subscripts identify firm 'j' and period 't' indicating that the coefficients $a0$ to $a2$ also vary with the firm and the period. Ln is the natural logarithm operator. The variation in output response across firms and over time may be related to the firm level factors such as size of the firm, quality of managerial inputs or the policy environment in which the firm is operating or time related factors such as changes in technology. This formulation allows one to incorporate the effects of infrastructure development on productivity or production through its effect on firm level characteristics or broader policy related factors.

The coefficients aj_i are assumed to be random with,

$$aj_i = \bar{a}j + vj_i \qquad (5.3)$$

where vj_i is distributed with mean zero and a constant variance; $\bar{a}j$ is constant that reflects the average response of output for variations in the level of j-th input. Note that the random error vj_i associated with the intercept term can be combined with the error term ε in equation (5.2).

Substituting (5.3) into (5.2) we get,

$$\mathrm{Ln}Q_{it} = \bar{a}_0 + \bar{a}_1\mathrm{Ln}X1_{it} + \bar{a}_2\mathrm{Ln}X2_{it} + w_{it} \qquad (5.4)$$

where,

$$w_{it} = (\varepsilon_{it} + v_{oit} + v_{1it}\,\mathrm{Ln}X1_{it} + v_{2it}\mathrm{Ln}X2_{it}) \qquad (5.5)$$

With appropriate assumptions on the distribution of the error term '*w*', the statistical model in (5.2–5.5) can be interpreted as a linear model with heteroskedastic error term. Kalirajan and Shand (1994) adopting a methodology based on Hildreth and Houck (1968) and Griffiths (1972) show that along with $\bar{a}j$, estimates of v_{jit} (in the case of $v0_{it}$ it is actually $v0_{it} + \varepsilon_{it}$) can also be recovered. Thus, we have estimates of a_{jit}, providing producer-specific and time-specific production function,

$$\text{Ln } Y_{it} = a0'_{it} + a1'_{it} \text{Ln}X1_{it} + a2'_{it} \text{Ln}x2_{it} \tag{5.6}$$

where aj'_i are the estimated production function coefficients.

The firm-specific coefficients lead to a definition of production frontier and technical efficiency of firms in the use of inputs.

In the present case, a production frontier is defined as,

$$\text{Ln } Y^*_t = a_{ot}{}^* + a1_t{}^* \text{Ln}X1_t + a2^*_t \text{Ln}X2_t \tag{5.7}$$

where

$$aj_t^* = \max\{aj_{it} \; \forall \; i = 1, 2, \ldots, n \text{ and } t = 1, 2, \ldots, t\} \tag{5.8}$$

The implication is that a technology frontier once achieved does not slip backwards. The movement from $a_{jt}{}^*$ to $a^*_{j(t+\Delta)}$ is due to technical progress. Deviation of a_{ijt} from a^*_{jt} is due to the level of technical efficiency of the *i*th producer with respect to the use of *j*th input in the *t* in period. Technical efficiency also may vary from one period to another for a number of reasons.

Efficiency of a producer with respect to the frontier is defined in alternative forms: overall efficiency and input-specific efficiency (Kalirajan and Shand, 1994). Overall efficiency is defined as the ratio of actual output of producer *i* to the output level from the frontier function (5.7),

$$\text{OEFF}_{it} = (Y_{it}/Yt^*) \tag{5.9}$$

Note that due to the stochastic nature of the frontier there is no restriction that ($OEFF_{it} < 1$) in all the cases. However, if estimated, $OEFF_{it}$ is defined as $(\hat{Y}_{it}/Y_t^*)$ where $\hat{Y}_{it}$ is obtained as the predicted value of output from the production function for producer *i*, then ($1 > OEFF_{it} > 0$).

Technical efficiency with respect to a specific input X_j can be defined as,

$$EFFX_{ijt} = (aj_{it}/aj_t^*) \text{ for } j = 1, 2 \tag{5.10}$$

In the case of intercept efficiency, termed 'general efficiency', it can be defined as,

$$GEFF_{it} = (a0_{it}/a0_t^*) \tag{5.11}$$

The production function is expressed for the panel data as,

$$\text{Ln}Y_{it} = a0_{it} + a1_{it}\,\text{Ln}X1_{it} + a2_{it}\,\text{Ln}X2_{it} + \varepsilon_{it} \tag{5.12}$$

With,

$$ak_{it} = (\bar{a}k_{it} + v_{kit}) \tag{5.13}$$

We can, therefore, now examine the impact of infrastructure variables on the 'productivity' of agricultural sector through the shifts in intercept or the input-specific coefficients.

Following the notation of Zhang and Fan (2001) we write,

$$GEFF_{it} = \beta 0 + \beta 1\,(\text{Road})_{it} + \beta 2\,(\text{HYV})_{it} + \beta 3\,(\text{RAIN})_{it} + v_{it} \tag{5.14}$$

The GEFF can be transformed to retain predictions of equation (5.14) to fall between zero and 1. Note that the formulation in (5.14) now captures shifts in improvement in the application of inputs rather than technical progress (Kalirajan, Obwana and Zhao, 1996).

As an illustration, we apply the above framework using state-level data for Indian agriculture.

STATE-LEVEL VARIATIONS IN AGRICULTURAL PRODUCTIVITY IN INDIA

The extent of variations in agricultural productivity across the Indian states is evident from Tables 5.1 and 5.2. Rice yield in Punjab is nearly three times the yield per hectare in Orissa. Wheat yield in Punjab is again about three times the level in Maharashtra. On per capita basis, the gross state domestic product from agriculture in Punjab is four times the level in Orissa. Given the wide diversity of Indian agriculture with respect to the composition of output, agro-climatic conditions

Table 5.1 Variations in agricultural productivity (average crop yield for 2002–03 to 2004–05)

State	*Food Grain*	*Rice*	*Wheat*	*Food Grain*	*Rice*	*Wheat*
Andhra Pradesh	1937	2861	NA	49.3	79.8	—
Assam	1451	1510	1119	36.9	42.1	25.9
Bihar	1616	1472	1912	41.1	41.1	44.3
Chhattisgarh	1012	1175	—	25.7	32.8	—
Gujarat	1386	1532	2361	35.2	42.7	54.7
Haryana	3105	2708	4041	79.0	75.6	93.7
Jharkhand	1212	1268	1608	30.8	35.4	37.3
Karnataka	1045	2165	611	26.6	60.4	14.2
Kerala	2193	2193	—	55.8	61.2	—
Madhya Pradesh	1120	855	1629	28.5	23.9	37.8
Maharashtra	872	1606	1339	22.2	44.8	31.1
Orissa	1150	1289	—	29.2	36.0	—
Punjab	3932	3583	4313	100.0	100.0	100.0
Rajasthan	1087	—	2765	27.6	—	64.1
Tamil Nadu	1798	2643	—	45.7	73.8	—
Uttar Pradesh	2114	2049	2715	53.8	57.2	62.9
Uttaranchal	1641	—	1878	41.7	—	43.6
West Bengal	2407	2494	2240	61.2	69.6	51.9
All India	1668	1969	2698	42.4	55.0	62.5

Source: Ministry of Agriculture (2005).

Table 5.2 Variability in selected factors affecting interstate differences in agricultural productivity

	Rural Literacy Percentage		*Per Capita Real NSDP Average for 2002–04 (Rs)*	
State	*1991*	*2001*	*Agriculture*	*TSC*
Andhra Pradesh	35.7	47.0	2586	1066
Assam	NA	49.2	2012	314
Bihar	33.8	34.8	1530	235
Gujarat	53.1	51.5	2716	1400
Haryana	49.9	52.8	4364	1748
Karnataka	47.7	50.9	2352	965
Kerala	88.9	79.1	1678	1810
Madhya Pradesh	35.9	46.8	2409	720
Maharashtra	55.5	59.7	2026	2125
Orissa	45.5	50.9	1520	690
Punjab	52.8	56.0	6056	1102
Rajasthan	30.4	44.4	2256	620
Tamil Nadu	54.6	58.2	1664	1358
Uttar Pradesh	36.7	42.1	2015	481
West Bengal	50.5	53.4	2430	823

Source: Based on data from EPW Research Foundation (2009).

Notes: NSDP = Net State Domestic Product (in 1993–94 prices); TSC = transport, storage and communication; Figures for 1991 not available in the case of Assam.

and hence production practices and inter-linkages between agriculture and other sectors of the economy in different regions, variations in the outcome of strategies to raise agricultural productivity have also been significant. As noted earlier, green revolution had greater impact on food grain output and more specifically on rice and wheat yields per hectare of land. Milk output saw rapid increases than other livestock products. Crop area devoted to the production of coarse cereals and pulses declined but area under oilseed production increased. Sawant (1997) estimated that crop area under oilseeds increased during

1981–82 to 1994–95 by 3.41 per cent per year while area under cereals and pulses declined. In terms of production, non-food grain output increased by 4.37 per cent per year during 1981–94 while food grain output increased by only 2.76 per cent per year. However, acceleration in the growth of output of non-food grain was due to increased rate of growth of area as well as yield but in the case of food grain, there was a decline in crop area. These changes also influenced the pattern of changes in crop productivity across states.

Some states achieved larger gains in input use as well as productivity while the others lagged behind. While there is some evidence that growth rates of agricultural output are 'converging' to some common level, the fact that initial productivity levels have varied significantly across the states, and hence the differentials in productivity are likely to continue. Policies affecting productivity improvements in each state, therefore, become important for raising overall agricultural output: in other words, state/region-specific policies become important.

ESTIMATES OF PRODUCTION EFFICIENCY AND FACTORS AFFECTING IT: APPLICATION OF RCM

We now provide an application of the RCM outlined earlier to assess the role of infrastructure development on agricultural productivity. Estimated technical efficiencies at the regional level are a link between the production frontier and the production function.

At a theoretical level, production relationship is specified such that output and inputs are homogeneous across producing units. However, in practice, available data incorporates considerable heterogeneity in output and inputs. For example, in agriculture, output measured as value of gross output is an aggregate of the output of a number of diverse products. When output of a product increases by one unit, the gross value may increase at a different rate than when there is a unit increase in another product.

The heterogeneity in inputs across producing units may arise because of differences in quality that are not taken into account at the time of measurement. One instance is the labour units. Differences in

the skill level, ability are not incorporated, often, in the overall labour force estimates.

Finally, efficiencies may also vary due to other factors such as the infrastructure facilities (roads, power supply, input/output marketing network, extension support in the case of agriculture). Thus, from an empirical viewpoint, technical efficiency is the link between production function at the producer level and the frontier production function and shifts in production frontier are due to technical progress. With cross section data for regions, one can estimate regional production function and with technical progress, each region may adjust at different speeds to the shifting production frontier.

Estimating Crop Yield Function

Crop output is first specified as a product of crop area and crop yield per hectare of crop area:

$$Q_{jt} = \mathrm{GA}_{jt} * Y_{jt} \tag{5.15}$$

where Q is the value of crop output, GA is the gross cropped area, Y is the crop yield per hectare of crop area and the subscripts j and t refer to j-th state and t-th year, respectively.

The production/yield function for j-th state in t-th year is specified as,

$$\begin{aligned}\mathrm{Ln}\ Y_{jt} = a0_{jt}' + a1_{jt}\ \mathrm{Ln}\ R_{jt} + a2_{jt}\ \mathrm{Ln}\ (\mathrm{IA/GA})_{jt} + a3_{jt}\ \mathrm{Ln}\ (F/\mathrm{GA})_{jt} \\ + a4_{jt}\ \mathrm{Ln}\ (\mathrm{LAB/GA})_{jt} + a5_{jt}\ \mathrm{Ln}\ (\mathrm{TR/GA})_{jt} + a6_{jt}\ \mathrm{Ln}\ \mathrm{RWFG}_{jt}\end{aligned} \tag{5.16}$$

where R is the rainfall during June–September, IA is the irrigated crop area, F is fertiliser consumption, LAB is the labour force in agriculture, TR is the number of tractors at the beginning of the year and RWFG is the ratio of rice and wheat to total food grain output. Q and GA are as described earlier. The subscripts 'j' and 't' refer to j-th state and t-th year. While the choice of most variables is intuitive, the variable

RWFG was considered because of the rising prominence of rice and wheat in the food grain production basket and the relatively higher value of rice and wheat on per hectare basis relative to other coarse cereals and pulses.

Data on a number of variables were obtained from different sources and relevant variables were derived for the major 15 states for the period 1970–71 to 1992–93, on annual basis. Three alternative formulations of the crop yield function were estimated. The estimated equations for the 'mean level of output response' to input application are provided in Table 5.3. We have utilised the third equation in Table 5.3 (Alternative 3) for application as it has the least mean square error among the three alternatives.

The production function coefficients (ak_{jt}) were estimated using the program TERAN developed at the Australian National University. The estimation procedure provides for a Lagrange-multiplier test for the 'random coefficients model' versus 'fixed coefficients

Table 5.3 Estimated equation for GEFF in crop production, dependent variable: Ln (GEFF/(1 – GEFF))

	Alternative 1		*Alternative 2*		*Alternative 3*	
Independent Variable	*Coefficient*	*t-ratio*	*Coefficient*	*t-ratio*	*Coefficient*	*t-ratio*
Constant	180.9800***	20.29	159.1100***	16.34	139.98***	16.45
Ln (FGQ/NFGQ)	–0.3278***	9.80	–0.3198***	9.56	–0.5215***	16.85
DUMAG	0.4933***	13.41	0.6022***	15.89	0.5514***	15.13
(TSC/POP)	–0.0278***	8.76	—	—	—	—
Ln FSZ	–1.2439***	6.53	–0.9390***	4.82	–0.7596***	5.41
Ln RURLIT	0.0093	1.54	0.0287***	6.38	—	—
(Ln FSZ)* RURLIT	0.0267***	6.92	0.0150***	4.01	0.0072***	2.51
(TSC/POP)* RURLIT	0.0005***	7.70	–0.00001	0.80	0.00004***	3.45
T	–0.0898***	19.93	–0.0793***	16.12	–0.0687***	16.25
R^2	0.6638		0.5432		0.6022	

Source: Kalirajan and Bhide (2003).

Note: The equation is estimated using pooled Generalised Least Squares estimator. The level of significance of the estimated regression coefficients is indicated by *** when the probability is less than 1 per cent.

model' of the production function. In the present case, the test rejects the null hypothesis of fixed coefficients model (the test is also described in Kalirajan and Shand, 1994). Technical efficiencies are estimated for the intercept as,

$$GEFF_{jt} = (a0_{jt}/a0_t^*) \tag{5.17}$$

Note that efficiency is estimated with respect to the production frontier for a specific year 't'. We are not, thus, considering shifts in production frontier.

Variation in GEFF across states provides a basis for distinguishing output response to different exogenous changes in the model.

Estimating General Efficiency Equations

The estimates of efficiency at the state level suggest that the variation with respect to specific inputs is not large but the variation in the intercept is substantial. Given the relatively narrow range of variation in the coefficients of specific inputs, analysis is limited to the variation of the intercept alone. We have considered following factors as the likely explanations for variation in technical efficiency across states:

1. ratio of food grain to non-food grain output;
2. ratio of agricultural net state domestic product (NSDP) to total NSDP;
3. ratio of agricultural NSDP to population;
4. ratio of NSDP from agriculture to manufacturing;
5. ratio of NSDP from agriculture to unregistered manufacturing;
6. rural literacy rate;
7. average farm size of the land holdings;
8. ratio of real NSDP from transport, storage and communications to total NSDP from all the sectors of the economy; and
9. ratio of real NSDP from transport, storage and communications to population in the state.

The last two variables in the list above refer to the physical infrastructure conditions at the state level. The NSDP from transport, storage and communications is an indicator of the output of infrastructure sector rather than its supply capacity. In other words, the variable reflects both supply and demand conditions. Secondly, the variable reflects availability (or use) of infrastructure not only for agriculture but for all sectors of the economy. In this sense, the variables are only broad indicators of infrastructure development. Finally, we should also note that some of the other variables in the above list may also be influenced by the state of infrastructure, a condition we are not able to examine fully in this study. For example, the share of non-staple or non-food crops in crop output may well rise when there is better infrastructure which is needed to take the produce to the markets.

The general formation of the regression model for overall technical efficiency is

$$\text{GEFF}_{jt} = f(x1_{jit}, x2_{ji} \ldots t) \tag{5.18}$$

where $x1, x2, \ldots$ are the explanatory variables chosen from the aforementioned list. As we use panel data here, the GLS estimates would provide consistent and efficient estimates of the regression model. Since the efficiency estimates need to be bound between zero and unity, we use a transformed version, that is $\{\text{GEFF}_{jt}/(1 - \text{GEFF}_{jt})\}$ as the dependent variable rather than the GEFF itself. The transformation also implies variability of the response in efficiency to changes in independent variables is dependent on the initial level of efficiency. Three alternative estimates are presented in Table 5.3.

In the first equation, Alternative 1 in Table 5.3, the coefficient on (TSC/POP) is significant but negative: more developed the infrastructure, represented by transport, storage and communication, the impact on agricultural productivity appears to be negative. However, we should point to two other offsetting effects in the equation. First, the sign of (TSC/POP)* FSZ is positive implying that infrastructure has positive impact on productivity when farm size is larger. Second, the coefficient on (TSC/POP)* RURLIT is positive, again indicating that as rural literacy improves, the impact of infrastructure development is greater.

An important point that was mentioned earlier is that the impact of infrastructure development may in fact be captured by the variable such as (FGQ/NFGQ) since better infrastructure may enable greater diversification of agriculture and move to non-food crops. Keeping this in view, we estimated a second equation where we drop the (TSC/POP) variable while retaining the interaction terms of (TSC/POP)*RURLIT and (TSC/POP)* FSZ. The impact of (TSC/POP)*RURLIT now turns out to be not significant. The improvement in rural literacy may have similar effects on output diversification as better infrastructure and we estimate a third equation (Alternative 3) by dropping the RURLIT from the list of independent variables. The results are in Table 5.3.

The signs of the various coefficients in the third equation (Table 5.3) are along expected lines and all the estimated coefficients are statistically significant.

In this study, we have not examined the impact of infrastructure development on the efficiency of specific inputs. We have also not examined the impact of infrastructure development on the use of inputs: efficient infrastructure may encourage greater application of inputs as it may reduce the cost of purchase of inputs.

The results point to the positive and significant effect of infrastructure—both physical and social—on agricultural productivity. Infrastructure development influences productivity through more than one channel and it also affects productivity in interactive ways. The analysis presented here provides an alternative framework to articulate the channels of influence infrastructure development will have on productivity. The results also point to the impact infrastructure development may have on the composition of output itself.

CONCLUSIONS

The need for building economic infrastructure in developing economies has been highlighted in many policy initiatives across the world. At an empirical level, however, there has been some debate on the nature of the impact of infrastructure development on economic growth. As much of infrastructure development in developing world is expected

to be driven by public sector spending strong analytical and empirical basis for articulating the need for new investments is important.

In this chapter, we propose a generalised approach to the assessment of this impact explicitly differentiating the impact of different inputs on crop output and differentiating technical progress from technical efficiency. Infrastructure development may influence technical efficiency of the firms or regions more strongly than influencing technical progress. The results also point to the potential for changes in the composition of crop output with the development of infrastructure—physical infrastructure or social infrastructure.

6

Investment Patterns and Response to Economic Reforms at the State Level

GROWTH AND INVESTMENT

The overall growth performance of the Indian economy has been characterised by substantial regional variation in growth over the decades. This is despite the focus in successive Five Year Plan policies and programmes on reducing the incidence of poverty and of achieving balanced regional development. This variability is evident in the figures for a large state such as Uttar Pradesh which has about 16 per cent of India's population but accounts for just eight per cent of India's GDP. The variability is also striking when we compare the per capita GSDP between the highest and the lowest among the major states. Among the states with a population of more than 20 million, Haryana, Maharashtra, Punjab and Gujarat have a per capita annual GSDP of more than USD 900 whereas Uttar Pradesh and Bihar, each with a population of above 90 million, have a per capita annual GSDP of less than USD 350. Even as measures of the productive capacity of the states, these numbers point to the challenges and opportunities for development effort.

A close understanding of the regional patterns of growth within India is desirable for several reasons. First, central importance in policy continues to be the objective of achieving and sustaining a

higher overall growth rate in the Indian economy. Policy makers need insights on past performance at state level in order to formulate future policy directions more effectively. Second, high levels of foreign and domestic investment are needed to reach the growth objectives. Third, the problems of the state economies, whether in terms of poor growth or weak fiscal position, often spill over to the national level. Finally, with greater decentralisation of policy making process consequent to the economic reforms in the 1990s, performance of each state has a consequence for policies of the other states as they try and maximise the complementarities of growth.

The economic reforms that began in the early 1990s brought to the fore the role of state governments in attracting new investments from the private sector needed for growth. In the days of centralised planning, the states' role was largely limited to lobbying for public sector investment. Private investment was influenced by the incentives offered by the states for such investments, but the centralised planning process laid down the criteria for new investments. In the new environment of liberalised economic policies, state governments are increasingly recognising the need for a more competitive approach to attracting new investments in their own states. This change in the perception on the part of the state governments is also due to the emergence of regional-level political parties at the state level and their need to improve economic performance as an important electoral appeal. The industrial policies announced by the various states in the mid-1990s reflect the recognition of the need for a proactive policy towards attracting private investment at the state level.

While there is evidence of changes in perception of the role of the states among the policy makers in the various policy statements, actual implementation of the new policies was less impressive (Lahiri and Fardoust, 2000).

State-level prospects within the context of economic reforms have received attention in a number of studies. The profile of states presented in the study by the Department of Foreign Affairs and Trade (2001), also highlights the importance of regional diversity of India and points to the relative advantages of the key states.

Clearly a large part of the onus for stimulating economic development and attracting the necessary investment resources lies with the

states. Their capacity to rise to this challenge is central to the theme of this chapter. This chapter profiles investment trends in India's regions in the years immediately following the launching of economic reforms in the country. The chapter draws on our previous work reflected in Department of Foreign Affairs and Trade (2001).

INVESTMENT PATTERNS

Growth of investment is a key determinant of GSDP growth rates as it affects the short-term growth performance through its impact on aggregate demand as well as the long-term performance through its impact on the creation of productive capacity in the economy. The key components of investment are private and public sector investment. Private investment comprises domestic and foreign direct investments. Public investment comprises capital outlays in the budgets of the governments and resources mobilised by public sector units (PSUs) outside the budget, such as borrowings.

There is no single time series that covers all these types of investment for India at the state level, so it is necessary to choose proxies that best represent the components. Those selected here for private domestic investment[1] are the state-level growth rates and shares of disbursements of credit from the All India Financial Institutions (AIFI), and total proposed industrial investment by the companies/agencies listed in the stock exchanges in the country. The role of AIFI in financing new investments has now diminished relative to the other financial institutions, particularly the banks and capital markets. The proxy used

[1] We have used alternative data on investment. The sources comprise the following:
i) Data on sanctions and disbursement of assistance/credit provided by the All India Financial Institutions.
ii) Data on Foreign Direct Investment provided by the Secretariat for Industrial Approvals, Government of India.
iii) CMIE data on total investment by the corporate sector is a good proxy but reflects only book value of investment, not in real terms.
iv) Annual Survey of Industries data on Gross Fixed Capital Formation.

for foreign direct investment is total approvals for foreign direct investment, as there is no series available for actual foreign direct investment at state level. The proxy used for public sector investment is total state capital outlay. This proxy also has limitations as it does not include direct investments by the central government in the states, particularly in sectors such as railways, airports and national highways.

As in Chapter 2, we have grouped the major states into three categories: high growth, medium growth and low growth based primarily on their growth performance:

1. High Performing State Economies (HPSE): Karnataka, Maharashtra, Tamil Nadu and Gujarat.
2. Medium Performing State Economies (MPSE): West Bengal, Andhra Pradesh, Kerala, Haryana, Madhya Pradesh and Rajasthan.
3. Low Performing State Economies (LPSE): Orissa, Punjab, Uttar Pradesh and Bihar.

Private Domestic Investment

Disbursements by All India Financial Institutions are a proxy for domestic private investment activity and thus for domestic private capital formation (Table 6.1). This is only an indicative variable as their role in financing private investments has diminished with the rise of other financial institutions as financiers of investments. The significance of states, or performance groups of states, is reflected in their rate of growth of, and shares of, disbursement. The patterns for the 1993–99 reform period can be summarised as follows:

- The HPSE group was by far the most dominant. The average annual rate of growth of real disbursement (18.9 per cent) was higher than those of the other two performance groups.[2]

[2] Disbursements are calculated in real terms by deflating the nominal values by the wholesale price index for manufactured products.

Table 6.1 Annual growth rates and shares of disbursements by All India Financial Institutions, 1993–99 (percentage)

	Average % Growth Rate	*Rank*	*Average % Share*	*Rank*
High Growth				
Karnataka	23.7	3	8.1	4
Maharashtra	20.8	5	22.3	1
Tamil Nadu	15.9	9	9.0	3
Gujarat	19.4	7	16.1	2
Medium Growth				
West Bengal	30.3	1	4.3	9
Andhra Pradesh	14.6	10	6.7	6
Kerala	14.2	11	1.8	12
Haryana	17.1	8	3	10
Madhya Pradesh	10.6	13	5.1	7
Rajasthan	3.9	14	4.5	8
Low Growth				
Orissa	25.6	2	1.7	13
Punjab	20.5	6	2.7	11
Uttar Pradesh	13.3	12	7.4	5
Bihar	22.4	4	1.1	14
14 States	16.0		93.7	
All India	16.3		100	
HPSEs	18.9		59.8	
MPSEs	12.4		21.1	
LPSEs	12.2		12.9	

Source: Industrial Development Bank of India (2000).

Notes: (1) For growth rates: 1981–82 prices were used, deflated by WPI manufacturing.
(2) For shares: current prices were used.

- The rankings of disbursement growth rates of individual states within the HPSE group were high but not all were in the top four (for example, Tamil Nadu), but they were the top four states in terms of disbursement shares over the period.

- The overall share of the HPSE group was dominant at 60 per cent of the total over the period.
- The average rate of increase for the MPSE group of 12.4 per cent was well below that of the HPSE but higher than LPSE group.
- The MPSE group's share of disbursements (21 per cent) was substantial.
- The average rate of growth of disbursement of the LPSE group (12.2 per cent) was the least among the three performance groups as also was its share of total disbursements (13 per cent).
- The exception was Uttar Pradesh, which had a low rate of growth of disbursement of 13.3 per cent in keeping with its classification in the LPSE group, but because of its size, it was ranked fifth in terms of disbursement share over the period (7.4 per cent).

A second measure of private investment is given by total proposed industrial investment. This combines investment through Industrial Entrepreneurs' Memoranda (IEM) and Letters of Intent (LOI) for the period from August 1991 to November 2000 (Table 6.2).

- The HPSEs dominated with a 54.6 per cent share.
- This group itself was dominated by two states—Maharashtra (21.8 per cent) and Gujarat (17.4 per cent). Their investment proposal shares were disproportionately high in relation to their population shares of 9.6 per cent and 5.1 per cent, respectively.
- The MPSE group attracted a 22.3 per cent share of proposed investment, with Andhra Pradesh (7.2 per cent) and Madhya Pradesh (7 per cent) as the two largest state recipients.
- Investment proposal shares for West Bengal (3.5 per cent) and Kerala (1 per cent) were low and well below their population shares of 8.3 per cent and 3.4 per cent, respectively.
- LPSEs attracted only 16.8 per cent of total proposed investment, and achieved this share only because of Uttar Pradesh with 8.2 per cent and Punjab with 4.3 per cent.
- Uttar Pradesh and Bihar's shares were disproportionately low in relation to their population shares of 17.9 per cent and 10.5 per cent, respectively.

Table 6.2 Percentage of proposed industrial investment (IEMs + LOIs) and population by major states, August 1991 to November 2000

State	*% Share of Investment*	*Ranking*	*% Share of Population (1998–99)*
High Growth			
Karnataka	5.1	7	5.5
Maharashtra	21.8	1	9.6
Tamil Nadu	6.8	6	6.5
Gujarat	17.4	2	5.1
Medium Growth			
West Bengal	3.5	10	8.3
Andhra Pradesh	7.2	4	8
Kerala	1	14	3.4
Haryana	3.3	11	2.1
Madhya Pradesh	7	5	8.4
Rajasthan	3.8	9	5.6
Low Growth			
Orissa	2.7	12	3.8
Punjab	4.3	8	2.5
Uttar Pradesh	8.2	3	17.9
Bihar	1.6	13	10.5
14 States	93.7		97.2
HPSEs	54.6		26.7
MPSEs	22.3		35.8
LPSEs	16.8		34.7
All India	100		100

Source: Secretariat for Industrial Approvals (2000).
Notes: IEM = Industrial Entrepeneur Memoranda; LOI = Letter of Intent.

Private Foreign Investment—Foreign Direct Investment Approvals

FDI approvals provide a good proxy for changes in the investment climate and investment intentions. However, it is not a satisfactory proxy for actual FDI as the latter is a fraction of approvals. In 2001,

it was estimated that investment 'actuals' were only 37 per cent of approvals from January 1991 to August 2000 (Nabhi, 2001). The highlights emerging from the statewise data on FDI approvals for the period August 1991 to January 2000 (Table 6.3) are:

- The HPSE group dominated, attracting 33.3 per cent of total approved investment.
- MPSEs (15.4 per cent) accounted for less than half that amount and LPSEs less than half that of the MPSE group (6.9 per cent).
- In the HPSE group, Maharashtra alone received 13.7 per cent of approvals, while Karnataka (7.6 per cent) and Tamil Nadu (6.7 per cent) and Gujarat (5.3 per cent) were also very significant.
- In the MPSE group, Madhya Pradesh (4.5 per cent), Andhra Pradesh (4.2 per cent) and West Bengal (3.7 per cent) attracted significant proportions of approvals.
- In the LPSE group, only Orissa (3.8 per cent) attracted a significant proportion of approvals. Uttar Pradesh and Bihar were virtually ignored.

It is important to note that the smaller states which are not included here, such as Delhi, accounted for substantial proportion of foreign investment proposals, as the three groupings of the states accounted for only 55 per cent of the foreign investment approvals during this period.

Public Investment

Public sector investment was measured for each state over the 1993–99 period with the proportions of total state capital outlays for development to the all India total (Table 6.4). Capital outlays are drawn from the state budgets only and do not include resources mobilised by public sector undertakings outside of the budget, such as by borrowing. It is a reasonable proxy for infrastructure investment by state governments. The highlights were:

Table 6.3 Statewise break up of value of foreign collaborations and foreign investment proposals approved, August 1991 to January 2000

State	*FDI Approved (Rs crore)*	*Percentage of Total*	*Rank*
High Growth			
Karnataka	15979	7.6	2
Maharashtra	28919	13.7	1
Tamil Nadu	14123	6.7	3
Gujarat	11092	5.3	4
Medium Growth			
West Bengal	7688	3.7	8
Andhra Pradesh	8764	4.2	6
Kerala	812	0.4	13=
Haryana	2939	1.4	10
Madhya Pradesh	9492	4.5	5
Rajasthan	2444	1.2	11
Low Growth			
Orissa	7987	3.8	7
Punjab	1934	0.9	12
Uttar Pradesh	3768	1.8	9
Bihar	832	0.4	13=
14 States	116773	55.6	
HPSEs	70113	33.3	
MPSEs	32139	15.4	
LPSEs	14521	6.9	
Other*	93877	44.4	
All India	210650	100	

Source: Nabhi (2001).

Notes: * Includes Delhi (14.4 per cent); Goa (0.2 per cent) and others without states indicated (29.4 per cent); = indicates that the same rank is shared with another state.

- The high growth (HPSE) group of four states accounted for 34.1 per cent of total state government capital outlay during the 1993–99 period. This was on par with the 34.9 per cent outlay of

the MPSE group of six states and considerably greater than the 18.4 per cent allocated by the LPSE group. The group pattern is consistent with a positive association between public capital outlays and GSDP growth rates of states.

- At individual state level, Maharashtra dwarfed other states with a share of 15 per cent of total capital outlays. Gujarat was third most important in the HPSE group.

Table 6.4 Average annual shares of total capital outlays for development by states, 1993–94 to 1998–99

State	*Share Percentage*
High Growth	
Karnataka	6.5
Maharashtra	15
Tamil Nadu	4.7
Gujarat	7.9
Medium Growth	
West Bengal	7.9
Andhra Pradesh	7.3
Kerala	2.9
Haryana	2.8
Madhya Pradesh	5.5
Rajasthan	8.5
Low Growth	
Orissa	3.9
Punjab	3.1
Uttar Pradesh	7.9
Bihar	3.5
14 States	83.0
All India	100.0
HPSEs	34.1
MPSE	34.9
LPSE	18.4

Source: Ministry of Finance (2001b, 2008).

FACTORS INFLUENCING INVESTMENT

What accounts for the differences in the success of states in attracting investments? Several factors can be hypothesised to influence investment in particular regions. One of such factors is economic infrastructure comprising both physical infrastructure and social infrastructure. We have constructed two separate indices of infrastructure—relating to physical and social—to assess the association between investment pattern and the pattern of development of infrastructure across states.

Variables were constructed to represent both physical and social infrastructure and then they were aggregated into two composite indices.

Physical Infrastructure

A composite index of economic infrastructure was calculated for the mid-1990s comprising a range of variables (Table 6.5):

- Percentages of villages electrified.
- Number of irrigation pumps energised per geographical area.
- Electricity generation capacity per population.
- Road lengths per geographical area.
- Railway length per geographical area.
- Telephone lines per population.
- Post offices per population.

The overall index is a simple average of all the sub-indices. We summarise the patterns across the three groups of states as follows:

- The indices for the three state performance groups show a positive association with growth performance, between the HPSEs and the other two groups with an index value of 131.0 for the HPSE, 103.4 for the MPSE and 106.2 for the LPSE groups. There is narrow and variance between infrastructure indicator and growth performance between the other two state groups.

- At a more disaggregated level, the positive link between high economic infrastructure and high GSDP growth rates is more apparent when we consider Tamil Nadu, Maharashtra and

Table 6.5 Composite index of economic infrastructure mid-1990s (all India = 100)

State	*Value*	*Rank*
High Growth		
Karnataka	102.8	7
Maharashtra	135.4	4
Tamil Nadu	154.4	3
Gujarat	117.1	6
Medium Growth		
West Bengal	89.8	10
Andhra Pradesh	100.2	9
Kerala	177.5	2
Haryana	132.8	5
Madhya Pradesh	82.2	12
Rajasthan	85.6	11
Low Growth		
Orissa	73.7	13
Punjab	185.3	1
Uttar Pradesh	101.5	8
Bihar	72.3	14
All India	100.0	
HPSEs	131.0	
MPSEs	103.4	
LPSEs	106.2	

Sources: CMIE (1995), Ministry of Finance (2001a), Central Statistical Organisation (Various annual Issues; Statistical Abstract of India).

Notes: (1) The indices of economic infrastructure represent the relative position of each state with respect to all India.

(2) Each index is scaled with all India as 100.

(3) Variables included are: % of villages electrified, number of irrigation pumps energised per geographical area, electricity generation capacity per population, road length per geographical area, railway length per geographical area, phone lines per population and post offices per population; the overall index is a simple average of all the sub-indices.

Gujarat with relatively high index value, and Orissa and Bihar in the LPSE group, which had the lowest index values.

- Clearly, this association did not hold consistently for all individual states. Punjab had the highest index value (185.3) but was in the LPSE. Kerala (177.5) was in the MPSE group. On the other hand, Karnataka with average infrastructure (102.8) was in the HPSE group and Madhya Pradesh (82.2) and Rajasthan (85.6) had low index values but were in the MPSE group.
- This suggests that relatively favourable economic infrastructure does not guarantee high growth performance, nor does relatively poor infrastructure necessarily prevent high growth rates. Clearly, there are other factors that influence economic growth, including perhaps distribution of infrastructure within states.

Social Infrastructure

A composite index of social indicators was also constructed from variables including number of hospital beds, female literacy and infant mortality rate (IMR). The values for the major 14 states and their 'growth groupings' (Table 6.6) indicate:

- The three state groups showed a positive association between growth rates and this index of social infrastructure, with average index values ranging from 130 for the HPSE group, to 117.1 for the MPSE and to 90.7 for the LPSEs.
- Individual states' infrastructure rankings generally matched their grouping in growth performance, but there were exceptions. Kerala enjoyed the highest state index value (243.6), but was placed in the MPSE group. Also, third ranked Punjab (133.6) was in the lowest growth group.
- As in the case of economic infrastructure, these findings also suggest that high index values and rankings for social infrastructure alone do not ensure high growth performance.

In the remaining sections of this chapter, we have reviewed the performance of selected states and state groupings with respect to their pattern of investments and growth of investments (Tables 6.7 to 6.22).

Table 6.6 Composite index of social indicators, mid-1990s (all India = 100)

State	*Value*	*Rank*
High Growth		
Karnataka	110.7	6
Maharashtra	137.8	2
Tamil Nadu	119.1	5
Gujarat	132.3	4
Medium Growth		
West Bengal	107.0	7
Andhra Pradesh	90.7	9
Kerala	243.6	1
Haryana	101.0	8
Madhya Pradesh	79.7	12
Rajasthan	80.3	10
Low Growth		
Orissa	76.7	13
Punjab	133.6	3
Uttar Pradesh	79.8	11
Bihar	72.6	14
14 States	111.8	
HPSEs	130.0	
MPSEs	117.1	
LPSEs	90.7	
All India	100.0	

Sources: Central Statistics Organisation (1999), Institute of Applied Manpower Research (2000).

Notes: (1) The indices of social infrastructure represent the relative position of each state to all India level. They are all scaled with all India as 100. A simple average of these indicators is obtained to give the overall index.

(2) The combined index is expected to indicate the level of overall social infrastructure relative to the national average; the sub-indices included are: number of hospital beds per population, female literacy rate and inverse of infant mortality rate. IMR = Infant mortality rate; CPR = Child protection rate.

THE HIGH PERFORMANCE ECONOMIES

Karnataka

Karnataka was the eighth largest state economy in 1998–99 (5.9 per cent of the national economy). It ranked first among states in terms of GSDP growth over the 1993–99 reform period at an annual average of 8.1 per cent, against an all India average of 6.6 per cent. The state attained this leadership despite relatively slow growth in its agricultural sector, averaging at 3.4 per cent, which was below the all India average of 3.8 per cent. The strength of performance came from the industrial sector with 11.8 per cent average growth per annum, the highest among the major states, and from the service sector growth (10 per cent per annum) which was ranked second. Its GSDP per capita in 1998–99 was seventh among states at Rs 17,433 or USD 414, a little above the national average.

Population growth[3] of 1.9 per cent was below the national average of 2.1 per cent. The urbanisation of population (30.9 per cent) was also ahead of the national average; literacy, work participation rate and life expectancy were all higher than the national average. The composite index of economic infrastructure was above the national average at 102.8 per cent, as was the index of social infrastructure (110.7 per cent).

The disbursements of the AIFI suggest that Karnataka was a favoured state for private investment. The high average growth rate of 23.7 per cent for 1991 to 2000 placed it third among states. Its average share of 8.1 per cent of total disbursements in that period gave it fourth ranking. It rated second on value of FDI approvals in that period. Karnataka showed a relatively healthy fiscal record with the second lowest average fiscal deficit of 3 per cent of its GSDP in 1993–98, and third lowest debt/GDP proportion of 18.9 per cent in 1999–2000 (Table 6.7).

During the 1980s, Karnataka was rated only amongst the middle ranking group of states for GSDP growth, averaging 5.7 per cent per

[3] We have used population growth during the period of 1981 to 1991 in this discussion.

annum, which equaled the all India average and placed the state sixth. The reform period witnessed acceleration into the highest performing state in growth terms at 8.1 per cent per annum between 1993–99 and an even higher 8.7 per cent per annum from 1996 to 1999.

Table 6.7 Statewise average fiscal deficits and debt

	Fiscal Deficit	*Debt as % of GSDP*		*Growth of Debt*
State	*Average for 1994–98 as % of GSDP*	*1993–94*	*1999–2000*	*(% per year)*
High Growth				
Karnataka	3.04	16.3	18.9	2.6
Maharashtra	2.91	12.0	13.9	1.9
Tamil Nadu	3.15	15.8	16.8	1.0
Gujarat	3.27	18.3	19.0	0.7
Medium Growth				
West Bengal	4.99	20.2	30.4	10.2
Andhra Pradesh	4.41	19.1	21.0	1.9
Kerala	3.99	26.3	28.2	1.9
Haryana	4.51	18.9	22.6	3.7
Madhya Pradesh	3.24	17.7	19.2	1.5
Rajasthan	5.53	25.4	32.0	6.6
Low Growth				
Orissa	6.67	33.2	40.0	6.8
Punjab	5.06	33.6	34.0	1.3
Uttar Pradesh	5.34	26.4	34.9	2.9
Bihar	3.47	32.4	35.3	2.9
HPSEs	3.06	15.1	16.7	1.6
MPSEs	4.42	20.8	25.3	4.5
LPSEs	5.02	29.8	35.3	3.0
All India	3.83	21.5	24.3	2.8

Source: RBI (2000).

Note: The average for performance groups of state economies (HPSE, MPSE, LPSE) is a weighted average for component states, the weights being GSDP.

A sectoral breakdown provides insights to this change. The sectoral shares of GSDP of 33 per cent agriculture, 22 per cent industry and 45 per cent services showed similarity to the all India structure (29 per cent, 22 per cent and 49 per cent, respectively). But it was the combination of sectoral growth performances that elevated this state to leadership in the 1990s. Karnataka recorded the fastest industrial expansion in the reform period, at 11.8 per cent average per annum from 1993–99 and sustained in 1996–99. The average growth rate of 10 per cent per annum for services was second only to that of Tamil Nadu, and was the highest (10.4 per cent) in the recent years from 1996–99. Its agricultural sector growth was below the all India average from 1993 to 1999, and fifth lowest among the 14 major states. Thus it was the combined strength of the industrial and service sectors that provided this leadership, with industry as the lead sector.

The most important contributors to gross fixed capital formation of manufacturing industry in Karnataka, averaged over the three years 1995–96 to 1997–98 (Table 6.8), are basic chemicals and products (17.3 per cent), rubber, plastic, petroleum and coal products (17.3 per cent), machinery and equipment (15.1 per cent), non-metallic minerals (8.7 per cent), food products (8.2 per cent) and paper and products (7.7 per cent). Industries in which the state makes a significant contribution to national gross fixed capital formation are (Table 6.9) textile products (8 per cent), machinery and equipment (7.6 per cent), paper and products (6.5 per cent), rubber, petroleum and coal products (5.6 per cent), food products (5.5 per cent), beverage, tobacco and related products (5.3 per cent) and non-metallic mineral products (5.3 per cent). The state's contribution to overall gross fixed capital formation in the organised sector of all India manufacturing industry averaged 3.8 per cent over the three-year period.

This recent high growth record is supported by rapid growth in private investment. In contrast to a below average record of attracting private investment in the 1980s, Karnataka achieved the third highest rate of growth of disbursements by All India Financial Institutions in the 1993–98 reform period (23.7 per cent average per annum). Its share of all India disbursements rose from 7.1 per cent in the 1980s (sixth position) to 8.1 per cent in 1993–98 (fourth ranking).

Table 6.8 Structure of manufacturing industry in the organised sector: Average share of each industry in a state's industrial investment (percentage of GFCF in the state) in high growth state economies, 1995–96, 1996–97 and 1997–98

Sl. No.	*Industry*	*Karna-taka*	*Mahara-shtra*	*Tamil Nadu*	*Gujarat*	*HPSE*	*All India*
1	Food products	8.23	4.48	7.23	3.10	4.66	5.78
2	Beverage, tobacco and related products	1.89	1.29	1.12	0.16	0.91	1.29
3	Cotton textiles	4.20	2.41	22.69	7.86	7.55	6.55
4	Wool, silk and man-made fibre textiles	1.28	5.71	2.74	2.71	3.75	4.35
5	Jute and other vegetable fibre textiles except cotton	0.66	0.00	0.02	0.02	0.03	0.22
6	Textile products including wearing apparel	2.47	0.84	4.37	0.26	1.34	1.40
7	Wood and wood products and furniture and fixtures	0.16	0.06	0.10	0.04	0.07	0.22
8	Paper & products and pub-lishing, printing and allied	7.68	3.46	5.86	2.33	3.69	4.66
9	Leather and products, fur and substitutes of leather	0.37	0.06	2.24	0.01	0.44	0.50
10	Basic chemicals and products	17.31	16.70	17.65	56.80	30.59	22.08
11	Rubber, plastic, petroleum and coal products	17.27	17.29	6.06	5.36	12.01	10.33
12	Non-metallic mineral products	8.71	2.15	3.61	5.19	3.88	6.33
13	Basic metals and alloys	6.56	12.23	6.07	9.36	9.99	16.63
14	Metal products and parts except machinery and equip-ment	1.61	5.81	1.75	1.11	3.06	2.33
15	Machinery and equipment except transport equipment	15.14	10.53	10.87	4.07	8.64	8.10
16	Transport equipment and parts	4.35	15.11	6.56	1.33	8.19	8.10
17	Other manufacturing	2.11	1.86	1.06	0.31	1.19	1.13
	All India	100.0	100.0	100.0	100.0	100.0	100.0

Source: Central Statistics Organisation (2000).

Note: A negative GFCF value is due to the sales of capital assets during the year by firms which are recorded as decline in GFCF in that sector.

Table 6.9 Structure of manufacturing industry in the organised sector: Average share of each state industry in its total industry (percentage of all India GFCF) in high growth state economies, 1995–96, 1996–97 and 1997–98

Sl. No.	*Industry*	*Karna-taka*	*Mahara-shtra*	*Tamil Nadu*	*Gujarat*	*HPSE*	*India*
1	Food products	5.49	17.14	10.66	9.31	42.61	100.00
2	Beverage, tobacco and related products	5.53	22.75	7.52	1.93	37.74	100.00
3	Cotton textiles	1.91	7.78	30.00	20.77	60.45	100.00
4	Wool, silk and man-made fibre textiles	1.35	29.10	5.22	10.07	45.75	100.00
5	Jute and other vegetable fibre textiles except cotton	3.69	0.16	0.80	1.66	6.32	100.00
6	Textile products including wearing apparel	7.98	12.87	24.99	3.43	49.27	100.00
7	Wood and wood products and furniture and fixtures	3.61	5.47	4.30	2.97	17.34	100.00
8	Paper and products and pub-lishing, printing and allied	6.54	16.77	11.08	7.41	41.80	100.00
9	Leather and products, fur and substitutes of leather	3.30	2.67	37.91	0.60	44.58	100.00
10	Basic chemicals and products	1.88	16.44	7.66	45.87	71.84	100.00
11	Rubber, plastic, petroleum and coal products and pro-cessing of nuclear fuels	5.64	34.10	6.32	10.06	56.13	100.00
12	Non-metallic mineral products	5.34	7.42	4.81	14.58	32.15	100.00
13	Basic metals and alloys	1.65	15.98	3.39	10.09	31.11	100.00
14	Metal products and parts except machinery and equip-ment	1.69	49.97	6.53	8.59	66.78	100.00
15	Machinery and equipment except transport equipment;	7.63	28.10	11.51	8.56	55.80	100.00
16	Transport equip & parts	2.40	42.46	6.89	2.69	54.43	100.00
17	Other mfg	8.02	30.87	7.12	5.16	51.18	100.00
	All India	3.79	22.17	8.65	17.83	52.44	100.00

Source: Central Statistics Organisation (2000).

Note: A negative GFCF value is due to the sales of capital assets during the year by firms which are recorded as decline in GFCF in that sector.

Industrial investment proposals during the period from 1991 to 2000 indicates Karnataka, located at a modest position in terms of numbers of IEMs and LOI, at seventh position among the major 14 states with 5.1 per cent of proposals among all states and territories.

A state-level break-up of foreign collaboration and foreign direct investment proposals approved from 1991 to January 2000 shows Karnataka with 1,254 approvals, mostly financial, which was third highest among states and territories. The value of approvals was Rs 159.8 billion and 7.6 per cent of the total value approved. This made Karnataka the second largest destination for foreign collaborations and FDI approved in India after Maharashtra or third if Delhi is included.

All states ran revenue and fiscal deficits in the 1980s and 1990s. Within that context, Karnataka showed a relatively sound record of fiscal responsibility. While the 14-state average revenue deficit grew from 1.1 per cent to 1.3 per cent over the two decades, Karnataka recorded the lowest revenue deficits in both decades, at 0.5 per cent in the 1980s and 0.6 per cent in 1993–98, or less than half the all India averages. Karnataka also recorded the lowest state fiscal deficit in the 1980s (3.4 per cent) and the second lowest in 1993–99 (3.0 per cent).

Average growth of public debt in states grew more rapidly than that of revenue during 1990–99, showing general fiscal deterioration. For Karnataka (and Maharashtra), the gap in growth rates was lowest at only 0.7 per cent. From 1990 to 1993, the growth rate of debt was actually lower than for revenue, which indicated fiscal stability. This was reversed in 1996–99, indicating fiscal instability. In 1993–94 for Karnataka, debt was 16.3 per cent of GSDP. This was third lowest amongst the 14 major states. It increased to 18.9 per cent in 1999–2000, but was still the third lowest proportion among the states.

Selected development features all place Karnataka above the national average: in population growth (1.9 per cent), literacy rate for 7-year-olds and over, work participation rate, urbanisation rate and life expectancy (Table 6.10).

High growth rates of the state economies are associated with a number of social indicators (Shand and Bhide, 2000b). These indicators included lower population growth rate, higher proportion of urban population, higher work participation rate, and higher life expectancy

Table 6.10 State GSDP growth rates and selected development indicators: Potential for economic expansion

			State Rankings (better performance = lower numerical value of rank)								
Variable	*Unit*	*Period*	*All India*	*Karna-taka*	*Maha-rashtra*	*Tamil Nadu*	*Gujarat*	*West Bengal*	*Andhra Pradesh*	*Kerala*	*Haryana*
GSDP Growth	% pa	1993–98	6.6	1	2	3	5	4	6	7	8
- Agricultural Growth	% pa	1993–98	3.8	10	3	5 =	7 =	1	4	9	12
- Industry Growth	% pa	1993–98	7.7	1	4 =	9 =	12	14	3	4 =	7
- Services Growth	% pa	1993–98	8	2	4 =	1	3	5 =	9 =	7	5 =
Sectoral Shares											
- Agriculture	%	1993–99	29.4	9	14	13	12	6	10	11	2
- Industry	%	1993–99	21.5	6	2	3	1	10 =	9	14	5
- Services	%	1993–99	49.1	8	2	3	11	5	4	1	13
Economic Infrastructure	Index	1990s	100	7	4	3	6	10	9	2	5
Social Infrastructure	Index	1990s	100	6	2	5	4	7	9	1	8
Size of Economy	Rs billion	1998–99	10818.3	8	1	3	5	6	4	12	13
GSDP per capita	Rs	1998–99	11,096	7	1	6	4	9	8	5	3
Av. growth rate of per capita income	%	1993–98	5	1	2	3	5 =	4	7	5 =	9
Total Population	Millions	1998–99	943	9	3	7	10	5	6	12	14
Population Growth	%	1981–91	2.1	4 =	10 =	2	4 =	8 =	8 =	1	12 =
Urban/Total population	%	1991	25.7	4	1	3	2	6	7	8	9
Literacy of 7 years +	%	1991	52.2	8	2	3	4	6	11	1	7

(*Table 6.10 continued*)

(*Table 6.10 continued*)

			State Rankings (better performance = lower numerical value of rank)								
Variable	*Unit*	*Period*	*All India*	*Karna-taka*	*Maha-rashtra*	*Tamil Nadu*	*Gujarat*	*West Bengal*	*Andhra Pradesh*	*Kerala*	*Haryana*
Work participation rate	%	1991	37.5	5	3	2	6	9 =	1	12 =	12 =
Life expectancy	Years	1991	60.3	6	3	5	9	7	8	1	4
Proposed industrial investment	%	1991–2000	100	7	1	6	2	10	4	14	11
FDI Approvals	%	1991–2000	100	2	1	3	4	8	6	13 =	10
AIFI disbursements:											
- Average growth rate	%	1993–99	16.3	3	5	9	7	1	10	11	8
- Average share	%	1993–99	100	4	1	3	2	9	6	12	10
Shares of govt. capital outlays	%	1992–98	100	7	1	9	3 =	3 =	6	13	14
Distribution of total investment	%	Nov. 2000	100	5	1	3	2	9	4	10	14
Average fiscal deficit	% of GSDP	1994–98	3.8	13	14	12	10	5	7	8	6
Level of debt	% of GSDP	1999–2000	24.3	12	14	13	11	6	9	7	8

Source: Compiled by the authors.

Notes: AIFI = All India Financial Institutions.
Ranking: Sectoral shares are from smallest (1) to highest (14).

and literacy rate. Karnataka ranks high among states on a range of these social indicators, which would encourage higher growth rates. Its population growth rate at 1.9 per cent is below the average of 2.1 per cent for the country and is equal fourth lowest amongst states, above Kerala (1.3 per cent), Tamil Nadu (1.4 per cent) and Orissa (1.8 per cent). Its literacy rate of 56 per cent is above the national average of 52 per cent, though it ranks only eighth among states. Its work participation rate of 42 per cent is above the all India average and is fourth among states. It also has a relatively high proportion of urban to total population (31 per cent) and life expectancy after birth (63 per cent) among states.

The average aggregate index of economic infrastructure placed Karnataka at seventh position with 102.8 per cent of the all-India index of 100. It was above average in percentages of villages electrified, post office availability and road lengths, but lower than average on pumps energised, electricity capacity and railways per thousand square kilometres. Despite shortcomings in infrastructure, the state achieved leadership in GSDP growth in the reform period (Table 6.11).

The IT Advantage

Karnataka is known as the Silicon State of India and Bangalore as the IT Capital of India. Karnataka was the first state to announce IT Policy in 1997, which acted as a catalyst for the growth of the IT industry in the state. Karnataka employed an estimated 75,000 IT professionals in 2000. It is estimated that in the year 2010, the potential for employment in the state's IT sector will reach one million.[4] Almost 100 multinational companies are located in Karnataka from all parts of the world as well as Indian multinational companies.

Maharashtra

Maharashtra ranked second behind Karnataka in the GSDP growth rate over the 1993–99 reform period, but in many ways it is the industrial

[4] See the website itfriend.mit.gov.in/karnataka.htm.

Table 6.11 Conditions for accelerated growth—Karnataka

				Performance	
Variable	*Unit*	*Period*	*State*	*All India*	*State's Rank*
GSDP Growth	% pa	1993–98	8.1	6.6	1
- Agricultural Growth	% pa	1993–98	3.4	3.8	10
- Industry Growth	% pa	1993–98	11.8	7.7	1
- Services Growth	% pa	1993–98	10	8.0	2
Sectoral Shares					
- Agriculture	%	1993–99	32.6	29.4	9
- Industry	%	1993–99	22.4	21.5	6
- Services	%	1993–99	45.1	49.1	8
Economic Infrastructure	Index	1990s	110.7	100	6
Social Infrastructure	Index	1990s	112	100	5
Size of Economy	Rs billion	1998–99	635.7	10,818	8
GSDP per capita	Rs	1998–99	17433	16532	7
GSDP per capita Growth	% pa	1993–99	6.5	4.7	1
Population Growth	% pa	1981–91	1.9	2.1	4 =
Urban/Total population	%	1991	30.9	25.7	4
Literacy of 7 years +	%	1991	56	52	8
Work participation rate	%	1991	42	37.5	5
Life expectancy	Years	1991	62.5	60.3	6
Proposed industrial investment	%	1991–2000	5.1	100	7
FDI Approvals	%	1991–2000	7.6	100	2
AIFI disbursements:					
- Average growth rate	% pa	1993–99	23.7	16.3	3
- Average share	%	1993–99	8.1	100	4
Average fiscal deficit	% of GSDP	1993–98	3.0	3.8	13
Level of debt (state government)	% of GSDP	1999–2000	18.9	24.3	12

Source: Compiled by the authors.

Note: AIFI = All India Financial Institutions; Ranking of all shares and percentages are from highest (1) to lowest (14).

leader. It has the largest state economy (13.1 per cent of the national economy in 1998–99), the largest industrial sector, highest per capita income, most developed financial sector infrastructure and is the hub of financial services trade. In physical infrastructure, it has the highest power generation capacity in the country, and has more than 215 industrial estates.[5] It has the largest and most diverse infrastructure for the IT industry, along the Mumbai-Navi, Mumbai-Pune 'knowledge corridor'. It has the strongest human resource development (HRD) infrastructure in terms of educational institutions, high literacy rate of 65 per cent in 2000 and a diversified industrial base.

Maharashtra is economically India's most influential state. With the third largest state population of 91 million in 1998–99, it contributed 13.1 per cent of all state GSDP, exceeding Uttar Pradesh's share of 12.3 per cent and its population of 169 million. It has traditionally been a high growth state. In the 1980s, it was in the top five states in terms of GSDP growth (6.3 per cent average per annum). In the reform period from 1993 to 1999, it registered 7.7 per cent per annum and was second only to Karnataka. In the most recent period (1996–99), it recorded 6.9 and was third behind Karnataka and West Bengal. Maharashtra is structurally a mature state, with its service sector contributing 54 per cent of GSDP, industry 29 per cent and only 18 per cent of GSDP originating from agriculture (Table 6.12).

This state has been a strong performer in all three sectors. Its agricultural growth (average of 5.1 per cent) in the reform period was third behind West Bengal and Rajasthan and second to Rajasthan in 1996–99. It was equal second with Andhra Pradesh for industrial growth in the 1993–99 reform period (8.7 per cent – per annum), and equal fourth with West Bengal in service sector growth (8.2 per cent) in that same period. It was third in growth of per capita GSDP during the 1990s.

Industries which made the largest contributions to gross fixed capital formation in the state itself in the three years 1995–96 to 1997–98 were rubber, plastic, petroleum and coal products (17.3 per cent),

[5] Industrial estates are geographically defined areas by the state governments in which land and other facilities are provided for location of industrial units.

basic chemicals (16.7 per cent), transport equipment and parts (15.1 per cent), basic metals and alloys (12.2 per cent) and machinery and equipment (10.5 per cent) (Table 6.9).

Nationally, Maharashtra is the largest single state contributor to national gross fixed capital formation in the organised sector of industry with an average contribution of 22.2 per cent per annum in the three years (Table 6.9). Its contribution to national gross fixed capital formation exceeded 30 per cent in four industries: metal products and parts (50 per cent), transport equipment and parts (42.5 per cent), rubber, plastic, petroleum and coal products (34.1 per cent) and other manufacturing (30.9 per cent). It contributed between 20 and 30 per cent in another three industries: beverages, tobacco and related products (22.8 per cent), wool, silk and man-made textiles (29.1 per cent) and machinery other than transport (28 per cent); and between 10 per cent and 20 per cent in another five industries. Thus, in 12 out of 17 industries, Maharashtra contributed a national share of 10 per cent or more.

The rate of growth of private investment (disbursements by All India Financial Institutions) in Maharashtra was 20.8 per cent, which was the fifth fastest in the 1993–98 reform period, but because of the size of the state economy, these disbursements contributed the largest share (22.3 per cent) of all-India disbursements. Over the decade of the 1990s, 21.8 per cent of all industrial investment proposals—Industrial Entrepreneurs' Memoranda and Letters of Intent (IEMs and LOIs)—were proposed and filed for Maharashtra alone. From August 1991 to January 2000, there were 2,527 foreign collaboration and FDI proposals approved, or 13.7 per cent of the national total approvals. The amount approved was Rs 289.2 billion rupees, making this state the most popular location in value terms for foreign collaborators and FDI among the 14 states and second after Delhi (14.4 per cent) nationally.

Maharashtra has many favourable features for development. While its population is one of the fastest growing (2.3 per cent per annum), it has a population density close to the country's average (257 per square kilometre). Its literacy rate of 65 per cent for 7-year-olds and over (in 1991) is second only to Kerala. It is a leader in work

participation rate (43 per cent) and is the most urbanised state (39 per cent). Life expectancy, at nearly 65 years, is the third highest amongst 14 major states.

Indices of economic infrastructure place Maharashtra in a favourable position among states (Table 6.5). The average index at 135.4 was fourth highest, just below Kerala and Tamil Nadu. It ranks first for a range of infrastructure sub-indices: percentage of villages electrified, pumps energised and frequency of post offices. It was below average for only two sub-indices—incidence of telephone lines and railways. Indices of social indicators showed Maharashtra second placed with an index level of 137.8, and the state was placed in the first three states for all but three sub-indices. These latter three reflected the state's relatively still rapid population growth.

Tamil Nadu

Tamil Nadu was the third fastest growing state in average overall real GSDP from 1993–99, a considerable improvement over its performance in the 1980s when it only just exceeded the average for the 14 major states. It had the fastest growing service sector (10.2 per cent) in the 1993–99 reform period, losing lead position to Karnataka only recently in 1996–99. In contrast, Tamil Nadu performed relatively poor in the industrial sector with an average annual growth rate of only 4.7 per cent in the 1993–99 reform period, which was well below the 8 per cent average for the 14 major states and 7.7 per cent for all India. It continued its record of relatively weak industrial performance of the 1980s. It recorded negative growth in the recent period of 1996–99. The post-reform agricultural growth rate of 4.3 per cent average per annum was well above the 14-state average and placed it fifth amongst the states. Its performance in the service and agricultural sectors lifted Tamil Nadu to third position in overall growth (Table 6.13).

Tamil Nadu was also a leader in terms of other economic criteria:

- It was the third largest state economy in 1998–99.
- It had the sixth largest per capita GSDP during 1993–99.

Table 6.12 Conditions for accelerated growth—Maharashtra

				Performance	
Variable	*Unit*	*Period*	*State*	*All India*	*State's Rank*
GSDP growth	% pa	1993–99	7.7	6.6	2
- Agricultural Growth	% pa	1993–99	5.1	3.8	3
- Industry Growth	% pa	1993–99	8.7	7.7	2 =
- Services Growth	% pa	1993–99	8.2	8	4 =
Sectoral Shares					
- Agriculture	%	1993–99	17.7	29.4	14
- Industry	%	1993–99	28.5	21.5	2
- Services	%	1993–99	53.9	49.1	2
Economic Infrastructure	Index	1990s	135.4	100	4
Social Infrastructure	Index	1990s	137.8	100	2
Size of Economy	Rs billion	1998–99	1717.7	10,818	1
GSDP per capita	Rs	1998–99	27650	16532	1
GSDP per capita Growth	% pa	1993–99	6.0	4.7	3
Population Growth	% pa	1981–91	2.3	2.1	4 =
Urban/Total population	%	1991	38.7	25.7	1
Literacy of 7 years +	%	1991	64.9	52.2	2
Work participation rate	%	1991	43	37.5	3
Life expectancy	Years	1991	64.8	60.3	3
Proposed industrial investment	%	1991–2000	21.8	100	1
FDI Approvals	%	1991–2000	13.7	100	1
AIFI disbursements:					
- Average growth rate	% pa	1993–99	20.8	16.3	5
- Average share	%	1993–99	22.3	100	1
Average fiscal deficit	% of GSDP	1994–98	2.9	3.8	14
Level of debt (state government)	% of GSDP	1999–2000	13.9	24.3	14

Source: Compiled by the authors.

Note: AIFI = All India Financial Institutions Ranking of shares and percentages are from highest (1) to lowest (14).

- It contributed 15 per cent of India's exports.
- It had 537 or 15 per cent of India's 100 per cent export oriented units (EOUs).

Tamil Nadu is an investor friendly economy, though it was a relatively late starter in the 1990s. From 1991 to May 1996, it had received only 8.5 per cent of total private investment disbursements (AIFI) in India. But of total investment approved since May 1996 it received the highest state share of 23.5 per cent. Similarly of total FDI received from August 1991 to January 2000, 73.8 per cent was received after May 1996.

It is a relatively mature state economy, with a small agricultural sector share (21.3 per cent) relative to the high shares for industry and services sectors. It has an established industrial culture and a favourable industrial climate. It has a sound all-round infrastructure with a ranking of third overall for economic infrastructure. Estimated shortage of power at 10.9 per cent of demand, is the lowest in India, and a large expansion in capacity is planned. Roads and railways are above the all India average, especially roads. Telecommunications are well developed, connecting all cities and towns and most villages.

The rate of growth of private investment in Tamil Nadu (proxied by the disbursements by All India Financial Institutions) was high in the 1980s at 15.1 per cent per annum. This increased in the 1993–98 reform period to 15.9 per cent per annum, though it was a little below the then all India rate of 16.3 per cent per annum. In the 1980s, private investment in the state contributed 9.7 per cent of total private investment in India, giving the state third ranking in share terms. This fell to 9 per cent in 1993–98, but the state retained its third ranking.

During the 1990s, 6.8 per cent of all industrial investment proposals were made in Tamil Nadu (IEMs and LOIs) giving the state the sixth ranking. Between August 1991 and January 2000, 1,496 foreign collaboration and FDI proposals were approved, which placed Tamil Nadu second in approvals behind Maharashtra. These were worth Rs 141.2 billion or 6.7 per cent of the total, placing the state third behind Delhi and Maharashtra.

Tamil Nadu's favourable development features include the second lowest annual population growth of 1.4 per cent, a high literacy rate of 62.7 per cent for 7-year-olds and over, a high work participation rate of 43.3 per cent, the third most urbanised population of 34 per cent and a life expectancy of 63.3 years at birth.

The state enjoys third ranking among states in terms of average (composite) available infrastructure. It leads in villages electrified. It enjoys third ranking in pumps energised, road length per square kilometre, telephone lines per 100 population and provision of post offices. The state is above average in terms of a range of social indicators, including hospital bed numbers, birth and death rates, female literacy, infant mortality rate and life expectancy. It is well above average for the combined index of social indicators.

The state improved its fiscal position in the reform period of the 1990s compared to the 1980s. In the earlier decade, the state's revenue and fiscal deficits were relatively high at 1.9 and 3.8 per cent of GSDP, respectively. In 1994–98, these were reduced to 1.2 and 3.2 per cent respectively, which were amongst the lowest for states. The average growth of revenue over 1990–93 exceeded that of public debt signaling fiscal stability. The reverse held from 1996–99. Overall in 1990–99, the growth of public debt was high at 17.5 per cent per annum and significantly exceeded revenue growth at 14.6 per cent per annum, so that fiscal instability prevailed. Debt as a proportion of GSDP increased from 1993–94 to 1999–2000 from 15.8 to 16.8 per cent, but in both years, Tamil Nadu recorded the second lowest proportion of all states.

Human resource development is relatively well advanced. Population growth is reduced to replacement rate, the urban to total population ratio is third highest, as is the literacy rate of 7-year-olds and over. The work participation rate is also high and ranks second. There is a ready supply of skilled manpower at affordable wages and industrial relations are peaceful with low losses from labour disputes.

The structure of organised manufacturing within the state over the recent three year period of 1995–96 to 1997–98 (Table 6.8) shows three lead industries in terms of average gross fixed capital formation (GFCF): cotton textiles (22.7 per cent), basic chemicals and products

Table 6.13 Conditions for accelerated growth—Tamil Nadu

				Performance	
Variable	*Unit*	*Period*	*State*	*All India*	*State's Rank*
GSDP growth	% pa	1993–98	7.4	6.6	3
- Agricultural Growth	% pa	1993–98	4.3	3.8	5 =
- Industry Growth	% pa	1993–98	4.7	7.7	14
- Services Growth	% pa	1993–98	10.2	8	1
Sectoral Shares					
- Agriculture	%	1993–99	21.3	29.4	13
- Industry	5	1993–99	26.3	21.5	3
- Services	%	1993–99	52.4	49.1	3
Economic Infrastructure	Index	1990s	154.4	100	3
Social Infrastructure	Index	1990s	119.1	100	5
Size of Economy	Rs billion	1998–99	812.9	10818	3
GSDP per capita	Rs	1998–99	19014	16532	6
GSDP per capita Growth	% pa	1993–99	6.2	4.7	2
Population Growth	% pa	1981–91	1.4	2.1	13
Urban/Total population	%	1991	34.2	25.7	3
Literacy of 7 years +	%	1991	62.7	52.2	3
Work participation rate	%	1991	43.3	37.5	2
Life expectancy	Years	1991	63.3	60.3	5
Proposed industrial investment	%	1991–2000	6.8	100	6
FDI Approvals	%	1991–2000	6.7	100	3
AIFI disbursements					
- Average growth rate	% pa	1993–99	15.9	16.3	9
- Average share	%	1993–99	9	100	3
Average fiscal deficit	% of GSDP	1994–98	3.2	3.83	12
Level of debt (state government)	% of GSDP	1999–2000	16.8	24.3	13

Source: Compiled by the authors.

Note: AIFI = All India Financial Institutions; Ranking of all shares and percentages are from highest (1) to lowest (14).

(17.7 per cent) and machinery and equipment other than transport (10.9 per cent).

While Tamil Nadu contributed an average of 8.7 per cent over the three year period to national GFCF of organised manufacturing, three industries made exceptional contributions: leather and products, fur and substitutes of leather (37.9 per cent), cotton textiles (30 per cent) and textile products including wearing apparel (25 per cent). Tamil Nadu also made significant contributions in machinery and equipment other than transport (11.5 per cent), paper and products and allied products (11.1 per cent) and food products (10.7 per cent). There were smaller contributions from a range of other manufactures, which underscore the considerable diversification in manufacturing in the state.

The IT Industry

- Tamil Nadu was one of the earliest states to announce a separate IT Policy in November 1997. The key elements, which have made Tamil Nadu important in this area, have been availability of skilled and educated manpower, a comparatively higher standard of educational institutions, sound infrastructure and lower costs of operation.
- The software industry in Tamil Nadu has grown from 10 companies in 1993–94 to 764 in 2000–01 with over 35,000 professionals employed.[6]
- Software exports have grown from Rs 10 million in 1993–94 to Rs 31,160 million in 2000–01. Hardware exports in 2000–01 were Rs 5760 million. By 2008, the government plans to have all students passing out of school 'digitally literate'.

Gujarat

Gujarat was the third fastest real GSDP growth performer in the 1980s, averaging 6.4 per cent per annum, well above the 14-state average

[6] www.tn.gov.in.

of 5.4 per cent, and slightly ahead of Maharashtra (6.3 per cent). Over the period of the crisis and reform in the 1990s (1990–99), Gujarat was the leading state with an average of 7.6 per cent. In the 1993–99 reform period, however, its growth performance was less impressive at 6.8 per cent average per annum, placing it fifth, and in the most recent 1996–99 period it slipped to eighth position with 5.8 per cent, only just above the average (Table 6.14).

Gujarat performed above the 14-state average in all three sectors. It was among the leading states in agricultural growth both before and during the reform period. It was the leading state in industrial growth during 1993–99 (11 per cent average per annum), though the growth rate slackened significantly in the most recent years from 1996 to 1999. It also maintained a strong growth performance in services, though easing recently in 1996–99.

In the 1980s, average annual growth in private investment matched the average for all India (13.5 per cent). In the reform period 1993–99, it accelerated to 19.4 per cent, exceeding the all-India average of 16.3 per cent. It held that level in the 1996–98 sub-period, despite the industrial slowdown, which reduced the all India average to 11.7 per cent. Its share of total disbursements in the 1980s was a substantial 11.8 per cent of the total. In 1993–99, this increased to 16.1 per cent and again to 17.5 per cent in 1996–99, and was second only to Maharashtra.

Over the period 1991–2000, 13 per cent of all industrial investment proposals (IEMs and LOIs) were filed for Gujarat, involving 17 per cent of total proposed investment, giving it second rank to Maharashtra.

Gujarat attracted 859 or 5 per cent of all foreign collaboration and FDI proposals approved from 1991 to 2000, involving 5.3 per cent of total FDI approved and placing Gujarat fourth on the state list of preferred locations. One half were technical and one half were financial.

Overall, development features and infrastructure variables might be expected to have a positive influence on the growth rate of NSDP in this state. Its annual population growth at 1.9 per cent is below average; it has a low population density; a high literacy rate of 61.3 per cent amongst 7-year-olds and over; a higher than average work participation rate of 40.2 per cent; an average life expectancy rate;

but it remains strongly rural with only 34.5 per cent of its population in urban areas.

It lies sixth in the average index of economic infrastructure (117.1 per cent) and is above average for most sub-indices. These include villages electrified (116 per cent), electricity capacity of public utilities (150 per cent) and railways (142 per cent). Indices are below average for pumps energised, post office frequency and road length.

The overall index for social indicators shows Gujarat well above average (132.3 per cent) and in fourth position. The state registers average or above average for all sub-indices. It is the leading state in number of hospital beds.

Gujarat contained its revenue deficit reasonably well in the 1990s. It was 0.9 per cent over 1990–98 but fell slightly to 0.7 per cent in the most recent years, and was among states with the lowest levels. Its fiscal deficit was considerably higher in the 1990s (3.9 per cent) though not amongst the highest, and it fell recently (3.3 per cent). The debt growth rate was less than the revenue growth rate over the 1990s and the state was stable fiscally until recent years. Debt as a percentage of GSDP was low in 1993–94 (18.3 per cent), and grew only slowly to 1999–2000 (19 per cent).

By far the most important contributor to the state's industrial gross fixed capital formation during the three-year period 1995–96 to 1997–98 (Table 6.8) was basic chemicals and products (56.8 per cent). Other significant contributors were basic metals and alloys (9.4 per cent), cotton textiles (7.9 per cent), rubber, plastic, petroleum and coal products (5.4 per cent) and non-metallic minerals (5.2 per cent).

With a highly diversified manufacturing sector, many state industries contributed substantially to gross fixed capital formation nationally (Table 6.9). They included basic chemicals and products (45.9 per cent), cotton textiles (20.8 per cent), non-metallic minerals (14.6 per cent), wool, silk and man-made textiles (10.1 per cent), basic metals and alloys (10.1 per cent) and rubber, petroleum and coal products (10.1 per cent). Gujarat was the second most important contributor (17.8 per cent) to national industrial gross fixed capital formation over the three years.

Table 6.14 Conditions for accelerated growth—Gujarat

				Performance	
Variable	*Unit*	*Period*	*State*	*All India*	*State's Rank*
Average GSDP growth	% pa	1993–99	6.8	6.6	5
- Agricultural Growth	% pa	1993–99	4	3.8	7 =
- Industry Growth	% pa	1993–99	8.3	7.7	5 =
- Services Growth	% pa	1993–99	8.6	8	3
Sectoral Shares					
- Agriculture	%	1993–99	22.2	29.4	12
- Industry	%	1993–99	35.5	21.5	1
- Services	%	1993–99	42.3	49.1	11
Economic Infrastructure	Index	1990s	117.1	100	6
Social Infrastructure	Index	1990s	132.3	100	4
Size of Economy	Rs billion	1998–99	749.1	10818	5
GSDP per capita	Rs	1998–99	21312	16532	4
GSDP per capita Growth	% pa	1993–99	5.1	4.7	5 =
Population Growth	% pa	1981–91	1.9	2.1	9 =
Urban population ratio	%	1991	34.5	25.7	2
Literacy of 7 years +	%	1991	61.3	52.2	4
Work participation rate	%	1991	40.2	37.5	6
Life expectancy	Years	1991	61	60.3	9
Proposed industrial investment	% per cent	1991–2000	17.4	100	2
FDI Approvals	%	1991–2000	5.3	100	4
AIFI disbursements:					
- Average growth rate	% pa	1993–99	19.4	16.3	7
- Average share	%	1993–99	16.1	100	2
Average fiscal deficit	% of GSDP	1994–98	3.3	3.83	10
Level of debt (state government)	% of GSDP	1999–2000	19	24.3	11

Source: Compiled by the authors.

Note: AIFI = All India Financial Institutions; Ranking of all shares is from highest (1) to lowest (14).

PROSPECTS FOR SUSTAINED GROWTH

The review of various indicators of investment immediately following the period of economic crisis of the early-1990s and the subsequent reforms showed that some states were more poised for accelerated growth than the others. While the pattern of growth across the states since this period of the later half of the 1990s has been consistent with the assessment based on the early experience there have also been some surprises.

We present first the scenario which emerges from the indicators of investment in the recent period.

The distribution of project announcements (Table 6.15) shows that Gujarat, Maharashtra and Karnataka among the HPSEs have continued to attract the same share of investments even in 2008 as they did in 1995 or 2000 (CMIE data base Capex). The share of Tamil Nadu has dropped sharply in 2008 as compared to the previous years. The surprise improvements are in Orissa, Uttar Pradesh and West Bengal where the investment shares increased significantly. The data do not fully reflect the investment activity in a state because the 'multi-state' projects are listed separately. Nevertheless, the flow of investments has followed broadly the 'enabling environment'. It is important for the states to continue to improve these enabling conditions.

Before we proceed to present an assessment of the prospects for the states based on the various indicators in the period immediately following economic reforms, it is interesting to note that the Eleventh Five Year Plan provides a strategy that appears to push all the states to growth rates of more than six per cent per year in the next five years (Table 6.16). The only laggard among the major states is Punjab, which we had also identified as one of the 'LPSEs'. One reason for the lower expectations may be the relatively lower performance of many other states in the previous years and the need to push growth in these states. All the four HPSEs identified in this analysis are projected to grow at average annual rates of more than seven per cent during the Eleventh Five Year Plan.

Table 6.15 Share of states in the value of proposed investments at the beginning of the quarter (%)

	Share of States in Investment (%)		
State	*June 1995*	*June 2000*	*June 2008*
Andhra Pradesh	8.10	10.60	9.66
Bihar	0.00	1.14	0.00
Gujarat	11.73	10.24	10.08
Haryana	2.30	1.59	5.10
Himachal Pradesh	3.23	1.93	0.91
Karnataka	5.22	7.87	6.85
Kerala	2.11	3.28	1.81
Madhya Pradesh	6.54	3.42	4.40
Maharashtra	11.54	11.27	12.86
Orissa	9.92	7.73	12.14
Punjab	2.06	2.33	1.56
Rajasthan	4.48	2.34	2.05
Tamil Nadu	7.61	12.04	6.97
Uttar Pradesh	5.94	3.75	4.19
West Bengal	6.14	3.59	8.65
Multi State	3.63	6.86	9.72
Other including unallocated	9.46	10.03	3.06
Total	100.00	100.00	100.00

Source: Based on CMIE's Capex data base, Mumbai.

HIGH PERFORMING STATE ECONOMIES

The experience of the HPSEs in the 1990s provides at least two sound reasons for continued confidence in their sustained high growth performance into the new century. One is that these are the states that have performed strongly in all three sectors—agriculture, industry and services. This cushioned and helped these states during the period of the crisis of the early-1990s. The positive complementarities were

Table 6.16 Strategies for balanced regional development

Sl. No.	*Growth Category (GSDP growth per year)*	*Eighth FYP*	*Ninth FYP*	*Tenth FYP*	*Eleventh FYP*
1	<3	Orissa, Bihar			
2	3 to <4 per cent		Rajasthan		
3	4 to <5 per cent	Punjab	Bihar, Uttar Pradesh, Madhya Pradesh, Gujarat, Haryana, Punjab, Andhra Pradesh, Maharashtra	Madhya Pradesh, Punjab, Uttar Pradesh, Bihar	
4	5 to <6 per cent	Haryana, Andhra Pradesh	Orissa, Goa, Kerala	Rajasthan	Punjab
5	6 to <7 per cent	Karnataka, Madhya Pradesh, West Bengal, Kerala	Tamil Nadu, West Bengal	West Bengal, Tamil Nadu, Andhra Pradesh	Uttar Pradesh, Madhya Pradesh, Orissa
6	7 to <10 per cent	Tamil Nadu, Rajasthan, Goa, Maharashtra	Karnataka	Karnataka, Kerala, Haryana, Goa, Maharashtra, Orissa	Goa, West Bengal, Tamil Nadu, Maharashtra, Andhra Pradesh, Kerala, Rajasthan, Bihar
7	>10 per cent	Gujarat		Gujarat	Karnataka, Haryana, Gujarat

Source: Based on Eleventh Five Year Plan (Planning Commission, 2008).

sufficient to ensure either that the reductions in overall growth rates were minor or there was still an overall increase in the growth rate.

A second reason is the growing spirit of competitive federalism. Economic reforms are continuing at state level because the lead states recognise the continuing need to attract more private investment,

domestic and FDI, and to provide an attractive investment environment for this investment.

These strengths, however, have to offset weaknesses revealed in infrastructure, for example, power supply and inadequacy in ports, and in fiscal control, which weakens the capacity of even these progressive states to provide the necessary economic infrastructure and social services to sustain high GSDP growth rates.

Prospects for the four HPSEs in the near to medium term turn principally on the rates of investment by the government and private sectors. In these terms, prospects appear sound with a continuation of the high investment levels of the 1990s.

The HPSEs have led in shares of total government investment (42.3 per cent). Gujarat received 13 per cent, Maharashtra 12.8 per cent and Tamil Nadu 12.2 per cent. Only Karnataka's share was low (4.4 per cent). Amongst other states, Andhra Pradesh benefited most with a 7.6 per cent share.

Sources of government investment varied in emphasis within the group. The HPSEs received a more modest share of central government investment, in keeping with policy of emphasising relatively backward states. Tamil Nadu nevertheless received an exceptionally high share of 16.1 per cent from the central government, followed by Gujarat (8.7 per cent), Maharashtra (7.4 per cent) and Karnataka a low 2.2 per cent. Their shares of other (mainly state) government investment were higher for the group (51.8 per cent), probably reflecting the greater financial capacity of these states to invest. In particular, Maharashtra received 19.2 per cent and Gujarat 18.2 per cent, while shares were lower for Tamil Nadu (7.5 per cent) and Karnataka (6.9 per cent).

The four states also attracted relatively high shares of all-India total private investment (45.5 per cent). Shares of the four varied between 11 per cent and 12.5 per cent. Andhra Pradesh was the only other state to attract a similar share (12.9 per cent).

The HPSE group attracted 50 per cent of all private domestic investment and the four states individually achieved shares of between 9.6 per cent and 13.2 per cent. The HPSEs attracted a lower group share 37.9 per cent of FDI. This was partly because of the low share for Gujarat (3.4 per cent). But it was also due to large shares for states

other than the HPSEs, particularly Andhra Pradesh (24.3 per cent) and Orissa (19.8 per cent). Together the five state share leaders obtained 78.6 per cent of FDI, and 82 per cent including Gujarat.

The distribution of total investment by ownership in the HPSEs in October 2000 (Tables 6.17 and 6.18) shows an even split between government and private sources for the group and for three of the four states in the group. The exception was Karnataka, which depended primarily on private investment (72.7 per cent) rather than government investment (27.3 per cent). MPSEs relied on government investment less than on private sources. Within MPSEs, Andhra Pradesh relied heavily on private investment (71.1 per cent) as did West Bengal to a lesser extent (58.5 per cent). In contrast, Haryana was heavily dependent on government investment (78.3 per cent). In the LPSE group, Bihar relied almost exclusively on government for investment (95.6 per cent), whereas Punjab and Orissa succeeded in attracting significant levels and shares of private investment at a significant level (64.1 and 61.9 per cent, respectively).

Within government sources, the proportion from the central government for HPSEs was dominant only for Tamil Nadu (39.2 per cent), while state government investment dominated in the other three states, particularly in Maharashtra and Gujarat. Amongst MPSEs, central government investment dominated in Kerala and Haryana. The same was true of Orissa, Uttar Pradesh and Bihar in the LPSE group.

Within private investment sources, all four states in the HPSE group depended on domestic investment far more than on foreign private investment, particularly Gujarat. The latter provided significant shares in Karnataka, Maharashtra, less so in Tamil Nadu and with a small share in Gujarat. Andhra Pradesh and Orissa were the only two (other group) states in which foreign private greatly exceeded domestic private investment at that time. Private domestic investment was much more dominant amongst MPSEs, except for Andhra Pradesh where FDI provided around two-thirds. This was even more evident in the LPSE group with the exception of Orissa, where FDI contributed more than 75 per cent.

The state shares of investment under implementation in 2000 showed the HPSEs more active (40.5 per cent) than the MPSEs (24.6 per cent) and the LPSEs (18.9 per cent). Maharashtra and Gujarat had

Table 6.17 Statewise distribution of total investment (percentage of all India), October 2000

State	*Total Govt.*	*Central-Govt.*	*Other-Govt.*	*Private-Total*	*Private-Domestic*	*Private-Foreign*	*Total*
High Growth	42.32	34.35	51.78	45.48	49.55	37.9	43.81
Karnataka	4.36	2.23	6.92	12.51	13.19	11.25	8.28
Maharashtra	12.77	7.39	19.24	11.11	9.60	13.91	11.97
Tamil Nadu	12.16	16.07	7.46	11.04	11.95	9.35	11.62
Gujarat	12.97	8.66	18.15	10.82	14.81	3.40	11.93
Medium Growth	23.53	21.87	25.52	27.80	24.74	33.50	25.59
West Bengal	3.06	2.04	4.29	4.64	4.47	4.97	3.83
Andhra Pradesh	7.63	6.14	9.42	12.89	6.78	24.25	10.16
Kerala	3.30	4.51	1.84	2.75	3.09	2.12	3.04
Haryana	2.24	2.87	1.48	0.67	0.79	0.44	1.48
Madhya Pradesh	4.52	4.35	4.73	4.61	6.18	1.70	4.57
Rajasthan	2.78	1.96	3.76	2.24	3.43	0.03	2.52
Low Growth	16.84	22.43	10.10	16.65	13.32	22.89	16.75
Orissa	5.06	7.15	2.54	8.85	2.97	19.81	6.89
Punjab	1.33	1.05	1.67	2.55	3.52	0.76	1.92
Uttar Pradesh	5.35	6.55	3.90	5.00	6.44	2.32	5.18
Bihar	5.10	7.68	1.99	0.25	0.39	0.01	2.77
14 States	82.31	78.54	87.30	89.94	87.61	94.32	86.16
All India	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: CMIE Capex database, Mumbai.

the highest shares. Comparison with the previous year showed more than 3 per cent reduction in share for the HPSEs, due mostly to lower shares in Karnataka and Gujarat, and higher shares under implementation for the LPSEs, suggesting a slight change in geographical emphasis of new investment. Orissa and Uttar Pradesh have more proposed investment brought under implementation.

Overall, the foregoing analysis suggests that the leadership in growth rates and investment shown by the HPSE group in the 1990s will be maintained at least in the short to medium term. It will be sustained by this strong investment performance at the end of the decade, by

Table 6.18 Distribution of total investment by ownership in each state, October 2000

State	*Total Govt.*	*Central Govt.*	*Other-Govt.*	*Total Private*	*Private-Domestic*	*Private-Foreign*	*Total*
High Growth	50.01	22.22	27.79	49.99	35.44	14.56	100.00
Karnataka	27.27	7.63	19.64	72.73	49.87	22.86	100.00
Maharashtra	55.31	17.50	37.81	44.69	25.14	19.55	100.00
Tamil Nadu	54.26	39.17	15.09	45.74	32.20	13.53	100.00
Gujarat	56.32	20.56	35.76	43.68	38.89	4.79	100.00
Medium Growth	47.67	24.22	23.45	52.33	30.30	22.03	100.00
West Bengal	41.53	15.13	26.40	58.47	36.59	21.88	100.00
Andhra Pradesh	38.92	17.12	21.80	71.08	20.92	40.16	100.00
Kerala	56.36	42.12	14.24	43.64	31.92	11.72	100.00
Haryana	78.33	54.83	23.50	21.67	16.69	4.98	100.00
Madhya Pradesh	51.35	27.01	24.34	48.65	42.40	6.25	100.00
Rajasthan	57.12	22.00	35.12	42.88	42.70	0.18	100.00
Low Growth	52.11	37.93	14.18	47.89	24.90	22.99	100.00
Orissa	38.10	29.42	8.68	61.90	13.50	48.40	100.00
Punjab	35.93	15.48	20.45	64.07	57.44	6.63	100.00
Uttar Pradesh	53.51	35.81	17.71	46.49	38.96	7.52	100.00
Bihar	95.59	78.67	16.92	4.41	4.37	0.03	100.00
14 States	49.72	25.87	23.86	50.28	31.86	18.42	100.00
HPSEs	49.33	21.65	27.68	50.67	35.53	15.15	100.00
All India	51.85	28.33	23.51	48.15	31.33	16.83	100.00

Source: CMIE Capex database, Mumbai.

high growth rates in the 1996–99 period and by the progressive reform policies being implemented by the state governments.

PROSPECTS FOR OTHER STATES

This final section commences with a review of potential industrial opportunities in the MPSE and LPSE groups, bearing in mind that

there are important concentrations of manufacturing in the two groups. This is followed by an assessment of prospects for these other states through the identification of the likely determinants of GSDP growth rates across all states.

As for the HPSEs, two indicators give a profile of potential industrial opportunities in these two performance groups:

1. the structure of manufacturing industry, given by the average shares of each industry in a state's industrial investment (Tables 6.19 and 6.21), and
2. the structure of manufacturing industry given by the average share of each state industry in its total industry at national level (Tables 6.20 and 6.22).

In the MPSE group, West Bengal shows a strong concentration in manufacturing industry. Basic metals and alloys contribute 29.7 per cent of total GFCF, followed by rubber, petroleum, plastic and coal products (14.8 per cent) and machinery and equipment (11.6 per cent), with the three making up 56 per cent of the total. Food products and basic chemicals and products add a further 7 per cent each. There is a similar concentration in Andhra Pradesh with basic chemicals and products as the leader (27 per cent), followed by paper and products (12.3 per cent) and non-metallic mineral products (11.2 per cent), contributing 50 per cent in all. In Kerala, four manufacturing industries dominate: basic chemicals and products (19.3 per cent), basic metals and alloys (15.6 per cent), rubber, petroleum, plastic and coal products (14.1 per cent and food products (10.6 per cent), comprising 60 per cent of the total. Haryana has a different pattern with transport equipment and parts dominating (26.8 per cent), machinery and equipment (17.8 per cent), and basic metals and alloys (13.7 per cent), giving 58 per cent in total. Madhya Pradesh concentrated on basic metals and alloys (28.1 per cent), non-metallic mineral products (24.3 per cent) and food products (12.5 per cent), contributing 65 per cent in total. Rajasthan concentrated on two industry groups: non-metallic mineral products (31.8 per cent), and wool, silk and man-made fibre textiles (24.7 per cent).

In a national context, the MPSE group contributed 24.1 per cent to all India GFCF. It contributed most substantially in jute and other

Table 6.19 Structure of manufacturing industry in the organised sector: Average share of each industry in a state's industrial investment in the medium growth states, average for 1995–96 to 1997–98 (percentage of GFCF in the state)

Sl. No.	*Industry*	*West Bengal*	*Andhra Pradesh*	*Kerala*	*Haryana*	*Madhya Pradesh*	*Rajasthan*	*MPSE*	*India*
1	Food products	7.29	9.02	10.61	5.94	12.49	1.80	8.28	5.78
2	Beverage, tobacco and related products	2.98	0.34	1.52	1.90	1.03	1.23	1.37	1.29
3	Cotton textiles	6.18	7.70	6.50	2.94	5.46	6.09	5.50	6.55
4	Wool, silk and man-made fibre textiles	0.95	1.42	1.05	1.31	3.73	24.67	5.02	4.35
5	Jute & other vegetable fibre textiles except cotton	6.50	0.27	0.58	0.00	0.05	0.00	0.85	0.22
6	Textile products including wearing apparel	0.48	0.56	1.62	1.81	0.06	1.73	0.93	1.40
7	Wood and wood products and furniture & fixtures	0.40	0.13	0.64	0.11	0.18	0.11	0.19	0.22
8	Paper and products and publishing, printing and allied	2.56	12.30	9.71	4.75	1.06	0.89	6.03	4.66
9	Leather and products, fur and substitutes of leather	0.58	0.05	0.44	0.34	0.13	0.20	0.31	0.50
10	Basic chemicals & products	7.18	27.02	19.27	4.87	5.30	12.11	12.23	22.08
11	Rubber, plastic, petroleum and coal products; and processing of nuclear fuels	14.75	9.89	14.07	5.24	9.45	4.38	8.53	10.33
12	Non-metallic mineral products	2.64	11.20	6.72	5.10	24.30	31.80	14.60	6.33
13	Basic metals and alloys	29.72	7.73	15.59	13.66	28.09	4.41	18.57	16.63
14	Metal products & parts except machinery and equipment	1.78	2.16	1.33	2.41	2.10	0.85	1.81	2.33
15	Machinery and equipment except transport equipment	11.59	6.82	7.04	17.80	4.68	6.82	8.78	8.10
16	Transport equipment and parts	3.62	2.40	2.90	26.76	1.75	1.26	5.67	8.10
17	Other manufacturing	0.80	1.00	0.41	5.06	0.15	1.65	1.32	1.13
	All Industries	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Central Statistics Organisation (2000).

Table 6.20 Structure of manufacturing industry in the organised sector: Average share of each state industry in its total industry (per cent of all India GFCF) in the medium growth states, average of 1995–96 to 1997–98

Sl. No.	*Industry*	*West Bengal*	*Andhra Pradesh*	*Kerala*	*Haryana*	*Madhya Pradesh*	*Rajasthan*	*MPSE*	*India*
1	Food products	3.46	8.35	4.55	3.16	12.52	0.93	32.97	100.00
2	Beverage, tobacco and related products	6.08	–1.76	4.64	4.91	4.18	2.39	20.44	100.00
3	Cotton textiles	2.42	6.71	1.71	1.40	5.02	2.75	20.01	100.00
4	Wool, silk and man-made fibre textiles	0.63	1.88	1.68	0.98	5.29	16.91	27.38	100.00
5	Jute and other vegetable fibre textiles except cotton	77.88	6.70	3.80	0.03	1.20	0.00	89.61	100.00
6	Textile products including wearing apparel	1.01	2.35	3.96	4.73	0.26	3.60	15.91	100.00
7	Wood and wood products and furniture and fixtures	4.88	3.98	3.88	1.63	6.11	1.44	21.92	100.00
8	Paper and products and publishing, printing and allied	1.69	14.53	9.76	3.11	1.43	0.58	31.11	100.00
9	Leather and products, fur and substitutes of leather	3.32	0.63	8.23	2.06	1.60	1.23	17.08	100.00
10	Basic chemicals and products	0.94	7.24	1.57	0.73	1.47	1.67	13.62	100.00
11	Rubber, plastic, petroleum and coal products; and processing of nuclear fuels	4.42	6.88	2.12	1.84	7.72	1.64	24.61	100.00
12	Non-metallic mineral products	1.16	9.87	2.49	2.51	23.04	14.91	53.97	100.00
13	Basic metals and alloys	4.97	2.58	5.90	2.57	10.54	0.80	27.35	100.00
14	Metal products and parts except machinery and equipment	2.14	5.24	2.50	3.09	5.96	1.10	20.03	100.00
15	Machinery and equipment except transport equipment	3.82	4.71	4.77	6.75	3.55	2.53	26.14	100.00
16	Transport equipment and parts	1.16	1.69	2.72	11.26	1.39	0.54	18.76	100.00
17	Other manufacturing	1.81	5.71	1.94	14.58	0.89	4.47	29.40	100.00
	All Industries	2.72	5.58	3.47	3.08	6.24	2.98	24.08	100.00

Source: Central Statistics Organisation (2000).

Table 6.21 Structure of manufacturing industry in the organised sector: Average share of each industry in a state's industrial investment in the low growth states, average for 1995–96 to 1997–98 (percentage of GFCF in the state)

Sl. No.	*Industry*	*Orissa*	*Punjab*	*Uttar Pradesh*	*Bihar*	*LPSE*	*India*
1	Food products	2.21	9.67	5.22	1.88	4.75	5.78
2	Beverage, tobacco and related products	0.41	6.17	2.39	0.66	2.21	1.29
3	Cotton textiles	0.17	7.75	6.21	0.02	4.34	6.55
4	Wool, silk and man-made fibre textiles	0.05	15.72	3.45	0.00	3.96	4.35
5	Jute and other vegetable fibre textiles except cotton	0.24	1.78	0.02	0.03	0.22	0.22
6	Textile products including wearing apparel	0.07	3.57	1.08	0.03	1.06	1.40
7	Wood and wood products and furniture and fixtures	0.60	1.49	0.16	0.04	0.31	0.22
8	Paper and products and publishing, printing and allied	14.48	4.05	5.50	0.14	5.09	4.66
9	Leather and products, fur and substitutes of leather	0.00	0.28	1.28	0.02	0.74	0.50
10	Basic chemicals and products	7.91	9.97	22.18	2.24	14.40	22.08
11	Rubber, plastic, petroleum and coal products; and processing of nuclear fuels	3.44	1.41	10.25	–0.57	6.04	10.33
12	Non-metallic mineral products	4.19	6.95	2.11	5.06	3.60	6.33
13	Basic metals and alloys	64.19	5.91	15.51	78.58	33.76	16.63
14	Metal products and parts except machinery and equipment	0.40	2.44	1.20	0.35	1.07	2.33
15	Machinery and equipment except transport equipment	1.45	10.73	6.84	1.81	5.64	8.10
16	Transport equipment and parts	0.17	11.52	15.39	9.61	12.05	8.10
17	Other manufacturing	0.00	0.59	1.20	0.08	0.76	1.13
	All Industries	100.00	100.00	100.00	100.00	100.00	100.00

Source: Central Statistics Organisation (2000).

Table 6.22 Structure of manufacturing industry in the organised sector: Average share of each state industry in its total industry (percentage of all India GFCF) in the low growth states, average for 1995–96 to 1997–98

Sl. No.	*Industry*	*Orissa*	*Punjab*	*Uttar Pradesh*	*Bihar*	*LPSE*	*India*
1	Food products	0.89	3.86	9.99	1.29	16.03	100.00
2	Beverage, tobacco and related products	0.72	10.14	21.28	2.07	39.21	100.00
3	Cotton textiles	0.07	2.57	9.40	0.01	12.05	100.00
4	Wool, silk and man-made fibre textiles	0.02	9.22	7.81	0.00	17.05	100.00
5	Jute and other vegetable fibre textiles except cotton	2.38	15.41	0.84	0.44	19.07	100.00
6	Textile products including wearing apparel	0.14	6.26	7.68	0.08	14.16	100.00
7	Wood and wood products and furniture and fixtures	5.35	12.41	8.31	0.98	27.05	100.00
8	Paper and products and publishing, printing and allied	6.22	2.29	12.44	0.13	21.08	100.00
9	Leather and products, fur and substitutes of leather	0.00	1.47	27.50	0.16	29.13	100.00
10	Basic chemicals and products	0.73	1.07	9.47	0.39	11.66	100.00
11	Rubber, plastic, petroleum and coal products; and processing of nuclear fuels	0.83	0.36	11.97	–0.54	12.62	100.00
12	Non-metallic mineral products	1.57	2.70	3.47	3.23	10.97	100.00
13	Basic metals and alloys	9.63	0.83	10.10	19.27	39.83	100.00
14	Metal products and parts except machinery and equipment	0.45	2.48	5.38	0.61	8.92	100.00
15	Machinery and equipment except transport equipment	0.42	3.12	8.80	0.90	13.24	100.00
16	Transport equipment and parts	0.04	3.43	17.25	4.71	25.43	100.00
17	Other manufacturing	0.01	1.26	11.82	0.42	13.51	100.00
	All Industries	2.35	2.35	10.30	4.00	19.00	100.00

Source: Central Statistics Organisation (2000).

vegetable fibre textiles (89.6 per cent) and in non-metallic mineral products (53.9 per cent). It contributed over 30 per cent in two other industries, paper and products and food products (33 per cent). States which contributed significantly in particular industries were West Bengal in jute (77.9 per cent), Andhra Pradesh in paper and products (14.5 per cent), Haryana in transport equipment and parts (15 per cent) and other manufacturing (14.6 per cent), Madhya Pradesh in non-metallic mineral products (23 per cent) and basic metals and alloys (10.5 per cent) and Rajasthan in wool, silk and man-made fibre textiles (16.9 per cent) and in non-metallic mineral products (14.9 per cent).

In the LPSE group, the concentration of manufacturing industries within each state was even greater than in the MPSE group. In Orissa, basic metals and alloys added 64.2 per cent and paper and products (14.5 per cent). In Punjab, wool, silk and man-made fibre textiles contributed 15.7 per cent, transport equipment and parts 11.5 per cent, and two other industries at 10 per cent each. In Uttar Pradesh there were four prominent industries: basic chemicals and products (22.2 per cent), basic metals and alloys (15.5 per cent), transport equipment and parts (15.4 per cent) and rubber, petroleum, plastic and coal products (10.3 per cent). Bihar had the greatest concentration with 78.6 per cent in basic metals and alloys and 9.6 per cent in transport equipment and parts.

At the national level (Table 6.22), the all industry contribution of the LPSE group to all India GFCF was only 19 per cent. Among industries, it was over 30 per cent for two industries: basic metals and alloys (39.8 per cent) and beverage, tobacco and related products (39.2 per cent). It was above the all industry average for wood and wood products (27 per cent), leather and products (29 per cent) and transport equipment and parts (25.4 per cent).

Orissa made no industry contributions nationally above 10 per cent. Punjab's most important industry was jute and other vegetable fibre textiles (15.4 per cent) followed by wood and wood products (12.4 per cent). There were contributions nationally of over 15 per cent from Uttar Pradesh in three industries: leather and products (27.5 per cent), beverage, tobacco and related products (21.3 per cent) and transport equipment and parts (17.3 per cent). The only significant industry nationally in Bihar was basic metals and alloys (19.3 per cent).

Uttar Pradesh made the highest contribution of all states among the MPSEs and LPSEs of 10.3 per cent.

Prospects for other states are also assessed through identification of the determinants of the GSDP growth rates. For this, the range of socio-economic features of development considered earlier in this chapter is brought together in Table 6.10. It includes sector growth rates and shares, economic and social infrastructure, size of economy, GSDP per capita, average growth rate of per capita income, total population, population growth, urban/total population ratio, literacy, work participation rate, life expectancy, investment variables, fiscal deficit and level of public debt. The investment variables comprise proposed industrial investment, FDI approvals, private investment growth rates and shares, shares of government capital outlays and distribution of total investment. These variables are ranked as described in Table 6.10 for the 14 major states and are set out against GSDP growth rates by states. They are discussed in turn in the following in terms of their expected and actual associations during the reform period of the 1990s.

CONCLUSIONS

The ordering of the 14 major states into three performance groups based on their rates of growth of GSDP in the reform period of 1993–99 has been fruitful in a number of ways. First, the ordering suggests some geographical dimensions. The four HPSEs are maritime states and the three states thought to have most potential to become HPSEs (West Bengal, Andhra Pradesh and Kerala), are also maritime. Only one coastal state, Orissa, is excluded from this pattern. By contrast, states in the LPSE group, together with the relatively low performers in the MPSE group, are all northern hinterland states.

Second, the ordering revealed a remarkably consistent pattern with a range of variables considered as determinants of growth rates. In their association with GSDP growth rates, all of these variables behaved in the expected fashion. These associations suggest several messages.

A central message is given by the strong positive association between GSDP growth rates and investment levels in the reform period of the 1990s in the government and private sectors. This held for public and private sectors, and for the latter, for domestic and foreign direct investment with few state exceptions. It also held for total investment most recently, with few state exceptions.

A second message is the importance of adequate economic and social infrastructure. This was manifest most strongly at the low end of the GSDP growth rates. States that rated low on these indexes were low growth states. This is consistent with low investment flows.

This gives rise to a third message for state governments because of the strong inverse associations found between fiscal deficits and debt levels and GSDP growth rates. State governments with high fiscal deficits and growing debt levels choke off the flow of government outlays on fixed capital formation. Moreover, they fail to provide the necessary investment environment for investors. Corroborative evidence was found in the low rates of investment in the power sector during the 1990s, particularly in the LPSE and MPSE groups of states.

A fourth message is the need for state governments to develop effective policy packages to accelerate growth in all three sectors simultaneously. The record of the 1990s has revealed disappointing performances for most major states in industrial and agricultural sectors in a new era of economic reform. States have to be able to identify and promote investment opportunities on a sectoral basis that will be competitive enough to attract investment flows.

At this point, the most prospective states for elevation to the HPSE group are those showing the best signals on key development variables of infrastructure, investment and policy environments. West Bengal already has a GSDP growth rate to qualify in the HPSE group. But the question is whether this can be sustained. Many of the other indicators put this in question. A first concern is its low ranking for industrial growth and its relatively narrow industrial base. Second is its low ranking for economic infrastructure. Third is its low ranking for a number of investment indicators, including low shares in proposed industrial investment in the 1990s and in FDI approvals. Fourth, the state has a weak record on fiscal responsibility and debt control.

Andhra Pradesh is the second candidate for promotion. In many respects, this state closely parallels its neighbour Karnataka, but without the latter's high growth performance. In the 1990s, it was ranked fourth in agricultural sector growth and third for industrial growth. Its weakness was in services as Karnataka's was in agriculture. It is endeavouring to rectify this, particularly with the promotion of its expanding IT sector for which the state has a number of considerable advantages. It was ranked not far below Karnataka in economic and social infrastructure and was ranked lower in a majority of key investment indicators including FDI approvals and average growth rate and shares of private investment. It has an ambitious and visionary government policy on agricultural, industrial and service industry development, including measures to attract new foreign investment. It is making a strong competitive pitch for its IT sector. It needs firmer fiscal control, but overall, it has the potential to lift performance progressively to reach HPSE status.

Other states currently are more seriously disadvantaged by weaknesses in investment performance (Kerala, Haryana and Punjab) or weak infrastructure (Madhya Pradesh and Uttar Pradesh) or both (Orissa, Rajasthan and Bihar) and are unlikely candidates for promotion in the short to medium term. Some of the reasons for the widening disparities, and the ways they can be narrowed have been identified in the above analysis, and can be a source of guidance for policy makers.

7

Policy Conclusions

When India launched its economic reforms in the early-1990s, it was a major break from the past policies aiming to achieve economic development through reliance on public sector investment, high import tariffs and high rates of domestic taxes to generate resources to finance investment. This is admittedly a simple description of the policies that were pursued in the past. The economy was indeed far more complex where private sector played a prominent role both in terms of providing an impetus to growth and providing employment to the growing labour force. We should also note that while beginning of 1991 is generally the beginning of the economic reforms with the unraveling of the rigid industrial licensing policies and reduction in import tariffs, some reform measures were initiated in the middle of 1980s.

Following the 1991 'watershed decisions', it has been a period of evolution of new economic policies as there has emerged a new set of fiscal, monetary, financial and sectoral policies providing a greater role for markets in the allocation of scarce resources. In about a decade and a half following the macroeconomic crisis which triggered the reforms in 1991, there has been an acceleration of economic growth in India. While the growth acceleration can be traced to the early 1980s, its sustenance and further strengthening occurred in the next 15 years. The Approach Paper to the Eleventh Five Year Plan prepared by the Planning Commission of India articulated the feasibility of accelerating

overall GDP growth to above eight per cent per year during the period 2007 to 2011. The Approach Paper, however, also drew attention to the need for a balanced and inclusive pattern of economic growth.

India is a large economy in terms of population and output. In purchasing power parity terms it is now ranked fourth next to USA, China and Japan. India has 28 states with their own directly elected assemblies and seven territories administered by the centre. The states vary in population and geographical size. Some 10 states have a population today exceeding 50 million, which is the population that many countries possess. For the national economy to be doing well, it is necessary that several of the states also perform well.

An important dimension of policy making in India has also been its federal nature of the government. The states are responsible for many policies which affect investment climate and actual conduct of an enterprise. For instance, access to essential infrastructure services and facilities such as land, water and electricity are influenced by policies at the state level. The employment related regulations are also primarily states' responsibility. Performance of the state economies is, therefore, a concern for both the central government as it is to the state governments. The lessons that can be drawn from the varied performance of the states over the years are a matter of interest for designing policies to promote economic growth.

With this in view, we set out to examine selected dimensions of economic growth of the state economies of India. The selection of topics was dictated by a research agenda of the authors which developed over the past few years. An important underlying theme of the work has been the issue of agricultural growth. Agriculture has not seen significant reforms in the current phase of economic reforms. Agricultural growth performance has also been far less impressive relative to the non-agricultural sectors. Therefore, agricultural growth is an important policy concern.

The issues we have examined include the sources of economic growth at the state level, patterns of economic growth across states, intersectoral linkages between agriculture and industry, interregional linkages, investment patterns in the states and the impact of economic policies at the macro level on the state-level economies.

The findings emerging from the analysis presented in various chapters point to the factors that have led to the success of some states relative to the slow progress of the others. We summarise these findings as follows:

Lessons from Income Convergence Analysis

The principal force driving convergence in the neoclassical growth model is diminishing returns to reproducible capital. Thus, economies with lower initial values of capital–labour ratios will have high marginal products of capital and, therefore, will tend to grow at higher rates. But inefficient and poor-quality institutions and organisations could lead to violation of the critical assumption of diminishing returns to reproducible capital. This means divergence of income for a considerable period of time in the development process. Therefore, it is logical to argue that the convergence hypothesis will hold only when country-specific institutions and organisations do not intervene in the process negatively to delay or constrain the convergence process. Thus, drawing on Hayami's findings, testing the convergence hypothesis of income provides an alternative method of examining the link between institutions and inequalities.

First, using Williamson's weighted coefficient of variation and covariation across sectors, the degree of interregional income inequalities is examined. The results show that interregional income inequality increased over time, which indicates the inefficient functioning of the institutions in India during the period. The growth of the tertiary sector has contributed more than the growth of the primary and secondary sectors to interregional inequality. Per capita incomes across states over the pre-reform period have shown divergence, indicating the accentuation of interstate disparities in the pre-reform periods. The results indicate an inverted U-shaped relationship between the quality of institutions and inequality.

These results are consistent with the recent view that greater equality can be positively associated with growth (Birdsall et al., 1995). The link is provided by the quality of institutions. Thus primary importance

in the governance should be given to improving and sustaining the quality of country-specific institutions.

The accelerated acceptance of better technologies and best techniques depends on sustained investment in agricultural infrastructure, including agricultural credit. Central and state government expenditures on subsidising inputs such as power and fertilisers would be better spent on infrastructure. Relaxing government regulations and promoting competition from enterprises within and outside India would improve the performance of the secondary sector, particularly manufacturing. Accountability and not paternalism should be the driving force for public sector enterprises. The recent economic reform appears to be working in these directions to improve the overall performance of the Indian economy.

Sources of Economic Growth across States

The most important perspectives emerging from the analysis of variation in the patterns of growth across states are that there were high growth rate states in each of the three decades that performed well above average. A second is that at least two of these were consistently top performers throughout the whole period. A third is that these performances were achieved with high growth rates in all three sectors—agriculture, industry and services. These performances set high norms for state level performance.

There are important policy implications concerning the importance of agriculture in the development process. The combination of the close association of high and sustained growth rates of NSDP with high growth rates of NSDP from agriculture, and the positive and significant relationship between the growth rate of agriculture and of the industrial and service sectors, clearly demand that reform policy should assign a high priority to implementing measures for achieving a high growth rate of NSDP from agriculture.

Second, this can be best achieved through increases in agricultural productivity. The lack of such priority in the past in all but a few states has been the principal cause of weak growth performance of overall

and state growth performance in the past. It has also slowed the transition process from agrarian-based state economies to industrial and service industry dominance and has slowed the rate of reduction of poverty. Given that investors tend to favour faster growing states, it has also severely reduced the number of states that are able to attract investors and large scale investment. The association of a number of other policy-related variables with high growth rates of NSDP also provides guidance.

The association of high growth rates of NDSP with low population growth rates, higher life expectancy and literacy rates provides support for policies of population control, and enhanced programmes of public health and primary education. This argument also applies to provision of better transport and communications infrastructure, such as railways and roads, and provision of expanded services such as power, gas and water. The analysis also gives a clear signal of the importance in policy of improving financial services, particularly the expansion and modernisation of the banking and insurance sectors.

Finally, the rapidly increasing importance of decentralisation of government and the growing responsibilities of states in the reform process lend added weight to the above policy implications, many of which need to be implemented by the states.

Harnessing Intersectoral Linkages for Growth

Results from the analysis of intersectoral linkages between agriculture and industry support the view that reforms should ideally be targeted at both sectors given the bi-directional interdependency prevailing in most states and for all India. Reforms that encourage investment in agriculture and raise incomes will effectively expand the market for manufactures.

The fact that agriculture has a relatively low import intensity makes the sector all the more attractive as a target for reform. Put another way, a reform process that ignores agriculture also ignores the sector's capacity to contribute to a more rapid overall rate of economic growth. Advantage should be taken of the fact that most agricultural

commodities are efficient exportables or efficient import substitutes (Gulati and Chadha, 1994). Investment in agricultural diversification, for example, into higher value added commodities such as fruit, vegetables, milk and milk products and into agro-processing, together with investment in neglected areas with unexploited agricultural potential, for example, the eastern region, could provide another surge in rural purchasing power which could in turn stimulate expansion in a modernising manufacturing sector and inject further dynamism into the intersectoral relations which this study suggests can be the basis for the acceleration of India's growth rate which is the basic objective of the reform and liberalisation process.

Various policies set out the critical areas for reform which include reduction of input subsidies, restructuring of public investment on agriculture, upgrading of quality of research and extension services, resurrection of private investment in the sector, strengthening of the institutional credit system and land reform in several states. The bi-directional linkage gives added strength to the argument as it reveals the mechanism by which the pace of overall economic development can be accelerated.

Harnessing Regional Linkages for Growth

Are there significant trickling down effects of economic growth in one state over the growth in another state in India? We have attempted to look at the statistically significant impulses emanating from growth in one state to the others. The pattern of statewise growth suggests that growth pattern has been different across the major states except for the trend of relatively slower agricultural growth in all the states. Only six states showed consistent acceleration in growth from 1970s into 1980s and then into 1990s: Gujarat, Maharashtra, Orissa, West Bengal, Kerala and Karnataka. These states could have acted as a source of growth impulse to other states. Of these, the analysis shows that West Bengal is the top 'growth causing' state, which is also being influenced by the growth impulses of Punjab and Uttar Pradesh. Kerala is the only state that is significantly enjoying the growth impulses from

Rajasthan, Orissa and West Bengal, while it is influencing growth in Bihar and Haryana. These specific cases of 'growth causing' and 'growth impulse receiving' are not intuitively appealing.

Abstracting from these specific cases, the results of causality tests showed that significant causality is found in relatively small proportion of possible cases. These results suggest that the growth impulses have been limited. A more accurate interpretation of the results, however, would be that the spillover effect has been prominent in only a small proportion of the potential cases. Thus, the results appear to be supporting the views expressed by earlier researchers including Higgins (1983) and Hansen (1990) that the existence of spillover effects across regions may not be significant, particularly in developing countries and one of the reasons appears to be the existence of poor economic institutions across several states.

As the attempt to discern causality or spillover effects has been based purely on statistical relationship, drawing on various theoretical models, we have also examined the importance of selected factors in leading to significant causality. The results suggest that it is the structure of the economy and the growth rate of a state, and the differential in these features in another state including the differences in the quality of state-specific institutions that raise the potential for significant trickling down effects of growth. Although factors such as literacy and infrastructure appeared to be significant in some combinations of the regression model, they were not significant consistently. The 'coastline' of a state appears to improve its being amenable to growth impulses of another state. On other hand, while common border is not an advantage, access to markets appears to be important.

These results also raise an important issue of nurturing appropriate economic institutions across states. This result of 'low' transmission could be more due to barriers to trade and other economic flows across states. Is this an opportunity lost in achieving more efficient allocation of resources which would be suggested by freer flow of factors of production and output across states? The results of the present study cannot be claimed to have settled the issue. A point that needs to be examined is whether the spillover effects are more evident at the sectoral level than at the overall GSDP level. We have also not examined if the 'causality' is positive or negative, that is, whether the

'spread effects (positive)' are more prominent than the 'back wash effects (negative)'.

Investment Patterns across States

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Second, the ordering revealed a remarkably consistent pattern with a range of variables considered as determinants of growth rates. In their association with GSDP growth rates, all of these variables behaved in the expected fashion. These associations suggest several messages.

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A fourth message is the need for state governments to develop effective policy packages to accelerate growth in all three sectors simultaneously. The record of the 1990s has revealed disappointing performances for most major states in industrial and agricultural sectors in a new era of economic reform. States have to be able to identify and promote investment opportunities on a sectoral basis that will be competitive enough to attract investment flows.

At this point, the most prospective states for elevation to the HPSE group are those showing the best signals on key development variables of infrastructure, investment and policy environments. West Bengal already has a GSDP growth rate to qualify in the HPSE group. But the question is whether this can be sustained. Many of the other indicators put this in question. A first concern is its low ranking for industrial growth and its relatively narrow industrial base. Second is its low ranking for economic infrastructure. Third is its low ranking for a number of investment indicators, including low shares in proposed industrial investment in the 1990s and in FDI approvals. Fourth, the state has a weak record on fiscal responsibility and debt control.

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Other states currently are more seriously disadvantaged by weaknesses in investment performance (Kerala, Haryana and Punjab) or

weak infrastructure (Madhya Pradesh and Uttar Pradesh) or both (Orissa, Rajasthan and Bihar) and are unlikely candidates for promotion in the short to medium term. Some of the reasons for the widening disparities, and the ways they can be narrowed have been identified in the above analysis, and can be a source of guidance for policy makers.

Economic Policies and Agricultural Growth

The alternative simulations of the model reflecting elements of diverse set of policies provide some important insights into the implications for policies towards agriculture. Policies were grouped into two main categories of *(a)* those affecting agriculture directly and *(b)* those affecting agriculture indirectly. The results point to the potential for raising agricultural output through alternative policy measures and the likely impact on a number of other variables relating to agriculture and other sectors in the economy. The results also point to the variation in the responses of different states to policy changes at the macro level or at the sector level. We summarise in the following the main results in terms of their implications for policies to accelerate and sustain agricultural growth.

Supply Response of Agriculture

Subsidised Public Distribution System props up consumption in the face of higher crop prices for selected crops. This is particularly so when higher crop prices result from increased support prices for agricultural products. However, the restrictions on agricultural trade which result in an implicit tax on agricultural output point to another source of improved price for agricultural output without the accompanying decline in consumption demand when trade restrictions are lowered. While domestic consumption demand may decrease as crop prices rise, export demand for agricultural output would absorb the increased output. In the simulation where crop prices increase by 5 per cent, real gross crop output increases by 1.84 per cent. The crop yield increases by 1.66 per cent as consumption of fertilisers, demand for tractors, gross irrigated area and gross crop area increase relative to their levels

in the base run scenario. The estimated increase in crop output (1.84 per cent) implies relatively low supply response to the price rise of 5 per cent. Therefore, the impact of lowering trade restrictions on agricultural output would depend on the extent of disprotection afforded to agriculture in the present trade regime.

Aggregate Economic Policies, Intersectoral Linkages and Agriculture

Macroeconomic policies such as those relating to exchange rate and fiscal balance influence different sectors in the economy differently depending on the flexibility for adjustment at the sector level. The flexibility of the sector is reflected in the variation in its price response to the overall shock. The differential impact on prices across sectors leads to the 'terms of trade' effect that influences the use of inputs in agriculture supplied by the manufacturing sector. As price of agricultural output varies relative to the price of manufactured products, input use in agriculture is affected. Improvement in terms of trade, thus, implies more intensive use of inputs and hence larger agricultural output. Intersectoral linkages, therefore, influence the transmission of changes in macroeconomic parameters to the sectoral level.

Results of the present study show that depreciation of the rupee is likely to benefit agriculture relative to manufacturing as crop exports respond to the rise in export price and non-food grain prices respond relatively more than the food grain prices. As the price of one of the key inputs, that is, fertiliser, remains fixed, higher crop prices result in more intensive use of inputs. In the case of manufacturing sector, depreciation implies higher input prices along with higher exports. The higher prices of manufactured products affect consumption demand adversely. However, the rise in manufactured products stimulates fixed investment leading to a marginal increase in the output of the manufacturing sector. Thus, while both agricultural and manufacturing outputs increase, the rise in agricultural output is relatively greater than in the case of manufacturing.

Reduction in the tariff rate for the imports of manufactured products results in a decrease in the domestic price of manufactured products. Reduction in the price of manufactured products implies lower price of inputs in agriculture that are produced in the manufacturing sector.

As agricultural prices are unaffected, improved terms of trade lead to an increase in the use of inputs in agriculture and hence an increase in output.

Composition of Crop Output

Crop output composition is of policy relevance due to the issue of food security. How would different policies affect the composition of output? In the present study an attempt has been made to differentiate crop output in terms of three groups: rice and wheat, other food grains and non-food grains. There are two basic mechanisms by which the crop output composition is influenced in the present model: *(a)* by the difference in the response of prices of different crop groups to various shocks and the subsequent response of output ratios to price changes; *(b)* response of crop output composition to changes in the production conditions reflected in access to irrigation.

The pattern resulting from alternative policy changes is a complex one given the role of regional variations in output response and the variation in the price response of crops to output changes which in turn influence crop-mix.

Some broad conclusions that can be drawn are, if the policy change begins with an increase of aggregate output, then the resulting price decline is the sharpest in the case of 'other food grains', followed by rice and wheat and non-food grains.

Any generalisation of the impact of policy changes on the crop mix is difficult. For some specific policies, the model results indicate that *(a)* a depreciation of the exchange rate increase the ratio of non-food grains to food grain output while both the outputs increase, *(b)* for a cut in tariffs on manufacturing imports, the ratio of food grain output to non-food grains increases and *(c)* for a uniform rise in all the crop prices, the ratio of food grain to non-food grain output increases. In the other cases, the results are affected by the combination of related policies.

Government Interventions

The government operations in the food grain sector to provide support prices to the farmers and subsidised food grains to selected consumer

groups are affected by specific policy choices relating to agriculture. For instance, policies that result in a reduction in the prices of rice and wheat may decrease the demand for food grains distributed through the PDS. But the policies that increase food grain prices, increase the demand for food grains sold through PDS. When the prices increase, it is not the support price mechanism that is relevant but the coverage of PDS. In the various simulations carried out in this study, the demand for PDS sales is projected to decrease when tariff on manufacturing imports are reduced. Food grain output as well as price decrease when aggregate demand is reduced. The demand for PDS sales is projected to increase when (*a*) exchange rate is depreciated and (*b*) agricultural prices increase. In these three cases, price of food grain increases. The decline in demand for PDS sales when there is a decrease in the food grain price suggests increased access to the supply in the market relative to PDS. There is a need to strengthen PDS in all the cases where there is a likely increase in food grain prices or a decline in the supply of food grains.

The State Dimensions of Impact

Regional variations in the response of agricultural output arise due to differences in production conditions. Two channels through which crop output is influenced is the level of input application and the efficiency with which inputs are utilised. While production response to input use has been found to differ little across states, there is significant variation in the efficiency in production among the states. Efficiency is estimated to vary across the states in response to changes in the composition of crop output. These changes affect production efficiency in each state depending upon the prevailing pattern of output composition and hence produce variation in the state's response to policy changes. Secondly, while production response to input use does not vary across states, demand for inputs is estimated to vary and result in variations in output response to policy changes. The net result of different factors provides an assessment of the impact of the policies on different states.

When there is an increase in the proportion of non-food grain output relative to the output of food grains, there is an increase in

efficiency in the sense that output per hectare is greater from the non-food grain crops. Thus, the policies which influence the composition of output mix produce variable impact at the state level in terms of efficiency, crop yield and crop output. When exchange rate depreciates, efficiency increases the most in Bihar, Uttar Pradesh and West Bengal. Although the ratio of food grain to non-food grain output changes at the same rate in all the states, the impact is greater in the states where initial level of efficiency is lower. The impact is less in the states of Assam, Tamil Nadu, Kerala and Gujarat where the initial levels of efficiency are higher. A similar pattern emerges when the policy changes influence crop output mainly by inducing changes in crop-mix. A change in the relative price of crops, therefore, will result in a greater change in total output in the states with relatively lower levels of efficiency.

Record of Agricultural Growth

We have examined the patterns of agricultural growth at the national as well as state level. The analysis brings out a number of interesting features of agricultural growth in India:

1. Unlike the non-agricultural sectors, growth in agriculture has been steady for almost four decades since 1950. The statistical tests show no structural break in the growth pattern of agriculture.
2. When trend growth in output per hectare is considered, structural breaks occur in the mid-1960s and in 1980s.
3. Growth rates in agriculture exhibit marked cyclical pattern at the crop as well as state levels. The crop level cycles may be attributed to movements in relative prices or other factors relating to market conditions, whereas the state-level cycles may be expected to be related to policies.
4. The pattern of growth rates of agricultural output of the states over short periods of 5 years indicate that all the 15 states are converging to one rate of growth; but over a longer time period

of 10 years, the states with higher proportion of crop area under irrigation are converging to higher rates of growth, whereas the states with lower proportion of crop area under irrigation are converging to lower rate of growth.

The long term growth rate of agricultural output has been seen to remain below that of the non-agricultural sectors. There has been no acceleration of the long-term growth trend in agricultural output as a whole at the national or state level. Output per hectare, however, has shown significant breaks in pattern during the period of 44 years since 1950–51.

On the third issue as to whether the effect of the various policies has been to induce significant convergence of agricultural growth rates across states over time, the evidence points to the importance of irrigation as the factor enabling sustained higher rates of growth in the long term. In the short run, the states exhibit a tendency to converge to a single rate of growth but in the longer run, the states with better irrigation coverage of crop area tend to converge to higher rates of agricultural growth.

State-level policies can have a significant impact in raising the agricultural growth rates when they are low, leading to a convergence of growth rates in the short run. Supply side measures at the state level, such as increasing irrigation facilities, improve the ability of farmers to exploit the market opportunities leading to higher output growth by comparison with states in which such infrastructure is poor and growth rates are lower. However, neither state-level measures taken to date, nor policies that have led to increases in productivity in agriculture, have induced a sufficient impact in the aggregate to create a break in the overall growth rate for agricultural output. Thus, policies to date have been conducive only to the achievement of a steady but slow growth of agriculture at the national level and creation of regional imbalances in the long term.

In a future context, it is clear that a break is needed to a higher growth rate of agricultural output if the sector is to make a dynamic contribution to a higher overall growth rate of the economy. An important policy option is to substantially improve demand side opportunities through

direct reforms to attract higher and sustained investment in improved technology and higher input levels that will create the break. In the process, care would be needed to ensure that such stimulus takes place in states with lower agricultural growth rates to avoid a widening of interstate disparities in agricultural development.

Understanding Linkages between Infrastructure Development and Agricultural Growth

The need for building economic infrastructure in developing economies has been highlighted in many policy initiatives across the world. At an empirical level, however, there has been some debate on the nature of the impact of infrastructure development on economic growth. As much of infrastructure development in developing world is expected to be driven by public sector spending strong analytical and empirical basis for articulating the need for new investments is important.

Applying a generalised approach to the assessment of the impact of infrastructure development explicitly differentiating the impact of different inputs on crop output and differentiating technical progress from technical efficiency, we find that infrastructure development may influence technical efficiency of the firms or regions more strongly than influencing technical progress. The results also point to the potential for changes in the composition of crop output with the development of infrastructure—physical infrastructure or social infrastructure.

A SUMMING UP

The wide range of issues addressed in different chapters of this volume point to the heterogeneity of growth experience of the states. While the state economies are bound by a national policy framework many of the states are large enough to have built diverse economic base. In other

words, the impulses originating in some large states can potentially be quite important for the others and for the national economy they can provide a source of stability. Thus, it is necessary for the larger states to proceed on a path of high growth so that the other smaller states can build their own momentum of growth. The analysis presented in this volume points to the role of institutions, development of physical and social infrastructure that can maximise the positive impact of various economic policies in support of high levels of economic growth. The analyses of this book highlights how crucial it is to improve the performance of the agricultural sector in India towards achieving a sustained high overall economic growth.

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