GROWTH INTERDEPENDENCE AMONG INDIAN STATES: AN EXPLORATION

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The objectives of this paper are to test whether there are any significant trickling down effects of economic growth across the Indian states and to identify the factors influencing the existence of such effects. Using data from 1971 to 1998, and the standard statistical test of causality, this study suggests that the transmission of growth impulses across states have been limited. The results indicate that the structure of the economies, the growth rates of the states and the quality of state-specific institutions appear to raise the potential for significant trickle down growth effects across states.

Variations in economic growth of regions within 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 specialization and a host of other such factors influence development patterns of regions within national economies. The pattern of growth across the states within India has been a subject of interest both to academics as well as policymakers. 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', the trickle down of growth from one region to another has generally been implicit. Relatively the large size of the state economies may indeed have led to an assumption that such inter-state trickling down or spillover effects of growth are small. Conceptually, however, linkages between the economies of different states can be wide-ranging. The input-output linkages, linkages between supply and demand centres for consumption, and linkages between sources of savings and investment are obvious (Krugman, 2000; Schmitz, 2000 and 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

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(Gaile, 1980; Higgins, 1983 and Hansen, 1990). Drawing on Hayami's (1997) discussion of the 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.

Also, the work on convergence of per capita income across Indian states has presented mixed results: the more recent study of Kalirajan and Akita (2002) points to lack of convergence and a previous study by Cashin and Sahay (1995) points to possible convergence. Lack of convergence implies that growth rates of the states are not negatively correlated with the initial level of income. Differential in income level can also have spillover effects on the growth of lower income states due to the mobility of factors of production, leading to convergence. Lack of convergence does not imply, however, lack of spillover effects: the differentials in growth rates may accentuate differences in per capita income but nevertheless there can be a leader-follower relationship.

This paper is an attempt to examine whether growth in one state trickles down (or spills over) to growth in another state using the statistical tests of 'causality'. Are the Indian states 'islands' isolated from each other's growth impulses, or, does growth in one state 'lead' to growth in another? If there is no such evidence statistically, then why is it so? In the following section of this paper, we discuss the changing nature of centre-state economic relations that may be relevant to the promotion or weakening of the linkages between states. In the third section, we briefly review the growth experience of the states in an attempt to discern if there are patterns with respect to growth across states: do some states generally perform 'better' than other states? In section III, 'causality tests' are discussed. We attempt to examine possible explanation for the causal linkages between states in section IV. In section V, the concluding remarks of this exploratory study are presented.

I. CENTRE-STATE ECONOMIC RELATIONS

The major policy shifts of 1991, in the wake of stabilization and structural adjustment programmes, have important implications on centre-state economic relations in India. These in turn have an impact on the nature of the inter-relationship of the economies of the states. First, the policy changes have meant a transfer of power from government controls in favour of markets in deciding the location and level of new investments. Second, stabilization programmes initiated by the central Government had serious consequences on state finances and through them on state economies. In the domestic sector, stabilization programmes essentially consisted of measures to raise Government resources and/or to curtail Government

expenditures to reduce high fiscal deficits from 12.1 per cent of GDP in 1990-1991, the base year for introducing stabilization programmes. Since the states were also contributing to widening fiscal deficits, their active participation was inevitable for the success of stabilization programmes. But, as in most other countries implementing stabilization programmes, the central Government has found the current expenditures sticky and therefore has attempted to reduce deficits by compressing 'developmental' or investment expenditures. In this process the states are affected in two different ways: (a) to the extent that central Government investment expenditures to an individual state shrink, the specific state economies are hurt; and (b) if the efforts to contain fiscal deficits result in a reduction in the transfer of fiscal resources to the states, the level of investment expenditures undertaken by the individual states are adversely affected.

In either case at least a part of the burden of stabilization programmes has fallen on state economies. This implies that the states have to rely increasingly on markets to attract new investments. The markets in turn will be influenced by the interdependence of the state economies for input supplies, demand and other factors influencing production and distribution. Both these influences, namely, the increasing role of the markets in determining location of new investments and the greater need for policy initiatives at the state level would have to take into account the inter-relationship of the state economies to optimize the output from new investments. Industrial policy reforms launched in July 1991 and later reforms concerning industry transfered greater autonomy to states to embark on their industrial development with minimum intervention from the centre. Under industrial policy reforms, now the licensing requirement has been abolished for all but three industries due to their strategic and environmentally sensitive nature or their exceptionally high import content. Existing industries are now permitted to expand according to their market needs without obtaining prior expansion or capacity clearance from the central Government. In the earlier licensing regime, manufacturers could produce only licensed products. Now, with industrial capacity licensing abolished, firms are free to manufacture any item in response to market signals, except for those subject to compulsory licensing. The need for separate permission from the Monopolistic and Restrictive Trade Practices Act (MRTP Act), 1969 for investment and expansion was also abolished. These steps are expected to encourage competition by reducing barriers to entry of new firms and to enable Indian firms to become large enough so that they can compete effectively in global markets.

The above reforms concerning industrial policies have removed past hurdles erected by the centre and the states on establishing and expanding industries. Now, the states have opportunities to contact foreign firms directly to promote

foreign investment. However, improvements in the licensing, inspection and approval procedures at the state level seem to be inadequate. Nevertheless, some of the states are moving forward with many reforms to make licensing procedures at the state level more efficient.

This means that not all the states are likely to enjoy similar growth momentum: either before or post-reform. Variation in the economic growth performance of the states has been significant. Based on growth performance, Lall (1999) classifies the states into lagging, leading and intermediate as follows: (i) lagging states: Bihar, Madhya Pradesh, Orissa, Rajasthan and Uttar Pradesh, (ii) the intermediates: Andhra Pradesh, Assam, Karnataka, Kerala, Tamil Nadu and West Bengal and (iii) leading states: Gujarat, Haryana, Punjab and Maharashtra. The classification is based on the growth of per capita income or per capita net State Domestic Product of the states. The persistence of low growth rates is characteristic of the 'lagging states'. This raises the following important questions: Are the trickle down effects of growth not flowing from the leading states to the lagging states? Why are the lagging states insulated from the economic impulses emanating from the leading states?

II. GROWTH EXPERIENCE OF THE STATES

A number of studies have examined the record of growth of state economies in India at different points in time. Both the sectoral and overall performances of output have received attention. A recent study by Shand and Bhide (2000) points to some regularities in the growth at the state level. A common feature that is observed is the decline in the share of agriculture in overall output. Between the three-year periods ending (TE) in 1972-1973 and 1982-1983, the average share of agriculture in the Net State Domestic Product (NSDP) decreased in 15 of the major states considered in the study.[1] This pattern was also observed for the period TE 1982-1983 to TE 1990-1991 and TE 1990-1991 to TE 1995-1996, with no

[1] These 15 major States account for 95 per cent of the population and 92.5 per cent of net domestic product in the country and are therefore representative. It should also be noted that the concept of NSDP only indicates the income originating in different States and does not represent total income accruing to them. Unfortunately, there are no estimates of the net factor income accruing to a State from outside its boundaries, and therefore it is not possible to take these into account. There is also a further issue relating to the comparability of estimates of NSDP across states as states may differ in the methodology of computation of NSDP for some sectors. Changes in the scope and methodology over time are also a concern. Despite their limitations we utilize these data in the present analysis, as they are the only comprehensive measures of performance of the economies of the states in India.

exceptions.[2] In the case of industry, its average share in NSDP declined in eight of the 15 states during TE 1990 to TE 1995, four states in TE 1982 to TE 1990 and four states during TE 1972 to TE 1982. The decline in the share of industry reflects an increase in the share of services, as the share of agriculture declined over the years in all the states considered. Only in one out of the 15 states in the period TE 1982 to TE 1990 and two out of the 15 in TE 1990 to TE 1995, the average share of services decreased where the average share of industry has risen. Thus, the rise in industry and service sectors has not been sustained across all of the major states in both the time periods. The pattern also suggests more rapid growth of services than industry.

Referring again to the results of Shand and Bhide (2000), in terms of pattern of growth performance across states, Haryana, Punjab and Maharashtra achieved the highest average annual growth rates during the 1970s. In the 1980s, Rajasthan, Haryana and Maharashtra were the top three performers with Gujarat and Tamil Nadu close behind. In the period of 1991-1992 and 1994-1995, the top performers were Maharashtra, Kerala and Gujarat, with West Bengal close behind. Thus, new states emerged among the high performers in the 1980s and 1990s although Gujarat and Maharashtra appeared more often in this category.

For a clearer illustration of the pattern of growth across states, data on trends in growth across the states overall as well as sectoral NSDP are shown in tables 1 to 4. While only some states have recorded “high’ growth rates of say over 4 per cent in the 1970s and 5 per cent or more in the 1980s or 1990s, there has been acceleration in growth during the latter two periods compared to the 1970s in all the states. In the 1980s, each of the 15 major states registered ‘acceleration’ in growth over the experience of 1970s. In the 1990s (1990-1991 to 1994-1995), nine states registered acceleration over the experience of the 1970s and six had slower growth. Over the experience of the 1980s, there were six states that saw accelerated growth in the 1990s. The states of Gujarat, Karnataka, Kerala, Maharashtra, Orissa and West Bengal have improved growth steadily during 1980s and 1990s while the others have ‘mixed’ growth performance.

The patterns examined above indicate that some states have succeeded in maintaining a steady rate of growth. The others were not able to sustain the acceleration in growth. It was noted earlier that agricultural growth lagged behind the other sectors in all the states through the three periods considered.

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[2] The three-year averages are used to remove short-term year-to-year fluctuations. The year terminology 1970-1971 refers to the financial year of April 1970 to March 1971.

Table 1. Pattern of growth in overall NSDP (real) across states

Sl. No.	State	Growth rate (Per cent)	Change in growth rate percentage points		
		1971-1972 to 1979-1980	1981-1982 to 1990-1991 over 1970s	1990-1991 to 1994-1995 over 1970s	1990-1991 to 1994-1995 over 1980s
1	Rajasthan	1.32	A	A	D
2	Tamil Nadu	1.79	A	A	D
3	Kerala	2.19	A	A	A
4	Orissa	2.28	A	A	A
5	Bihar	2.70	A	D	D
6	Karnataka	3.06	A	A	A
7	West Bengal	3.11	A	A	A
8	UP	3.17	A	D	D
9	MP	3.20	A	D	D
10	AP	3.25	A	A	D
11	Assam	3.28	A	D	D
12	Gujarat	3.88	A	A	A
13	Maharashtra	4.27	A	A	A
14	Punjab	4.43	A	D	D
15	Haryana	4.70	A	D	D
16	All 15	2.96	A	A	D

Source: Based on Shand and Bhide (2000).

Notes: 1. The growth rates are averages for the indicated periods; A = acceleration in growth, D = deceleration in growth; NC = no change in average growth rates.

2. The states are arranged in ascending order of the growth rates in the period 1971-1972 to 1979-1980 (1970s).

Table 2. Pattern of growth in agricultural NSDP (real) across states

Sl. No.	State	Growth rate (Per cent)	Change in growth rate percentage points		
		1971-1972 to 1979-1980	1981-1982 to 1990-1991 over 1970s	1990-1991 to 1994-1995 over 1970s	1990-1991 to 1994-1995 over 1980s
1	Tamil Nadu	-0.11	A	A	D
2	Rajasthan	0.08	A	A	D
3	Kerala	0.14	A	A	A
4	Karnataka	1.70	A	A	A
5	AP	2.00	A	A	D
6	Bihar	2.11	A	D	D
7	Orissa	2.75	D	A	A
8	MP	2.88	A	D	D
9	UP	2.98	NC	D	D
10	Haryana	3.00	A	D	D
11	Punjab	3.09	A	D	D
12	West Bengal	3.15	A	A	A
13	Assam	3.84	D	D	D
14	Maharashtra	4.63	NC	NC	NC
15	Gujarat	5.06	A	D	D
16	All 15	1.86	A	A	D

Source: Based on Shand and Bhide (2000).

Notes: 1. The growth rates are averages for the indicated periods; A = acceleration in growth, D = deceleration in growth; NC = no change in average growth rates.

2. The states are arranged in ascending order of the growth rates in the period 1971-1972 to 1979-1980 (1970s).

Table 3. Pattern of growth in industrial NSDP (real) across states

Sl. No.	State	Growth rate (Per cent)	Change in growth rate percentage points		
		1971-1972 to 1979-1980	1981-1982 to 1990-1991 over 1970s	1990-1991 to 1994-1995 over 1970s	1990-1991 to 1994-1995 over 1980s
1	Assam	-1.45	A	A	D
2	West Bengal	2.30	A	A	A
3	Bihar	2.64	A	D	D
4	Rajasthan	2.81	A	A	D
5	Orissa	3.13	A	A	A
6	Tamil Nadu	4.04	A	D	D
7	Maharashtra	4.63	A	A	A
8	AP	4.86	A	D	D
9	Kerala	4.97	D	A	A
10	Punjab	5.08	A	A	A
11	Gujarat	5.27	A	A	A
12	UP	5.28	A	D	D
13	Karnataka	5.47	A	A	D
14	MP	5.49	A	A	D
15	Haryana	7.46	A	D	D
16	All 15	4.07	A	A	D

Source: Based on Shand and Bhide (2000).

Notes: 1. The growth rates are averages for the indicated periods; A = acceleration in growth, D = deceleration in growth; NC = no change in average growth rates.

2. The states are arranged in ascending order of the growth rates in the period 1971-1972 to 1979-1980 (1970s).

Table 4. Pattern of growth in services NSDP (real) across states

Sl. No.	State	Growth rate (Per cent)	Change in growth rate percentage points		
		1971-1972 to 1979-1980	1981-1982 to 1990-1991 over 1970s	1990-1991 to 1994-1995 over 1970s	1990-1991 to 1994-1995 over 1980s
1	Tamil Nadu	2.18	A	A	A
2	Orissa	3.05	A	A	A
3	Kerala	3.12	A	A	A
4	UP	3.34	A	D	D
5	Rajasthan	3.92	A	A	D
6	West Bengal	4.10	A	A	A
7	MP	4.13	A	D	D
8	Maharashtra	4.22	A	A	A
9	Karnataka	4.33	A	A	D
10	AP	4.81	A	D	D
12	Bihar	4.95	A	D	D
13	Gujarat	4.95	A	A	D
14	Assam	5.50	D	D	D
15	Punjab	6.63	D	D	D
16	Haryana	8.20	A	D	D
17	All 15	4.04	A	A	D

Source: Based on Shand and Bhide (2000).

Notes: 1. The growth rates are averages for the indicated periods; A = acceleration in growth, D = deceleration in growth; NC = no change in average growth rates.

2. The states are arranged in ascending order of the growth rates in the period 1971-1972 to 1979-1980 (1970s).

Table 5. Testing for causality relationship across state economies: results from GCT tests

State	Causality from a state to rest of the states		Causality from the rest of the states to a state	
	F-Statistic	Probability	F-Statistic	Probability
AP	0.6991	0.57	0.1032	0.96
Assam	1.5601	0.24	0.1851	0.90
Bihar	0.3928	0.76	0.4160	0.74
Gujarat	5.3070	0.01***	1.1550	0.36
Haryana	1.5616	0.24	1.6157	0.23
Karnataka	0.1205	0.95	0.5844	0.63
Kerala	0.0471	0.99	3.3101	0.05**
MP	2.9318	0.07*	2.2512	0.12
Maharashtra	1.0128	0.41	2.1224	0.14
Orissa	0.4331	0.73	2.7154	0.08*
Punjab	0.1733	0.91	0.4372	0.73
Rajasthan	3.0616	0.06*	4.4024	0.02**
Tamil Nadu	0.3863	0.76	2.5084	0.10*
UP	0.6287	0.61	0.4636	0.71
WB	0.4012	0.75	0.9931	0.42

Note: The first difference of NSDP of the state and second difference of sum of NSDP of the remaining states are used for causality tests. The sign * represents statistical significance of the F-statistic at the 10 per cent level of probability, ** at 5 per cent and *** at 1 per cent.

The inability of the states to sustain higher growth rates may partly be attributed to this factor, the states dependent on agricultural growth were unable to maintain the higher rate of growth, or, non-agricultural growth was not enough to offset the slower growth in agriculture. Thus, although non-agricultural growth may have increased during the 1990s over the 1970s and 1980s, the increase was insufficient to raise the overall growth performance.

The pattern of agricultural growth across states shows that steady acceleration of growth was seen only in the case of Karnataka, Kerala and West Bengal. In the case of Maharashtra while acceleration was not observed, there was no deceleration either. Interestingly these are the states in which there was a steady acceleration of overall NSDP as well. The only other state with overall steady acceleration was Orissa where agricultural growth was slower in the 1980s than in the 1970s. Thus, growth in agriculture has been important for overall sustained growth.

The industrial sector saw sustained growth in Gujarat, Maharashtra, Orissa, Punjab and West Bengal. In the case of services the growth accelerated steadily in Kerala, Maharashtra, Orissa, Tamil Nadu and West Bengal.

Maharashtra and West Bengal are the only states where all three, agriculture, industry and service sectors witnessed steady or higher growth rates through the 1980s and the first half of 1990s. Karnataka and Kerala, the two other states where the overall NSDP growth accelerated in the 1980s and first half of 1990s, there were variations in the growth pattern of industry and services.

The overall pattern of growth across states shows that only six states witnessed steady or rising growth rate of output through the 25 years starting in 1970-1971. In the other states, the pattern is mixed. What explains this concentration of growth in only a few states? Could the six states have acted as source of growth for the other states? Or could some other states have induced growth in these six states initially? Alternatively, the sources of growth may be entirely internal to the states. It is to these issues that we turn now.

III. TESTING FOR CAUSALITY

Testing for causality in an economic model is required when one attempts to understand the interrelationships among its component subsystems. The objective of this section is to test whether or not growth in "one" state causes growth in "another" state through the 'spillover effects'. The *null-hypothesis* to be tested is that "growth in one state does not cause growth in another state". The

causality may be *uni-directional* or *bi-directional*. In the case of growth in state "X" causing growth in state "Y" or the vice-versa, but not both together, the causality is said to be uni-directional. The causality would be bi-directional if the growth of states "X" and "Y" are mutually dependent.

In order to test for possible causation of growth across states, we have used the standard econometric tool of the Granger Causality Test (Granger, 1969), or GCT, using EViews software. Though one can use simple regression analysis for establishing dependence of one variable on the other variables, it does not necessarily imply causation. The idea of causation should be based on *a priori* theoretical considerations. The diverse economic linkages across states provide a theoretical basis for the prevalence of spillover effects.

Let us assume that there exists the possibility of causation between the NSDPs, **x** and **y,** of the two states. Our null-hypotheses are that "growth in **x** does not Granger cause growth in **y**" and "growth in **y** does not Granger cause growth in **x**". The tests imply statistical testing of precedence of occurrence of two events. Although Granger Causality Tests have been well described in the literature (Greene, 2000) for a fuller understanding of the methodology adopted here, we briefly spell out the exact procedure followed in this paper. We have run the Granger causality test using the bivariate regressions with the following formula:

$$\mathbf{y}_{t} = \alpha_0 + \alpha_1 \mathbf{y}_{t-1} + ... + \alpha_n \mathbf{y}_{t-n} + \beta_1 \mathbf{x}_{t-1} + ... + \beta_n \mathbf{x}_{t-n}$$

$$\mathbf{x}_{t} = \alpha_0 + \alpha_1 \mathbf{x}_{t-1} + ... + \alpha_n \mathbf{x}_{t-n} + \beta_1 \mathbf{y}_{t-1} + ... + \beta_n \mathbf{y}_{t-n}$$

for all possible pairs of (**x**,**y**) series. The reported F-statistics are the Wald statistics for the joint hypothesis: $\beta_1 = \beta_2 = ... = \beta_n = 0$ for each equation. The null hypothesis is therefore that **x** does not Granger-cause **y** in the first equation and that **y** does not Granger-cause **x** in the second regression.[3]

The growth performance of fifteen major[4] states during 1970-1971 to 1997-1998 has been analysed on the basis of time series of Net State Domestic Product (NSDP) at factor cost at 1980-1981. Despite the fact that the SDP measurement across different states is not fully consistent with national level GDP

[3] See Greene (2000) for details of the Granger Causality test. Also see Eviews 3, User's Guide for details on executing this test. All estimated regression equations had R^2 higher than 0.70.

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

estimates, we use the NSDP series since these are the best available state-level data as of date.[5]

Before proceeding to the analysis of the relationship between individual state economies, it is useful to enquire if there exists significant linkages between any individual state and all the other states taken together. The analysis at this more general level would reveal the nature of integration of the state economies with the other states within the national economy. In the two equation system shown above, the variable 'x' relates to the NSDP of a selected state and the variable 'y' relates to the sum of NSDP of all other states. As a first step towards implementing GCT, each of the variables was tested for stationarity using Dicky-Fuller Unit Root tests. It was found that while the NSDP series for each state was integrated of order 1 or first difference stationary, the sum of NSDP for all the states excluding one state at a time was in general integrated of order 2 (second difference stationary). This may be a result of aggregating several states where growth acceleration has been significant over time. Given this result, we have carried out GCT using the first difference of logarithm of NSDP of each of the 15 major states and the second difference of the logarithm of sum of NSDP of all the states excluding one state at a time.

The results of GCT tests for growth of NSDP in I'th state vis-à-vis the acceleration in the growth of NSDP of all other 14 major states are summarized in table 6. When we consider the significance of growth impulses emanating from a state to the other states as a whole, only three states are found to have such an impact: Gujarat, Madhya Pradesh and Rajasthan. When we consider the impact of growth impulses from the larger group of economies on the economies of the individual states, only four significant cases of Kerala, Orissa, Rajasthan and Tamil Nadu emerge.

The results point to the fact that the linkages between state economies are not generally 'growth transmitting'. Only three out of the 15 major states considered here influence the other states and only four states are influenced by the growth impulses emanating from the other 14 states. It is difficult to provide rigorous explanations for the specific patterns that have emerged. In other words, it is difficult to speculate why only Gujarat is found to have significant impact on the other economies while Maharashtra, an equally industrialized, large and fast growing state does not have similar significant impact. It is equally difficult to explain why only a relatively small number of states are influenced by the growth

[5] Ahluwalia (2000) has suggested the need for a greater effort by the Central Statistical Organisation (CSO) and the State Statistics Departments to make the SDP data across states more comparable than it has so far been.

Table 6. Results of causality tests: First difference of Ln (NSDP), lag order = 5

State	KL	AP	HN	KT	RT	WB	AM	BH	GT	MP	PB	TN	MT	OR	UP	Total no. of States affected by
RT	*	*						*		**						4
WB	*			*	*							**				4
OR	**		**		**											3
KL			**						**							2
PB						**	*									2
HN		**														1
MP				*												1
MT											*					1
UP						**										1
AP																0
AM																0
BH																0
GT																0
KT																0
TN																0
Total no. of states affecting	3	2	2	2	2	2	1	1	1	1	1	1	0	0	0	19

Note: The states are ordered so that the causality links are maximum at the upper and left hand side of the table. The abbreviations are: AM = Assam, AP = Andhra Pradesh, BH = Bihar, GT = Gujarat, HN = Haryana, KT = Karnataka, KL = Kerala, MP = Madhya Pradesh, MT = Maharashtra, OR = Orissa, PB = Punjab, RT = Rajasthan, TD = Tamil Nadu, UP = Uttar Pradesh and WB = West Bengal.

impulses emanating from the larger national economy. Interestingly the state of Rajasthan is seen in both the groups: it influences growth elsewhere and it is influenced by growth elsewhere. We note that except in the case of Madhya Pradesh the other 'growth-linked' states of Gujarat, Rajasthan, Orissa and Kerala were among the high growth states at some point in the three decades of growth described in the previous section of this paper. Therefore, high rates of economic growth appear to be one feature that enables growth linkage of one state economy with the other economies.

We now proceed with the analysis of linkages of the individual state economies with each other.

We have conducted the Granger causality tests over the time-series variables of first differences in logarithms of the NSDP data for 15 states during 1970-1971 to 1997-1998 because the first difference of logarithms closely represents the growth rate of NSDP. Based on Akaike's Final Prediction Criterion the optimal lag length has been selected as 5 in the analysis. As noted earlier, we have also tested for the stationarity of all the first differences of logarithm of NSDP for all the selected fifteen states. The series turned out to be stationary.[6]

The results of the causality tests are shown in table 6. The causing states are shown in the first column and the caused states in the top row. Thus the causality has been shown to run across rows, that is, from rows to columns. A single star indicates 10 per cent level of significance while a double star is indicative of 5 per cent level of significance.

It may be observed from table 6 that there does not appear to be a wide spread causation of growth across states. Reading the first row, it may be observed that growth in Rajasthan causes growth in Kerala, Andhra Pradesh, Madhya Pradesh and Tamil Nadu but these effects are uni-directional. It means that the growth in Rajasthan, in turn, is not caused by growth in any of the four states in which Rajasthan's growth matters (the column for Rajasthan has very few entries). On the other hand, growth in West Bengal and Orissa causes growth in Rajasthan, but again this is uni-directional. In fact, we do not observe any bi-directional growth causality among states. Apart from Rajasthan, West Bengal is another high growth-inducing state with its growth causing growth in four other states, namely Kerala, Karnataka, Rajathan and Tamil Nadu. Orissa's growth has influence over the growth of three states, namely Kerala, Haryana and Rajasthan. Kerala's growth, in turn, causes growth in Haryana and Gujarat. Punjab's growth influences growth in Assam and West Bengal. Growth in Haryana, Maharashtra, Madhya Pradesh and Uttar Pradesh leads to growth in one state each with Haryana causing growth in Andhra Pradesh, Maharashtra in Punjab, Madhya Pradesh in Karnataka and Uttar Pradesh in West Bengal. Interestingly, growth in Andhra Pradesh, Assam, Bihar, Gujarat, Karnataka and Tamil Nadu does not cause growth in any other state.

[6] A stochastic process is said to be stationary if its mean and variance are constant over time and the value of covariance between two time periods depends only on the distance or lag between the two time periods and not on actual time at which the covariance is computed.

Among the affected states, Kerala appears to be the most 'influenced' state with its growth being influenced by growth in Rajasthan, West Bengal and Orissa. Growth in Andhra Pradesh, Haryana, Karnataka, Rajasthan and West Bengal, respectively, is caused by two other states in each case. Growth in Assam, Bihar, Gujarat, Madhya Pradesh, Punjab and Tamil Nadu, respectively is caused by growth in one other state. Growth in Maharashtra, Orissa and Uttar Pradesh is not caused by growth in any other state.

Are these results 'logical'? Do these results point to input-output linkages or hinterland-markets linkages? Or do these results represent entirely statistical phenomena rather than any economic linkage? While some of the results appear related to the rate of growth, geographical proximity does not seem to be important. However, it is important to examine if we can identify the factors influencing observed growth linkages between state economies. We attempt to do this in the next section.

IV. FACTORS INFLUENCING CAUSALITY BETWEEN STATES

The broad set of factors likely to cause the growth of the economy of one state to result in an impulse to the growth of another state's economy noted previously include: input-output linkages, mobility of factors, exposure to the rest of the world and relative size of the economies. In the theoretical literature on regional development, the center-periphery models (Myrdal, 1959, and Hirschman, 1958), dependency model (Frank, 1978) cumulative causation model (Myrdal, 1959, and 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 a wider set of outcomes that emerge from inter-regional linkages (Krugman, 2000 and Mellinger, Sachs and Gallup, 2000). There are also policy related factors that encourage strengthening of impulses or that may blunt responses (Rabellotti and Schmitz, 1999). For example, erecting barriers to trade in the form of border taxes can be an effective means of reducing inter-regional linkages. Policies in a region may also be influenced by 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 above theoretical models, the factors that enable the exploitation of the potential linkages can be hypothesized as adequate infrastructure,

suitable human capital resources, quality of state-specific institutions and access to markets, communication and transportation.

An attempt to assess the importance of the factors that lead to growth linkages can be formulated using the following regression model as,

$$C_{ij} = f \{ B_j, (B_j - A_i), G \} + u_{ij} \qquad (1)$$

Where,

C_{ij} = varaiable denoting the existence of a 'causal' relationship between states i and j, with value = 1 if the 'causality' prevails, and = 0 otherwise.

B_j = set of features of state j (caused state). The features may include initial levels of per capita income, growth rate of the economy during the specified period, size of the economy, whether it is 'coastal state' or otherwise, level of infrastructure, and level of human resources.

$(B_j - A_i)$ = differences in the features between the economies of states i and j. Of these, the difference in average annual growth rates of the states is taken as a proxy to represent the difference in the quality of institutions between the concerned states with the assumption that a state with high quality institutions would enjoy a higher growth rate.

G = set of factors common to both the states such as the 'shared borders' (value= 1 for shared borders and =0 otherwise).

U_{ij} = the conventional statistical error term.

The possible set of features can be expanded to include factors such as similarity of cultures, language, historic resource-processing linkages, ease of 'transportation-communication', political relationship or interaction among various features as the independent variables in the regression model above.

We have examined the relationship in equation (1) above in the framework of a logit model. The attempt is to examine if the pattern of 'causality' relationships estimated in the previous section can be explained in terms of any plausible hypotheses that link the different state economies. Results of the logit estimation are given in table 7. The state that is able to respond to the growth impulses elsewhere may be the one that supplies inputs for further processing. It may also be the one that is initially less developed and linkages with the more developed regions can stimulate growth in the former. The 'caused' state is also expected to have adequate infrastructure- social and physical – to benefit from the emerging linkages. The results of the regression analysis suggest some interesting

Table 7. Factors influencing causality

Independent Variables	*Dependent variable: based on the causality tests for ΔLn (NSDP)*		
	Coefficient	*Standard error*	*Probability of significance*
Constant	-17.7909	7.693	0.02
Coast_1	1.5652	0.871	0.07
Agrshr_1	17.8600	9.094	0.05
Indshr_1	24.9239	12.650	0.05
NSDPgr_1	- 2.4025	0.945	0.01
Percapy_1	0.0040	0.002	0.02
Agrshr_diff	8.9115	5.472	0.10
Indshr_diff	20.5281	8.739	0.02
NSDPgr_diff	-1.2349	0.612	0.05
Percapy_diff	0.0021	0.001	0.08
Border	1.7075	1.060	0.13
Likelihood ratio	19.00		0.04
McFadden R^2	0.45		
Total No. of Observations: 210, Observations with non-zero values for dependent variable: 18; Lag length = 5			

Notes: The difference between causing state and caused state (Causing-Caused) for the selected variables is denoted with '_diff'. All other variables are as explained below:
Agrshr = % share of NSDP from agriculture & allied activities, average for TE 1972-1973.
Indshr = % share of GSDP from industry, average for TE 1972-1973.
Coast = whether a state has a coast line or not.
NSDPgr = annual average growth rate (%) of real NSDP from 1971-1972 to 1997-1998.
Percapy= per capita NSDP, average for TE 1972-1973.
The 'caused state' is identified with ' _1'.

relationships between the features of the 'caused' state and the probability of a 'causal' relationship with another state.

In the final model that is selected, coastal access, initial share of agriculture as well as industry in a state's NSDP and growth rate of NSDP are found to be significant influences on causality. Initial levels of literacy and infrastructure, when tried earlier, did not appear as significant variables. It is possible that the variables such as structure of the economy and growth performance themselves capture the impact of literacy and infrastructure. 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. While coastal access increases the probability of growth spillover effects, higher shares of agriculture and industry,

rather than services, 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 NSDP of the state suggests that a state that has a 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 NSDP 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 the 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 2 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.

V. CONCLUDING REMARKS

This paper attempts to examine if there are significant trickling down effects or spillover effects of economic growth in one state over the growth in another state in India. The attempt has been mainly to look at statistically significant impulses. The pattern of state-wise growth suggests that growth patterns have been different across the major states except for the trend of relatively slower agricultural growth in all the states. Only six states out of the 15 major states showed consistent acceleration in growth from the 1970s into the 1980s and then into the 1990s. These states could have acted as a source of growth impulse to other states.

The first level analysis showed that the linkages of states in terms of economic growth are limited. Only three states were found to influence the performance of the other states and four states were found to be influenced by the performance of the other states put together. The latter category of the states included smaller states such as Kerala and Orissa whereas the first category included Gujarat, Rajasthan and Madhya Pradesh.

The relatively scarce evidence of strong inter-state linkages led us to examine the presence of linkages at the individual state level. Again, the findings showed that the linkages were relatively few.

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.

As our attempt to discern causality or spillover effects has been based purely on statistical relationships, 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 relative to another state that raise the potential for significant trickling down effects of growth. The 'coastline' of a state appears to improve its being receptive to growth impulses coming from another state. On the other hand, while a common border is not an advantage, access to markets appears to be important.

The exercise presented here is exploratory. The results suggest that transmission of growth impulses that could influence growth from one state to another is not common. However, 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 claim 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 NSDP level. We have also not examined if the 'causality' is positive or negative, that is to say whether the 'spread effects (positive)' are more prominent than the 'back wash effects (negative)'.

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