The changing structure of Karnataka's Five-year Plans-1985 through 2007: A Markov Chain approach*

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Abstract

Outlays and expenditure on the ten five year plans have been reviewed and their impact on the principal sectors have been analysed. Results reveal that irrigation sector and social welfare sector have been receiving consistent spending. Housing and Urban and Rural development also received a substantial outlay. Government's spending on infrastructure and transportation, which includes road development and education, has continued to receive government patronage right through the past four five year plans. Funds for agriculture and spending on rural development appear to be inadequate. The power sector is not receiving its due share corresponding to its priority in the state's economy. Budgetary allocation to a particular sector has not followed a consistent path due to ad hocism. The overall economy of the state has been growing in most of the plans. However, the rate of growth has not been uniform. The growth in real terms has shown a stellar performance during the VIII and X plan, recording high rates of growth in all sectors, primary, secondary and tertiary. Lack of consistency in budgetary support to the various sectors might have been one of the contributory factors to this erratic growth. The Tenth plan has taken cognizance of the changed global scenario brought by WTO, and has targeted relevant sectors of the economy.

Key words / phrases: *Changing structure, Markov Chain, Budgetary support, Consistency.*

1. Introduction

Planning in India started in the 1950's after India secured its independence which was implemented through a series of Five year plans. The process of liberalization of the Indian economy began in the year 1985-86 when the Government of India adopted the philosophy of "supply side economics" in its planning. Many of the stringent restrictions in the economy were reviewed and selectively relaxed in a phased manner. It has since gathered momentum and in subsequent plans the process of liberalization has been heading towards its logical end. The various plans attempted to identify the strengths and weaknesses in the economy, thus leading to the identification of critical needs of achieving growth with development. The primary objections of planning have been a) development of infrastructure like irrigation and power, b) reducing the fiscal deficit, c) improving the education standards and literacy, and d) strengthening the Research and Development. All these put together are the keying redients for sustainable economic development.

The call for a ten percent growth rate of the economy to become an economic super power and eradicate poverty was given by our honorable President Dr.A.P.J.Abdul Kalam during 2005. This has served as an eye-opener to the policy makers who now feel this rate of growth is eminently achievable and desirable from the standpoint of economy. In fact during the last year of the Xth Five year plan, the rate of growth has come very close to it. This has been achieved to a large extent by the Indian political system agreeing on a broad consensus about the direction of reform. This high rate of growth has to be sustained in order to perform well in the context

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of globalization, where India will have a much bigger role to play in future. Growth targets have been scaled up in successive plans to over 5% per annum and reduction in poverty to below 25% of the population. In addition, generating additional employment opportunities as well as improving the status of housing health education and water supply, development of irrigation facilities and augmenting power generation constitutes the critical resources for both agriculture and industrial development. Thus, irrigation and power has been receiving highest priority in all the plans in order to harness the state's potential. It is widely recognized that the lack of these critical resources could effect the development of the economy of the state.

This study is a modest attempt to see how the expenditure in the last four plans have allocated resources and what shifts have taken place in the budget allocations and to determine whether these shifts are in line with the long term goals of planned economic growth.

2. Methodology

Data on plan expenditure under major heads during the various plans has been collected from Five Year plan documents of the Government of Karnataka. Selectively the data has been regrouped aggregated and analyzed using Markov chain analysis. The major heads of accounts includes irrigation, power and energy, transportation that includes roads, education, sports and culture, water supply, agriculture and allied activities which includes livestock, rural and urban development, industries and minerals and welfare expenditure. All other items of expenditure have been clubbed under others. The data of shifts of shares of expenditure shares has been analyzed using Markov chain analysis.

Markov chain analysis: A Markov chain is a stochastic process which describe the finite number of possible outcomes $s_i = (i = 1,2,...r)$ which a discrete random variable at (t = 1, 2,....T) can take during a number of time periods. The assumptions that underlie a model are:

a) The probability of an outcome on the trial depends only on outcome of the preceding trial, and

b) The probability is constant for all time periods (Lee et al, 1970).

In the current application the average area under a particular jth size group is considered to be a random variable following a first order Markov process.

$$a_{jt} = a_{it-1} P_{ij} + e_{jt}............(1)$$

where, ajt is the share of share of expenditure in the ith sector during the year t.

ait-1 is the budget share of sector i in the state budget.

Pij is the probability that expenditure will shift from state i to state j.

et is the error term which is statistically independent of ait-1, and

r is the number of states or budget heads.

The transitional probabilities Pij which are arranged in a (r x r) matrix, have the following properties.

$1 > P_{ij} > 0$ and $\sum P_{ij} = 1$, for all j's.

The diagonal elements of the transitional probability matrix indicate the probability of expenditure shares being retained in a particular head and the off diagonal elements reveal the probability that expenditure from a particular budget head would shift from one budget head to another with the passage of time, i.e from i to j. The coefficient read along the row indicates the probability of loss of share and read along the column shows the probability of gain to the head of expenditure in the column. The transition probability matrix was estimated using the Minimization of Absolute Deviation (MAD) technique which is estimated in the Linear Programming framework. For details see Lee et. al, 1970.

Growth Rate: The compound growth rate of expenditure has been calculated planwise using the equation of the form:

$Y_i = a\ e^{bt+u}$

Where

Yi is the budgeted expenditure under each of the 9 heads of accounts defined earlier.

t is time

e is the constant 2.71828

a and b are the constants to be estimated.

u is the disturbance parameter.

The parameters of the equation are estimated by the method of Ordinary Least Squares (OLS) and the growth rate gi of each series is computed using the formula

gi = (1-b) *100

3. Results

In order to study the sectoral shifts in Government spending during the plans, Markov chain analysis was carried out and the estimated transition probability matrix for the first period, i.e., II to the VI Plans is presented in Table 1. Perusal of the table indicates that during the first six plans, rural development has received consistent outlay evidenced by a transitional probability of 0.4697 and so also agriculture with a retention probability of 0.09. The outlay in the other sectors has

not been consistent over the 1st to 6th Plan. The most striking feature of the outlays of this period is the strong tendency to shift from most of the sectors to the energy sector, which is indeed a consistent policy in line with the need for power. Specifically shifts in outlay were noticed from Agriculture, Irrigation and flood control and Transport to the Energy sector. The other sector to gain over the plans was Education, which gained from Irrigation, Industries and Social services. During this period the Social sector was a big casualty receiving very little from the other sectors and not able to retain its share from the previous plans. But the Energy sector did not receive the continuity of funding it requires, as evidenced by the retention probability of zero. The tendency to shift form other heads of accounts constantly appears to be adhoc and continuity in power spending would have been in order for the full realization of the potential. This is perhaps the reason for the power crisis that is hindering industrial development in the State.

about less than 10 percent. The decline in the allocation to Agriculture and Rural development is indeed a cause for concern as the problems of agriculture are plenty and there are cases of farmer destitution leading to suicides. As a policy, the Government should increase the allocation to agriculture and create yield and income, enhancing infrastructure.

Many policies in India, including economic reform policies, are officially intended to alleviate poverty. Mooij and Dev, 2004. A widened concept of poverty and a shift away from income and employment programmes to human development. They contend that the budget-making process is not very participatory, and the role of the Finance Ministry has increased. Although the widening of the concept of poverty has positive aspects, within the overall context of structural adjustment, it has facilitated the politically convenient neglect of other dimensions of income and employment.

A heartening feature of the state's budget is the increased

	Agriculture and Allied	Rural Development	Irrigation & Flood Control	Energy	Industry & Minerals	Transport	Education and Urban Development	Social Services
Agriculture and Allied	0.0909	0.0000	0.6191	0.2900	0.0000	0.0000	0.0000	0.0000
Rural Development	0.4117	0.4697	0.0000	0.0000	0.1185	0.0000	0.0000	0.0000
Irrigation & Flood Control	0.0000	0.0696	0.0000	0.3325	0.1075	0.0507	0.2803	0.1593
Energy	0.4178	0.0000	0.4880	0.0000	0.0000	0.0943	0.0000	0.0000
Industry & Minerals	0.0000	0.0000	0.0000	0.2115	0.0000	0.0000	0.7885	0.0000
Transport	0.0802	0.0000	0.9198	0.0000	0.0000	0.0000	0.0000	0.0000
Education and Urban Development	0.0000	0.0000	0.0000	0.7917	0.0940	0.1143	0.0000	0.0000
Social Services	0.0000	0.0582	0.0000	0.0000	0.2093	0.0000	0.7325	0.0000

Table 1 Transition Probability Matrix of five-year outlays II to VI Plans

The break up of plan expenditure is presented in Table 2. Perusal of the table reveals the noteworthy fact that the outlay on the Economic services, which was as high as 70 to 86 percent in the first six plans, showed a decline in the subsequent plans to a little over 50 percent in the Xth Plan. In this shift, irrigation and flood control held its own of about 30 percent. The casualties were Agriculture and Energy and Power, which showed a decline. Agriculture from about 8 percent to around 4 percent and Energy and Power from 19 percent to

allocation to the Social sector. Spending in this sector from a paltry 4 percent in the II Five plan, it has progressively increased to around 30 percent which has mostly been appropriated by housing and urban development. The rapid urbanization that is taking place in the state due to Karnataka becoming the preferred destination of a number of corporate entities, the pressure on urban infrastructure and housing is growing. The government is seized of this problem, which is reflected in the budget.

	II Plan	III Plan	An-nual I Plan	Annual Plan	Annual Plan	IV Paln	V Plan	VI Plan	VII Plan	VIII Plan	IX Plan	X Plan
	(1956-61)	(1961-66)	(1966-67)	(1967-68)	(1968-69)	(1969-74)	(1975-80)	(1981-85)	(1985-90)	(1992-97)	(1997-02)	(2002-07)
A. Economic Services	–	–	–	–	–	–	–	–	–	–	–	–
Agriculture and Allied	8.91	12.87	16.62	15.19	16.47	21.66	11.18	8.23	7.94	7.13	5.91	4.93
Rural Development	7.44	6.69	4.50	2.89	1.95	0.50	2.26	4.84	4.45	3.42	4.74	0.47
Special Area Programmes	1.54	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	4.54	2.24	1.35
Irrigation & Flood Control	25.50	20.96	22.52	28.30	28.39	31.71	27.92	23.51	19.63	18.84	24.89	29.79
Energy	18.70	28.02	29.60	29.96	29.23	23.46	26.66	25.47	21.06	24.04	15.11	4.76
Industry & Minerals	8.08	6.39	3.41	5.29	3.22	4.83	5.14	6.89	6.34	7.78	4.14	3.05
Transport	6.87	5.24	8.76	5.66	4.77	3.35	5.10	6.15	6.39	3.54	7.02	10.20
Science & Environment	–	–	–	–	–	–	–	0.8	4	11	40	0.05
General Economic Services	–	–	–	–	–	–	0.13	0.00	0.76	0.87	0.42	1.88
Total Economic Service	77.05	80.17	85.42	87.29	84.02	86.50	78.80	75.11	58.75	63.12	58.72	51.56
B. Social Services	–	–	–	–	–	–	–	–	–	–	–	–
Education Sports Art Culture	7.88	15.25	3.83	3.73	5.07	3.22	2.76	2.44	2.74	8.11	6.91	3.89
Health	–	–	–	–	–	–	42.04	65.53	118	342	1100	3.22
Water Supply	8.50	0.00	7.73	6.21	7.29	2.14	4.69	5.59	9.60	4.94	5.54	0.00
Housing	0.00	0.00	0.00	0.00	0.00	0.00	4.46	8.69	4.24	5.52	3.78	6.42
Urban Development	2.87	2.03	0.85	0.73	0.88	5.36	1.37	1.27	0.79	0.66	3.03	5.43
TOTAL WS, H UD	19.26	17.29	12.40	10.67	13.23	10.72	14.93	20.76	14.63	11.12	12.26	18.64
Information and Publicity	0.74	0.22	0.45	0.40	0.49	0.09	0.24	0.22	0.18	0.11	0.12	0.11
Welfare of SC, ST, OBC	2.03	1.79	1.13	1.00	1.36	0.80	1.23	1.78	1.97	1.98	3.23	2.46
Labour Welfare	0.54	0.41	0.45	0.50	0.68	0.54	3.69	0.87	0.74	0.29	0.26	0.15
Social Security & Nutrition	0.38	0.12	0.15	0.15	0.21	1.34	1.12	1.25	3.25	1.45	1.82	1.34
TOTAL Social Services	3.69	2.55	2.19	2.04	2.75	2.77	6.28	4.12	26.62	25.76	29.03	29.80
GRAND TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 2 Distribution of budget outlay allotted to sectors in the various plans

In order to study the sectoral shifts in Government spending during the last 4 plans, a period that is characterized as a period of liberalization, a second transition probability matrix is estimated and presented in Table 3.

Examination of the transition probabilities presented in the table reveals that budgetary allocation of Irrigation and Flood control have a high retention probability of 0.3835 which is matched only by industry and minerals with a retention of 0.4724. This is in line with the stated philosophy of the planning process. The continuity in spending displayed is indeed remarkable considering irrigation is the most pressing need of Karnataka with a very small area under assured irrigation. The other sectors had practically no retention in budget outlays. This is perhaps a sign of a lack of consistency in expenditure to a particular sector. The results reveal that the expenditure on irrigation and flood control has a tendency to shift to transport infrastructure and urban and rural development. These shifts are driven by the need to readjust the limited resources to other sectors and in line with the plan objectives. In contrast to the transitions of the first period, expenditures on energy, education and others showed a strong tendency to shift to irrigation and flood control. The sectoral allocation to the energy sector showed a strong tendency to shift to water supply and urban and rural development.

The lack of a consistent expenditure on energy is indeed a cause for concern as energy development in the state is inadequate to meet the power requirements of the state and to cope with the rapid industrial development. The tendency of budget outlays to shift from energy and power to urban and rural development, may have been dictated by the exigencies of social and economic justice. In the long run, power will be the critical resource as far as industrial and tertiary sector development are concerned. In fact budgetary support of power and energy should receive continued support of the Government as a long term solution of the states' energy problems. Thus, the Government should show a far greater consistency in budgetary support to the energy sector. The shift that is visible in the spending on energy is that it is at the cost of agriculture. The slow pace of expenditure in agriculture is evident. The outlay to agriculture is affected due to the shift of expenditure to urban and rural development programmes and welfare. Welfare is an area that the government should not neglect especially in an era of accelerated economic development as the vulnerable sections are likely to be hit hardest. Hence, welfare expenditure should be considered as priority. The Government should not be complacent to expect the gains of accelerated development to the trickle down, rather it is more likely to create a skewed distribution of wealth. Widening of this gap between the haves and have-nots can harm development die to social tensions.

The foregoing results suggest that the budgetary allocation to a particular sector has not followed a consistent path as there is degree of ad hocism. This could affect the long term interests of a sector which requires long and continuous funding. This is particularly evident in the case of plan expenditure on energy and agriculture and also welfare. Irrigation development however has been receiving the priority attention of the Government, and that is a healthy sign.

	Irrigation & Flood Control	Energy	Transport	Education Sports Art Culture	Water Supply	Agriculture & Allied	Housing Urban & Rural Dev	Industry & Minerals	Welfare	Others
Irrigation	0.3835	0.0000	0.3605	0.0000	0.0000	0.0097	0.1177	0.0000	0.0229	0.1058
Energy	0.5340	0.0653	0.0000	0.0000	0.2412	0.0000	0.0000	0.0805	0.0790	0.0000
Transport†	0.0000	0.0000	0.0000	0.3333	0.0000	0.0000	0.3465	0.0000	0.0000	0.3203
Education Sports Art Culture	0.7341	0.0000	0.0000	0.0000	0.2659	0.0000	0.0000	0.0000	0.0000	0.0000
Water Supply	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000
Agriculture & Allied	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Urban Rural Devp.	0.0000	0.0000	0.0000	0.4570	0.0000	0.2036	0.0313	0.0000	0.3081	0.0000
Industry & Minerals	0.0000	0.4385	0.0000	0.0000	0.0000	0.0000	0.0000	0.4724	0.0305	0.0586
Welfare	0.0000	0.6174	0.0000	0.0000	0.0000	0.3826	0.0000	0.0000	0.0000	0.0000
others	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 3 Transition Probability Matrix of Budgetary Expenditure from VII Plan to X Plan of Karnataka

The State domestic product in real terms in the state has been growing sequentially from plan to plan at an average rate of between 35.09 and 109 percent, in the secondary and tertiary sectors, respectively (Table 4). The agriculture sector has grown at 64 percent per plan. In real terms the outlay on agriculture has increased from Rs. 1802 at 1993-94 prices to Rs. 13901 crores in a span of over 45 years from 1960 to date. During the corresponding period, secondary sector growth has increased from Rs.1224 crores to Rs.16,159 crores and Services from Rs. 2,372 crores to Rs. 38,826 crores. If one were to examine the pace of growth of the State's economy, an inflection point can be seen during the VII plan, which has reached maturity in the X plan period wherein agricultural growth and tertiary sector growth, have reached a plateau while the service sector continued to grow.

The plan wise real rate of growth has been analysed and the results are presented in the table. Scrutiny of the table reveals that the highest rate of growth was witnessed in the III plan where the rates of growth varied between 1.07 for the tertiary sector to 16.61 for the agriculture sector. The high growth of the agriculture SDP could be attributed to the low base effect. During this plan period industry grew at 5.32 percent per annum. This was the highest growth recorded by the agriculture sector ever and thereafter the growth of the primary sector oscillated between -5.84 to 8.18 percent. The fastest growing sector was the tertiary sector. From the IV plan onwards the growth of the tertiary sector accelerated and touched a high of 18.55 percent per annum during the VIII plan. The growth of the agriculture sector picked up after the VI plan perhaps due to green revolution and recorded rates of growth of over 5 percent per annum in all the plans except during the IX plan where the growth was negative. In recent years the highest growth of the primary sector was in the 10th plan with an annual growth rate of 8.18 percent.

Plan Period	Primary	Secondary	Tertiary	All Sectors
III (1961-67)	16.61	5.32	1.07	7.29
Annual (1967-69)	6.87	−1.29	3.24	4.83
IV (1969-74)	5.89	14.91	−1.22	4.98
V (1975-80)	1.47	3.43	3.72	2.71
VI (1981-85)	7.40	2.65	12.69	7.68
VII (1985-90)	7.04	13.24	6.41	8.18
VIII (1991-96)	7.33	13.86	22.17	14.51
IX (1997-2002)	−5.84	−4.28	7.60	0.94
X (2002-07)	8.18	6.62	7.74	7.54

(Real Percent)

Table 4 Growth rates of State Net domestic product during the various plans.

4. Per Capital Income

The growth of per capital income in real terms is a true indicator of the growth of an economy in a developing region. The results presented in table 5 show that the growth has been erratic. It varied from −1.45 in the first plan to 11.63 in the VIII plan. The growth was year dismal in the IX plan when the growth had stagnated. However, growth picked up in the X plan and registered a decent growth of 6.45 percent per annum. As a policy, the state should aim at achieving a steady and high rate of growth of economy. The state has moved into a high growth era since the VII plan and has performed well in all the plans but in the IX plan, the growth rate stagnated during the entire plan.

Plan	Growth Rate
III	−1.45
A	6.40
IV	0.19
V	−1.09
VI	2.61
VII	10.99
VIII	11.63
IX	−0.06
X	6.45

Table 5 Growth of per capital income in the various plans

5. Summary

The objective of planning in Karnataka has been fairy consistent, centering on accelerated economic growth, reduction of poverty, improvement in the quality of education and eradication of illiteracy, development of infrastructure like irrigation and power. These objectives have been reflected in the various plans effectively; However, what is needed is a consistency in spending and that appears to be missing. There appears to be a degree of adhocism is earmarking funds to various sectors of economy. This is perhaps one of the reasons why a consistent growth in the economy has not been achieved. This is evident in the case of power and energy, agriculture and welfare. This imbalance should be made well with greater public-private partnership in some sectors and through direct intervention in sectors such as welfare. Agriculture and welfare spending have widespread welfare ramifications and hence these two sectors should not be neglected.

References

Draft Five Year Plans, various issues, Planning Department, Government of Karnataka, Bangalore.

Karnataka State Economic Survey (various issues)

Lee, T.C., G.G.Judge and A. Zellner, 1970, Estimating the parameters of the Markov probability models from aggregate time series data, North Holland Publishers.

Mooij, Jos, and S. Mahendra Dev (2004), Social Sector Priorities: An Analysis of Budgets and Expenditures in India in the 1990s, Development Policy Review 22 (1), 97–120.