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S. C. Gulati*Population Growth and Development: A District Level Analysis

Introduction

THIS study attempts to highlight the relative significance of different demographic and development factors in influencing the district level patterns of population growth in India during 1981-91. Due to non-availability of measures like per capita gross domestic product at the district level to reflect regional aspects of overall economic development, this study firstly elicits indices depicting sectoral asepcts of economic development. Similarly, we find that the data on basic components of population growth, viz., natural and migrational components, at district level, is also lacking. This study, therefore, attempts to evolve an index depicting natural growth potential based on some basic demographic parameters like fertility, mortality, contraception and marital pattern at the district level. Thereby, the study highlights the linkages between population growth and the components of devleopment.

The Problem

Several studies (Nerlove and Schultz 1970; Heller 1976; Wheeler 1980; Barnum and Mohtadi 1982) ssuggest that simultaneity bias, because of actions and interactions among the crucial demographic variables, viz., fertility, mortality and contraception, must be accounted for in any structural analysis. Interaction between fertlity, mortality, contraception and marital patterns are basically responsible for variations in the natural growth component of population growth. It is possible that different areal units traversing on different sections of demographic transition trajectory may result into similar population growth rates but entirely different natural growth potentials in the future. Thus linkages of present population growth rates with lagged indicators of natual growth potentials and migration component of the population growth, which are largely influenced by the development patterns and their sectoral aspects are intended to be highlighted in the present study. The demographic growth potential at the district level is based on the four basic demographic parameters for which the data are available for the beginning years of the decade 1981 -91.

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The developmental factors in literature have been conveniently termed as fundamental socio-economic, cultural and structural changes concomitant to the development process. The conceptualisation and concretisation of the regional development indicators become still more difficult because of development being a multi-dimensional phenomenon. This study has evolved indices of economic development at the district level based on several developmental variables using a multi-variate factor analytical approach (Gulati 1991). This method has an edge over other as it obviates the hypothesis about the groupings of related variables on *a priori* basis.

Data

A vector of fourteen development indicators, for 340 districts/union territories of India is selected to highlight the aggregate and sectoral aspects of development process. The data for developmental indicators is primarily drawn form CMIE report (1982) and on demographic indicators from a series of occasional papers of the Office of the Registrar General of India in 1984 and 1989. The data on 18 developmental and 4 demographic variables are available for 340 districts/union territories, excluding the districts of Assam and other six sisterly states over the north-eastern region like Arunachal Pradesh, Manipur, Tripura etc., and districts of Jammu and Kashmir basically because of non-availability of data on key parameters under the purview of the present study. The basic indicators reflecting the sectoral aspects of development are agricultural, industrial and metropolitisation activities, at the district level. A summary of the selected indicators alongwith their description is provided in the Appendix.

The data on demographic variables varying over 340 districts pertains to adjusted crude birth rate (CBR), probability of dying before age 2 (PDBT), proportion of married females in the age group 15-19 (PRMYA) and couple protection rate (CPR). The elicited factor scores reflect the natural growth potential at the district level. A spectrum of dispersions at regional and all India level is presented in Table 1.

Analysis

Using the Factorial Approach (Harman, 1960) the evolved factor structures of the developmental variables and the demographic variables are presented in Tables 2 and 3 respectively. Subsequently factor scores are calculated utilising the factor loadings and other parametric estimates of the varimax rotated factor structures. The elicited factor scores, representing key dimensions of the developmental variables and natural growth potential, are utilised in highlighting linkages between population growth rates and the elicited factor scores.

Elicited Factors

A perusal of the evolved varimax factor solution in Table 2 helps in identification of the first factor as 'Agricultural Activity' (AGDI) as its loadings on agricultural variables like per-hectare fertiliser consumption (PHFC), per capita food production (PCFP), per cent gross irrigated area to gross cropped area (PGIAGCA), per cent net area sown to geographical area (PNASGA), etc. are much higher compared to other variables under study.

TABLE 1 : SPECTURM OF DISPERSION OF SELECTED VARIABLES

	DGR (1)	*NGP (2)*	*OD1 (3)*	*AGO! (4)*	*INDI (5)*	*METDJ (6)*	*DEN (7)*
All India							
MAX	58.83	2.21	3.98	4.97	3.74	7.45	31651.0
MIN	5.05	-3.46	-1.11	-1.20	-2.15	-1.22	2.0
MFAN	23.42	0.02	0.01	0.25	0.02	-0.15	561.6
SD(o)	7.35	1.06	0.76	0.93	1.04	1.09	2368.6
Northern Regioi i							
MAX	50.64	2.12	3.19	4.97	2.56	6.68	4178.0
MIN	13.08	-1.58	-1.11	-0.78	-2.15	-1.22	2.0
MEAN	25.36	0.12	0.36	1.00	-0.08	0.12	323.8
SD(o)	7.84	0.98	1.02	1.59	0.94	1.32	688.3
Central Region							
MAX	50.92	2.21	1.22	1.74	1.98	1.78	798.0
MIN	5.97	-0.84	-1.10	-1.10	-1.78	-1.21	24.0
MEAN	25.58	0.93	-0.32	0.16	-0.52	-0.56	286.4
SD(o)	6.15	0.67	0.46	0.60	0.73	0.60	201.2
Western Region							
MAX	55.89	0.22	3.51	1.02	3.74	7.14	13644.0
MIN	10.92	-2.18	-0.77	-1.20	-0.95	-1.01	23.0
MFAN	23.22	-0.87	0.33	0.14	0.71	0.30	502.3
SD(o)	8.16	0.59	0.70	0.50	0.89	1.31	2005.8
Southern Region							
MAX	58.83	0.48	2.41	1.86	3.20	3.91	25123.0
MIN	5.05	-3.46	-0.51	-1.09	-0.71	-0.79	102.0
MEAN	19.08	-0.85	0.3	0.10	0.81	0.21	830.8
SD(o)	8.16	0.86	0.55	0.60	1.01	0.90	3188.7
Eastern Region							
MAX	30.41	1.18	3.98	0.88	3.04	7.45	31651.0
MIN	6.33	-2.80	-1.01	-1.18	-1.52	-1.15	64.0
MEAN	22.95	0.10	-0.37	-0.16	-0.37	-0.50	1008.6
SD(o)	4.31	0.79	0.70	0.51	0.89	1.17	4035.7

	PMFYA (S)	*PDRT (9)*	*CBR (10)*	*CPR (11)*	*UKB (12)*	*L1TCY (13)*	*FHHI (14)*
All India							
MAX	86.40	224.00	45.54	58.80	100.00	81.00	7942.0
MIN	4.30	33.00	21.83	6.40	0.00	11.00	0.0
MEAN	47.85	125.21	36.38	24.53	20.57	34.26	1246.0
SD(a)	21.40	36.97	4.02	11.09	11.09	12.79	924.1
Northern Region							
MAX	83.90	203.00	45.12	41.20	94.00	65.00	1773.0
MIN	8.50	63.00	29.66	6.40	0.00	12.00	0.0
MEAN	44.56	125.25	38.09	24.69	20.97	32.98	952.0
SD(a)	22.68	33.28	3.07	9.16	16.70	11.63	352.2

Table 1 *(contd. on p.* 202)

Table 1 *(contd.fromp.* 201)

	PMFYA (S)	*PDBT (9)*	*CBR (10)*	*CPR (11)*	*URB (12)*	*LITCY (13)*	*EHHI (14)*
Central Region							
MAX	86.40	224.60	45.54	35.20	76.00	52.00	7942.0
MIN	24.00	81.00	33.35	7.40	2.00	11.00	405.0
MFAN	62.06	156.86	39.03	17.80	18.33	27.68	1275.7
SD(o)	15.74	29.65	2.80	7.05	13.38	7.87	1071.9
Western Region							
MAX	64.10	174.00	40.80	58.80	100.00	68.00	5174.0
MIN	10.40	67.00	24.41	22.10	8.00	23.00	518.0
MEAN	34.91	113.73	34.03	38.94	26.42	43.51	1068.7
SD(o)	15.02	27.21	3.55	3.76	17.34	8.67	714.7
Southern Region							
MAX	74.60	157.00	39.32	56.40	100.00	81.00	7332.0
MIN	4.30	33.00	22.59	9.10	5.00	19.00	159.0
MEAN	36.18	94.57	32.84	29.25	24.60	42.16	1798.8
SD(0)	20.33	26.74	3.61	8.74	16.58	16.16	1226.4
Eastern Region							
MAX	80.80	175.00	41.69	41.50	100.00	69.00	2198.0
MIN	14.90	48.00	21.83	6.90	3.00	16.00	453.0
MFAN	50.76	116.25	35.99	19.38	14.83	30.53	1001.2
SD(a)	18.86	27.96	3.23	9.83	15.43	9.95	380.5

TABLE 2: VARIMAX ROTATED FACTOR STRUCTURE

Variable		*Factor loading on variables*		*Commonality*	
I(AGR.)		*II (IND.)*		*III(SER).*	
1.	PNASGA	.52 (.19)	.36 (.20)	-.26 (.06)	.46
2.	PGIAGCA	.73 (.27)	-.18 (.09)	.02 (.00)	.56
3.	PHFC	.85 (.32)	.24 (.13)	.10 (.02)	.79
4.	PCFP	.83 (.31)	-.00 (.00)	-.09 (.02)	.70
5.	ANR	-.54 (.20)	.31 (.18)	-.00 (.00)	.39
6.	PVE	.40 (.15)	.62 (.35)	.34 (.08)	.66
7.	EHHIPLP	-.05 (.02)	.52 (.29)	-.12 (.03)	.28
8.	ADEFPLP	-.10 (.04)	.60 (.34)	.38 (.09)	.51
9.	PCBCAI	-.01 (.00)	.21 (.12)	.72 (.18)	.56
10.	BOPLP	.02 (.01)	.07 (.04)	.79 (.20)	.63
11.	PCBD	.01 (.00)	-.07 (.04)	.94 (.23)	.88
12.	PCBASS	-.04 (.01)	-.18 (.10)	.77 (.19)	.63
13.	LITPTP	-.16 (.06)	.56 (.31)	.61 (.15)	.71
14.	URBPTP	-.00 (.00)	.22 (.12)	.81 (.20)	.71
Eigen Value		271,	1.77	4.00	

Note : Values in brackets are the factor score coefficients.

The second factor is identified as 'Industrial Activity' (INDI) because of its predominant constituting variables being extent of employment in factories (ADEFPLA), employment in houshold industry per lakh of population (EHHIPLP), extent of electrification (PVE), and extent of literacy (LITPTP).

The third factor is identified as 'Service Sector Activity' (METDI) because of its relatively high and positive factor loadings on urbanization (URBPTP), literacy (LITPTP), bank advances to service sector (PCBASS), per capita bank deposits (PCBD), etc.

The aggregate development index (ODI) is evolved by assigning weights to the sectoral factor scores in proportion to the eigen values of the three factors. It may be of interest to mention that the pattern of weights is in close correspondence with the conventional approach of assigning weights to different sectors in proportion to their percentage contribution towards the GDP, viz., agricultural (.32), manufacturing (.21) and the services (.47). Interestingly, the rank order correlation between the aggregate development index and per capita gross domestic product at state level turns out to be .96 reflecting the efficacy of the elicited indices of development.

A perusal of the factor structure in Table 3 renders the identification of the factor as 'Natural Growth Potential' (NGP) as its loadings on fertility (CBR), mortality (CHM), proportion married females in age group 15-19 years (PRMYA), and contraception (CPR) are quite high.

TABLE 3 : FACTOR STRUCTURE OF NATURAL GROWTH POTENTIAL (NGP)

	Variable	*Factor loadings of NGP*	*Communality*
1.	PMFYA	0.79	0.63
2.	CHM	0.79	0.63
3.	CBR	0.84	0.70
4.	CPR	-0.77	0.60
	Eigen Value	2.55	

As per general expectations we find that the factor has positive loadings on CBR, CHM and PMFYA and negative loading on CPR, depicting that the potentials are high if fertility and motality levels are higher and age at marriage and extent of contraception are low.

Predictors of Population Growth

The estimates of the regression coefficients where districts population growth rate (PGR) is regressed over demographic and developmental variables are presented in Table 4. Results of regresion 1 in Table 4 reveal that natural growth potential (NGP), aggregate development index (ODI) and density (DEN) variables account for almost 18 per cent of the inter-district variations in the population growth rates. As per general expectations we find that higher natural growth potential has led to higher population growth, higher aggregate development of an area has led to higher growth of population because of higher net in-migration rates due to better employment opportunities and better standards of living. Similarly, we find that higher density depicting higher pressure of population depicted significant and negative impact on population growth.

TABLE 4: PREDICTORS OF POPULATION GROWTH: 1981-91

Item		*Multiple Regression*		
		(1)	*(2)*	*(3)*
Multiple	R^2	.184	.276	.292
	R^2	.177	.265	.277
Regression Coefficients and /-value				
Intercept	INT	23.48 (62.83)	24.61 (62.46)	22.78 (25.89)
Variable	NGP	4.62 (8.56)	3.93 (8.64)	3.77 (7.72)
	GDI	3.08 (4.75)		
	AGDI		-0.27 (.72)	-0.53 (1.34)
	INDI		1.09 (2.01)	0.69 (1.22)
	METDI		4.42 (7.82)	3.97 (6.76)
	DEN	-0.03 (1-96)	-0.09 (5.05)	-0.09 (4.48)
Intercept Dummies	DNW			2.86 (2.72)
	DEC			1.82 (1.67)
F - Value		25.36	25.48	19.55

Results of regression 2 in Table 4 reveal that among sectoral aspects of development it is only metropolitisation activity (METDI) which depicts significant and positive impact on population growth. Basically, metropolitisation activity index reflects predominance of service sector activity and extent of urbanisation. Thus metropolitisation process seems to have promoted the process of migration (Bose 1978) to urban centers basically becaue of better economic opportunities and higher standard of living in the urban centres. However, along with natural growth potential and metropolitisation activity, having significant and positive impact on population growth, we find that industrial activity (INDI) variable also depicts significant and positive impact and density (DEN) depicts negative impact on population growth. Thus population pressure on land seems to exert negative impact on population growth.

In regression 3 we have introduced regional dummies depicting shifts in the intercepts in states over northern and western regions (DNW) and in states over central and eastern regions (DEC) compared to the southern states. It is of interest to mention that overall population growth rates in states over northern and western regions are significantly higher

than the SOUIthern States. The north-south differences in population growth rates could be due to some cultural factors as reflected by the regional dummies. However, significant intercept dummy for states over northern and western regions (DNW) does indicate higher population growth compared to the southern states of India.

TABLE 5 : PREDICTORS OF POPULATION GROWTH

Multiple Regressions							
		(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Multiple	R^2	.36	.38	.34	.38	.40	.42
	R^2	.35	.37	.33	.37	.39	.41
				Regression Coefficients and f-value			
Intercept	INT	25.97 (17.54)	21.21 (9.15)	30.57 (28.34)	20.47 (9.57)	22.67 (10.25)	19.55 (8.25)
Variables	NGP	1.83 (3.81)					
	CPR		-.03 (.83)	-.09 (2.40)			
	PMFYA		.10 (4.51)		.11 (5.07)	.10 (4.83)	.10 (4.76)
	URB	.29 (10.84)	.30 (11.26)	.30 (11.03)	.30 (11.24)	.11 (1.84)	.11 (L84)
	UBRSQ					.003 (3.28)	.003 (3.15)
	LTTPTP	-.20 (4.70)	-.18 (4.37)	-.28 (7.71)	-.19 (4.77)	-.19 (4.80)	-.17 (4.37)
	DEN	-.08 (5.08)	-.09 (5.72)	-.09 (5.35)	-.09 (5.68)	-.14 (6.46)	-.13 (6.19)
	EHHI	.10 (2.74)	.11 (3.30)	.10 (2.74)	.12 (3,34)	.09 (2.67)	.06 (2.45)
Intercept Dummies	DNW						3.41 (3.67)
	DEC						2.18 (2.32)
F-Value		37.65	34.27	35.02	41.02	36.98	30.39

Comparison of regressions 1,2,3 and 4 in Table 5 reveals he natural growth potential (NGP) and its constituents, viz., contraception (CPR) and marital patterns (PMF 15-19) depict significant impact on growth of population. As per general expectation we find higher natural growth potential (NGP) depicts positive impact, higher contraception (CPR) depicts negative impact and lower age at marriage depicts positive impact on the growth of population. Among the socio-economic variables we find the extent of urbanisation, depicting extent of in-migration because of better economic opportunities and other

amenities, depicts significant and positive impact on district's population growth. Thereby we find that level of literacy (LITPTP) depicts consistently negative and significant impact on growth of population. Similarly, we find that density (DEN) depicting pressure of population on land, and employment in non-agricultural activity (INDI), extent of employment in household industry (EHHI) also depict significant impact on the growth of population. As adjudged by the *t*-values, we find that extent of urbanization turns out to be the most significant determinant of the growth of population, followed by literacy and marital patterns. Overall, we find that employment in non-agricultural activities promotes in-migra-tion and helps in the growth of population.

Comparsion of regressions 5 and 6 in Table 5 reveals that parabolic effect of urbanization turns out to be significant and positive. Alternatively, higher levels of urbanization lead to still higher levels of in-migration (R.G. 1991) which, in turn, results into higher growth of population.

Results of the regression 6 in Table 5 reveal that both the intercept dummies, for states over other regions compared to states over the southern region of India, have turned out to be significant and positive. Alternatively, the growth of population in the southern states compared to states over other regions is significantly lower and this could be because of some cultural factors.

Concluding Remarks

•In summarising, the relative significance of effective contraception, higher age patterns of marriage, control of infant and child mortality seem to be much higher in controlling the growth of population compared to the development indicators. Furtnermore, within devleop-ment process we find that it is the process of industrialisation and metropolisation which exerts positive influence on growth of population through promotion of in-migration to the industrial and service centrres and not the agricultural prosperity. Still further, we find that levels of literacy depict significant inhibitory impact on the growth of population. Thus, for effective control of population, emphasis has to be laid on literacy and education, spread of effective contraception, higher age patterns of marriage, control of infant and child mortality and enhancement of employment opportunities in the non-agricultural sectors. The significant and positive parabolic effect of urbanisation suggests that migrational movements from rural and smaller size towns to the medium and large sized cities is unidirectional and larger cities attract more migrants.

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APPENDIX

LIST OF SELECTED VARIABLES

No.	*Abbreviated Name*	*Variable*
1.	PNASGA	Percent net sown area to total geographical area, 1973-74.
2.	PGIAGCA	Percent gross irrigated area to gross cropped area, 1973-74.
3.	PHFC	Per hectare fertiliser consumption of gross cropped area, 1 980- 8 1 .
4.	PCFP	Per capita food production ('000 kg), 1979-80.
5.	ANR	Annual normal rainfall (mm), Average of 1901-1950.
6.	PVE	Percent villages electrified, 1981.
7.	EHHIPLP	Employment in household industry per lakh population, 1981.
8.	ADEFPLP	Average daily employment in factories per lakh population, 1 98 1 .
9.	PCBCAI	Per capita bank credit to all industries, 1980.
10.	BOPLP	Bank offices per lakh population, 1 98 1 .
11.	PCBD	Per capita bank deposits, 1 98 1 .
12.	PCBASS	Per capita bank advances to service sector, 1980.
13.	LITPTP	Literates as percent of total population, 1 98 1 .
14.	URBPTP	Urban population as percent of total population, 1 98 1 .
15.	CBR	Crude birth rate as adjusted by P/F ratio method.
16.	PDBT	Probability of dying before age two multiplied by 1 000.
17.	PMFYA	Proportion of married females in the age group 15-19.
18.	CPR	Couple protection rate measuring percentage of eligible couples effectively protected due to contraception.
19.	DGR	Decadal growth rate: 1981-91.
20.	NGP	Natural growth potential.
21.	ODI	Overall development index.
22.	AGDI	Agricultural development index.
23.	INDI	Industrial development index.
24.	METDI	Metropolitan development index.
25.	DEN	Population density or persons per square kilometre of geographical area.