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Spatial Mobility of Population: An Inter-District Study of Rajasthan

Introduction

MOBILITY, movement and migration marked the development of societies. Mankindhas •^—witnessed population movement since time immemorial. Spatial movement is, however, the result of a complex mechanism involving social, psychological, economic, political institutions and other factors. Migration is in pursuit of the fulfilment of certain specified goals for certain period of time or on permanent basis. These goals as well as prospects of fulfilment of these goals may vary from individual to individual and from place to place. If the prospects at the place of residence are perceived to be bleak, he would be inclined to seek his future at other places. If the individual expects to do better at some other place, he may be pulled towards that place. Moreover, if the migrants from the same place of origin are relatively better in places other than the place of residence, they may decide to migrate even in the absence of push factors.The intensity of the pull effects and, therefore, the decision to migrate depends upon many factors, e.g., distance, the reliability of information, the risk and uncertainties involved and the social, psychological, political and economic costs ofmigration.

Thus, historically, "disparity and imbalances in the growth pattern, the relative deprivation of individuals and groups, dissatisfaction with the social and natural environment among people, the emergence of new opportunity structures, desire for improved socio-economic status and concern for preservation of liberty, freedom, marriage and disasters—both physical and social—figured among the causes for mobility, movement and migration of individuals and groups, spatially and socially" (Bogue 1952).

Three distinct conceptual approaches underlie the literature on migration models. These may be defined as size distance theories (gravity models), the push pull theories (regression models) and probabilistic theories (simulation models). Beals (1967), Greenwood (1969), Mehta (1975), Shah and Patel (1979), Mehta and Kohli (1991) have built the regression modelstoemphasizethepullandpushforeesinfluencingmigration. Fields(1979) examined the migration in detail by using the simulation techniques.

There arefourstreamsof migration: rural to mral,rural to urban, urbantourbanand urban to rural. In many studies, one of the four streams ofmigration has been analysed. Todaro (1967) highlighted in his study that rural-urban migration is stimulated primarily by rational

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economic consideration of relative benefits and costs, mostly financial but also psychological. Mitra (1967) speculated in his study that rural-urban migration will decline in volume and velocity because of a high degree of urban to urban migration in India, as well as rapid natural increase of urban population. Mehta (1975) emphasised that rural-urban migration is due to income differences and uneven distribution of economic opportunities between regions. Mukherji (1977) noted the problems of unemployment and underemployment resulting from extensive rural-urban movements in developing countries. Oberai and Singh (1983) emphasised in their study that migration is beneficial to the individual migrants and will continue until the underlying basic factors causing wide rural-urban and inter-urban differential in wages and employment opportunities are altered. Mehta and Kohli (1991) analysed that the differences in economic opportunities like income, social services and infrastructural opportunities in rural and urban areas are the main reasons for rural to urban migration. Shah and Patel (1979) observed in their study that rural to rural movements benefit both the receiving and supply regions. Premi (1983) noted that rural to rural migration has declined but it would remain a dominant stream in Indian migration for several decades.

There are also studies which emphasized the various factors influencing the migratory movements. Greenwood (1969). Levy and Wadycki (1972) attempted to account for family friend effect by including a migrant stock variable in their explanatory variables. Goldstein (1976) in his study emphasised that rapid population growth in the less developed regions of the world, substantial increases in the size of urban population and in the level of urbanization and size of big cities all account for population movement. Kundu (1992) examined regional migration pattern in relation to rural-urban interdependencies. The push factor is related to stagnant agriculture and the pull factor to diversification of the regional economy.

The assumption in all these studies is that individuals make rational decisions, explicitly or implicitly, about their place of residence. The econometric literature, in general, supports most of the conclusions of the descriptive literature.

Objectives, Scope, Data Set and Methodology

The present study attempts to determine the forces that affect inter-district migration in Rajasthan using 1971 and 1981 decadal census data as a basic source. States in India are generally heterogeneous with regard to cultural, social and economic development. Hence intra-state migration dominates over inter-state migration. Inter-state migration in India is quite low (Premi 1983). Districts, on the other hand, are more homogeneous with respect to the cultural, geo-physical conditions and social setting. Thus the effect of economic factors can be examined, keeping differences in non-economic factors to the minimum. They are also the units of administration. Hence the impact of economic and public policy factors can be better identified at the district level. At the same time districts in India, on an average, are quite large in area and possess large population. So they are expected to reveal variation in migration patterns.

Rajasthan is having 324,239 sq km of area (about 10.41 per cent of the total area of the country) inhabited by 43,880,640 persons in 1991 (5.20 per cent of the total population of India). The density of population per sq km, in the state is 128 as compared to the national figure 267. Moreover, the state has large variation in the distribution of population among the districts since the physical features and natural resources are not same in all the districts of Rajasthan, e.g., Jaipur district makes highest contribution to the population of the state (about 10.75 per cent of the population of Rajasthan). but is having only 4.11 per cent of the total area of the state. On the other extreme, Jaisalmer district is having 11.22 per cent of the total area of the state but its share in the population of the state is only 0.78 per cent. The density of population of Jaipur is 335 and that of Jaisalmer is 9 *(Census of India* 1991). Because of this, district is an ideal spatial unit for studying spatial mobility.

Upto 1961 census, intra-statedataon out-migration were notavailable. So in earlier studies of migration at district level, attempts were confined only to total number of persons enumerated in the districts but bom in all other districts of the State. Thus inmigration from other districts.within the state had to be clubbed together, as name of the special district from which the respondent had migrated was not enumerated. Hence, population movements between districts could not be found out. Previous models of migration, therefore, attempted to explain inter-district differences in inmigration, *(m),* on the basis ofinter-district variations in the level of development. Distance and other such variables could not be considered in the analysis. In such models, all explanatory variables refer to a particular district *(i)*

In contrast, the inter-district migration model, as specified below, attempts to explain migration between districts on the basis of relative development of these districts. A knowledge ofinter-district (or intra-regional) population movement (gross migration) is of interest for a number of reasons. With an understanding of gross-migration one can proceed to calculate net migration but the reverse is not possible. There are also other advantages of this study. For example, it allows us to capture the effect on migration of distance between two places/areas of the stock of migrants from a given area. It separates in a more explicit fashion the so-called push forces from the pull forces that determine migration (King 1978).

The migration behaviour under study refers to two census periods 1961 • 1971 and 1971 -1981. The study is based on district level secondary data from the Indian census and Basic Statistics Hand Books for different economic and non-economic variables. As the data on some of the variables are not available, their proxies have been used. For some of the variables composite indices have been constructed with the help of principal component analysis.

Multivariate step by step regression analysis is used to test the implication of the theory, with the inclusion/exclusion criterion $F = 1$'. The results at the last step are reported in this paper.

In order to minimize the risk of simultaneous equation bias, owing to the fact that migration influences contemporaneous economic conditions as well as is influenced by them, all explanatory variables are taken with one period time-lag, i.e., they are pre-detennined.

The data used in the study are highly aggregated, hence problems may arise in the interpretation of the coefficients obtained in cross-region regressions, in relating to individuals. However, gross migration rate can be interpreted as the probability of an individual migrating from the district. Hence, the cross-district gross migration model can be

' Since with this value, while dropping the variable (having t- ratio less than 1), R^2 would be increased without affecting the.R^1 of the model (Mehta and Mehta 1987).

interpreted as a probability model, which relates the probability of an individual migrating to certain measures of independent variables which can in turn be interpreted as measures of the probabilities of experiencing certain costs and benefits.

Regional Migration Pattern of Rajasthan

Rajasthan is a land of diversity with its diverse geographic, cultural and economic character. It is situated in north-western part of India. According to Rajasthan Ground Water Board (1983-84), the climatic features (geographically) divide the state into four main regions—arid, semi-arid, humid, and sub-humid. There are several other variations on regionalisation of the state. The pattern of migration inRajasthan is quite complex. Migration tables of Rajasthan (1971,1981) show at a glance the percentage distribution of life-time in-migrants in Rajasthan by place of birth. They show that in 1971.29.76 per cent of the total population was enumerated out of the place of birth, whereas in 1981 the percentage of in-migrants was 29.80. This shows that overall mobility in the state is lowin comparison to other states of India. These migration tables also point out that distance is a substantial deferent to migration. The percentage ofintra-district (short-distance), inter-district (medium distance) and inter-state (long-distance) in-migrants in 1971 was 19.17,6.85 and 9.94 respectively. In 1981, slight decrease in short-distance migration is visible, whereas the percentage of the medium and long distance in-migrants has gone up a little. But still short-distance in-migration dominates all duration in-migration in 1961-1971 and 1971-1981.

Out-migration from the state is more than in-migration. Table 1 shows the percentage of in-migration, out-migration and net-migration inRajasthan in 1961-71 and 1971-81. Itis seen from Table 1 that the mean of the percentage of interstate in-migrants to total population in Rajasthan for 1971 and 1981 census is (1.1139 and 1.2836) and C. V. (196.35 and 187.29) respectively. These figures show the high heterogeneity in the interstate migration pattern of Rajasthan. Coefficient of correlation between in-migration rate in 1971 and 1981 is .96, showing high temporal consistency in the regional pattern of in-migration of the state. The same trend is revealed in Table 1 for out-migrants from the state. Net-migration in the same table (cols. 6 and 7) point out that out-migration from the state is more than in-migration. The high correlation coefficient (0.71) between net migration rates in the two census periods (1971 and 1981) again points out the consistency in the net-migration patterns in Rajasthan.

Gujarat, Haryana, M.P., Punjab and U.P. are the bordering states of Rajasthan. Table 1 shows that the migration behaviour of these five states vis-a-vis Rajasthan is different from other states. There is net out-migration from Rajasthan to the neighbouring states such as Gujarat, Haryana and M.P., Punjab and U.P. Delhi, being the capital of the country, has the greatest pull of the out-migrants from the state. This pattern is temporally consistent.

Table 1 does not throw any light on the inter-district migration pattern of Rajasthan. Table 2 is related to net inter-district migration in Rajasthan (1971,1981).

It is clear from Table 2 that net result of the inter-district migration streams is significant only in few districts in 1961-71.1971-81. Sri Ganganagarleadsthe gainers with3.70per cent net in-migration in 1961 -71. In 1971 -81, the leading place goes to Kota with 4.40 per cent net in-migration. In the list of net losers, i.e.. with net out-migrants in 1961 -71. Jaisalmer leads with 3.37 per cent out-migrants, while in 1971 -81 the place is shifted to Nagaur with 3.42 per cent out-migrants.

TABLE 1: PERCENTAGE OF IN-MIGRANTS IN RAJASTHAN AND OUT-MIGRANTS FROM RAJASTHAN

(Based on place of birth in 1971, 1981)

Sl. No.	*State/Ut col.*	*In-migrants*		*out -migrants*		*Net Migration*	
		1971	*1981*	*1971*	*1981*	*1971*	*1981*
1.	Andhra	0.250	0.273	0.640	1.196	-0.440	-0.923
2.	Bihar	0.948	1.329	0.567	0.052	+.381	+ 1.277
3.	Gujarat	5.678	3.139	8.672	11.840	-2.994	-8.701
4.	Haryana	4.328	5.544	7.321	5.921	-2.993	-0.377
5.	Himachal Pradesh	0.213	0.386	0.156	0.181	+ 0.057	+0.205
6.	Jammu & Kashmir	0.144	0.244	0.112	0.146	+0.032	+0.098
7.	Karnataka	0.258	0.305	0.201	0.278	+0.057	+0.027
8.	Kerala	0.356	0.479	0.127	0.088	+0.229	+0.391
9.	Madhya Pradesh	5.674	6.498	7.532	9.394	-1.859	-2.896
10.	Maharashtra	0.783	1.864	0.653	0.789	+0.130	+ 1.075
11.	Manipur	0.056	0.071	0.034	0.055	+0.022	+0.016
12.	Meghalaya	0.019	0.028	0.076	0.089	-0.057	-0.061
13.	Nagaland	0.016	0.026	0.030	0.035	-0.014	-0.009
14.	Orissa	0.119	0.199	0.432	0.574	-0.313	-0.375
15.	Punjab	6.434	7.455	5.344	3.292	+1.090	+4.163
16.	Sikkim	0.002	0.028	0.029	0.038	-0.027	-0.010
17.	Tamil Nadu	0.436	0.336	0.936	1.230	-0.500	-0.894
18.	Tripura	0.005	0.033	0.136	0.023	-0.131	+0.010
19.	Uttar Pradesh	7.382	8.786	3.416	2.856	+3.966	+5.930
20.	West Bengal	0.312	0.913	1.156	3.180	-0.844	-2.267
21.	Andaman Nicobar	0.004	0.002	0.006	0.005	-0.002	-0.003
22.	Arunachal Pradesh	0.016	0.018	0.029	0.031	-0.013	-0.013
23.	Mizoram	0.003	0.003	0.040	0.015	-0.037	-0.013
24.	Goa, Daman andDiu	0.001	0.021	0.020	0.040	-0.019	-0.019
25.	Chandigarh	0.090	0.065	0.563	0.330	-0.473	-0.265
26.	Dadarand Nagar Haveli	0.003	0.001	0.004	0.006	-0.001	-0.005
27.	Delhi	0.873	1.370	0.955	8.725	-0.080	-7.355
28.	Lakshadweep	-	–	–	–	–	-
29.	Pondicherry	0.01	0.001	0.001	0.001	0.000	0.000
Mean		1.1139	1.2836	1.2846	1.6261	-.1322	-3154
C.V		196.35	187.29	190.64	191.50		
r			(.96)		(.84)		(.71)

Notes

(a) The figures for Assam (out-migration) are not available in 1981 census as due to disturbed conditions census could not be held in the state. For comparison the figures are also dropped form the 1971.

(b) mean refers to the unweighed average of the 29 States/UTs included.

Source: Census of India, 1971, 1981—Migration Tables, D-Series, Part V.

Thus in Rajasthan, intra-state disparity in migration and socio-economic development prevails, so the developed districts are the centres of attraction for migrants.- As distance is the main impediment for movement, migration is mainly confined to contiguous districts which are culturally homogenous (Mehtal983). The present paper attempts to identify and explore these intra-state variations.

From the census study (1971, 1981), the migration behaviour of border and interior districts of the State of Rajasthan is not clear. In this study an attempt has been made to make it clear with the inclusion of dummy variable. $B = 1$ for the border districts and B=0 otherwise. in the multivariate regression analysis.

TABLE *2:* NET INTER-DISTRICT MIGRATION IN RAJASTHAN. 1971. 1981

(Place of birth) (Males)

SI. No Migration	*District (1971)*	*Net Migration*	*Sex Ratio (In)*	*Sex Ratio (Out)*	*Net Migratio 1981*	*Sex Ratio (In) Migration*	*Sex Ratio (Out)*
1.	Sri Ganganagar	+3.70	1104	1939	+3.61	1101	1948
2.	Bikaner	-0.74	1759	2309	-1.10	1819	2608
3.	Chum	-1.27	5005	3073	-2.44	6410	3169
4.	Jhunjhunu	-1.95	6434	2995	-2.50	6222	2841
5.	Alwar	-1.07	5943	3436	-1.37	5370	3040
6.	Bharatpur	-0.43	5238	2904	-1.03	5671	2466
7.	Swai Madbopur	-0.21	3773	3588	-1.31	4642	3092
8.	Jaipur	+1.15	2190	3602	+2.75	1989	3779
9.	Sikar	-2.79	7730	3512	-3.28	2147	3441
10.	Ajmer	-1.00	2495	2217	-1.85	2646	2215
11.	Tonk	-0.52	4400	3019	-1.51	4630	2934
12.	Jaisalmer	-3.37	1563	3005	+2.77	2042	3015
13.	Jodhpur	-2.26	2124	2059	-1.51	4630	2934
14.	Nagaur	-2.30	5253	2543	-3.42	5733	2416
15.	Pali	-0.27	3047	2439	+0.40	2805	2644
16.	Banner	+0.20	2582	2773	-0.48	3008	2551
17.	Jalore	+0.11	2842	3937	+0.72	2816	3553
re	Sirohi	+1.26	2195	2608	+1.48	2307	2845
19.	Bhilwara	+0.27	3083	3426	+0.05	2966	2992
20.	Udaipur	-0.51	3077	2969	+1.49	2590	2989
21.	Chittorgarh	+2.63	2759	3397	+2.26	2141	2916
22.	Dungarpur	+0.13	3544	3155	-1.96	3637	1524
23.	Banswara	+0.31	1662	3459	+1.20	1672	2832
24.	Bundi	+3.16	1660	2707	+3.65	1848	2899
25.	Kota	+3.42	1271	2169	+4.40	1300	2446
26.	Jhalawar	-0.90	2534	1970	-1.99	2888	1838
			(r = 71)				

Note : r is the correlation coefficient between net migration of 1971 and 1981.

Source : Computed from *Census of India,* 1971, 1981, Series-18 Rajasthan, Part H-D,° *Migration Tables.*

Model Specification

Various functional forms of the migration function have been proposed in the literature. e.g., linear, double-log, semi-log etc. , which may be linear in the variables or in parameters , in differences or in ratios. Here the variables are used in a linear and log-linear multiple-regression framework to test the implications of the theory.[2] Let / represent the place of origin, *j* the place of destination and M/y the rate of migration between / andy. The regression model is of the usual form:

$$Mij = Mij/ni = bo + b1X1i + b2X2i + b3X3i + \ldots, + bn\,Xni + ei$$

where *Mij/ni* **(*DPT*) is the dependent variable. This is the out-migration rate of the male** population of the /th district to the/th district. It is defined as the number of people migrating from /th to/th district in the census period divided by the population of the district / of the same period. The *b* 's are the regression coefficients and *el* is the disturbance term. The model is assumed to conform to the standard properties or assumptions of the classical linear regression model (Johnston 1985). The model is estimated for the male population, since female migration in Rajasthan is mainly for demographic purpose of marriage. The female migration, a dominating scene in an exogamous society is attributed to social practice of kinship development (Rathore and Premi 1986). A major part of male migration can be attributed to economic reasons.

The A^s are the explanatory variables. In this study explanatory variables are defined as ratio of variable value of /th district to that of the ith district. This is for analysing the relative strength of pull and push forces of migration.[3] The computed ratio of each individual explanatory variable gives an indication of relative position of pull and push forces between two districts (/ and/).

The variables can be hypothesised to represent either the pull factors or the push factors. These hypotheses are developed in the next section, in the case of pull factors. 'If the ratio of the independent variable representing it of/th district to that of/th district is more than 1. it is the relative pull force of/th district which causes out-migration from the ith district, which inawayisthe in-migration of/th district. Hence, higher the value of the explanatory variable, larger will be the relative pull of they th district on the population of the ith district. The reverse is the case when variable represents a push factor.

In the available literature, the studies are mainly based on the difference of the two districts or they have taken variables of both the source and destination areas. In this study, the ratios of the independent variables have been taken to measure the relative effect of pull and push forces, since differences can be negative, in that case logarithmic specification is not possible. The study is conducted on 26 districts of Rajasthan. Obviously, there are (26 x 25) 650 districts between migration streams, i.e., $n = 650$. The explanatory variables are defined in Tables.

[1] The details of these computations can be obtained from the authors, on request

[1] All the included variables except distance *(D)* and dummy variables *B* and *T* are defined as the ratio of the value of yth district to that of the ith district.

TABLE 3: EXPLANATORY VARIABLES

SI. No.	*Explanatory variable*	*Acronym*	*Definition of variable*
1.	Density of Population	*DP*	Persons living per sq km of area
2	Centres of Administration	*CA*	Number of capital towns (former princely states)
3.	Prospects of Development	*PD*	Per capita plan expenditure (in Rs.)
4.	Distance	*(D)*	Distance in kms of the district headquarters from the nearest two cities. Distance is taken from the shortest road routes.
5.	Degree of Urbanization	*DU*	Total urban population of the /th district v ,nn / Total population of /th district
6.	Livestock (per hec. of net sown area)	*LIY*	Total number of livestock per hectare of net sown area.
7.	Agricultural Labourer	*AL*	Percentage of agricultural labourer to total workers
8.	Migrant Stock	*SMR*	The number of migrants located in districts j who migrated from place ; in the period before the census period of 10 years
9.	Average Age of the Population	*M*	The weighted average age of people in various 5 years age groups, using the median age of each group weighted by the number of people in the group and summed over all groups and divided by total population of each district. The oldest group is open intervalled and arbitrarily chosen median is 60 years (King 1978)
10.	Medical Faci-lities Index	*MF*	Composite indicator of (a) total number of hospital beds, and (b) doctors per lakh population. The percentage of total variance explained by first principal component in these two variables is 75 per cent in 1971 and 70 per cent in 1981
11.	Transport Facilities Index	*TP*	Composite indicator of (a) roads, and (b) railways per 10,000 sq km of area. 85 per cent variance in the two variables is explained by the first principal component in 1971 and 80 per cent in 1981
12.	Social Backwardness	*SB*	Composite indicator of percentages of index (a) Schedule Caste, and (b) Schedule Tribe population to the total population as given in the census. The first principal component explains 80 per cent of the total variance in the included variables in 1971 and 87 per cent in 1981

Table 3 *(contd.* on p. 255)

Table 3 *(contd. from* p. 254)

13.	Banking and Credit Facilities Index	*BAC*	Combination of total (a) number of commercial banks per lakh population, and (b) loans advanced by co-operative societies per hectare of gross cropped area. First principal component explains 85 per cent of the total variance in these two original variables in 1971 and 70 per cent in 1981.
14.	Educational Facilities Index	*ED*	Composite index of (a) percentage of literates to total population, (b) percentage of literates with some schooling and (c) total number of educational institutions per lakh population. The first principal component accounts for 61.21 per cent of the total variance in the original variables in 1971 and 69.52 percent in 1981.
15.	Industrial Development Index	*ID*	Aggregation of four indicators: (a) ratio of total number of registered factories in the ith district to the total number of registered factories in the state, (b) percentage of workers in manufacturing industries to total workers, (c) per capita value added in manufacturing industries and (d) per capita capital employed in manufacturing industries. The first principal component explains 72.44 per cent variance of the total variance in these four indicators in 1971 and 85 percent in 1981.
16.	Mechanization in Agriculture Index	*MECA*	Combination of three indicators: (a) pumps + oil engines per 1000 hectare, (b) tractors per 1000 hectares of net sown area and (c) power consumption in agriculture per hectare of gross cropped area. The percentage of total variance explained by the first principal component of these three indicators is 62.06 in 1971 and 61.63 in 1981.
17.	Water Resource Index	*WR*	Composite index of five indicators: (a) percentage share of wells and tube wells in irrigation, (b) normal rainfall in cms. (c) irrigation extent, (d) cropping intensity and (e) irrigation intensity. The percentage of the total variation explained by first principal component in these five original variables is 36.42 in 1971 and 40.48 in 1981.
18.	Agricultural Output Index	*AGO*	Aggregation of four indicators: (a) land productivity in agriculture, (b) labour productivity in agriculture. (c) degree of commercialization and (d) per capita availability of food grains. The first principal component accounts for 46.40 per cent of the total variance in these four indicators in 1 97 1 and explains 46.93 per cent of the variance in 1981.
19.	Border District Dummy Variable[4]	*B*	*B* = 1 for border districts, and *B* = 0 for interior districts.
20.	Temporal Dummy Variable (Time Shift Variable)	*T*	T= 0 for the base year 1971 and *T*= 1 for the year 1981

'Districts may have international or national borders (with other states of India). Here the dummy variable, *B* = 1, is for the districts having borders with other states of India. Whereas the interior districts. *B* = 0. are bounded by the districts of the states, they may have international borders.

On the basis of theories of migration and empirical studies mentioned above the following models are specified :

I. Linear

$$Mij = B_0 + b_1 DP + b_2 SB + b_3 CA + b_4 DU + b_5 PD + b_8 D + b_7 ED + b_8 TP + b_9 ID + b_{10} MF + b_{11} WR + b_{12} MECA + b_{13} AGO + b_{14} BAC + b_{15} AA + b_{16} SMR + b_{17} LIV + b_{18} AL + b_{19} B + b_{20} T + ei.$$

II. Log-linear (Double-log)

$$LNMij = b_0 + b_1 LNDP + b_2 LNSB + b_3 LNCA + b_4 LNDU + b_5 LNPD + b_8 LND + b_7 LNED + b_8 LNTP + b_9 LNID + b_{10} LNMF + b_{11} LNWR + b_{12} LNMECA + b_{13} LNAGO + b_{14} LNBAC + b_{15} LNAA + b_{16} LNSMR + b_{17} LNLIV + b_{18} LNAL + b_{19} B + b_{20} T + ei.$$

The above single equation models (I and II) have been specified. However, in general, some of the explanatory variables may be interdependent. Hence a simulantaneous equation model-would be more appropriate. This would require a better model of demographic interaction. Moreover, the aggregate stream need to be decomposed into genera! substreams, e.g., rural to rural, rural to urban, urban to rural and urban tourban. The results of this study can be different from the model based on more disaggregated data.

Hypotheses to be Tested

On the basis of past migration theories following alternative hypotheses (H_1,) are formulated. The null hypotheses *(H_0)* in all cases is that these factors do not influence the inter-district population movements, Since the variables are defined as a ratio of value of the district./ to that of the district /, they refer to the level of development of district y to that of the district /. Pull force would thus cause out-migration from district ith to district jth. The expected signs of the coefficients of variables are given in Table 4 (it should be kept in view that the dependent variable is out-migration from / toy district).

Results

Table 5 shows the hypothesised signs alongwith the estimated zero-order correlation coefficients between the dependent variables *(DPT and LNDPT)* and each of the explanatory variables. It reveals in the estimation of linear model that DPTXcols. 3 and 4). the correlation coefficients of degree of urbanization *(DU),* index of education development *(ED),* index of medical facilities *(MF),* index of banking and credit *(BAG),* stock of migrants *(SMR)* and dummy variable for the border districts *(B)* are statistically significant, while others are not having signs in accordance with the formulated hypotheses. The estimated correlation coefficients are low in almost all cases, revealing the weak linear effect of the correlates on out-migration. This may be due to the interaction of the explanatory variables. The real nature of the relationship between the dependent variable *(DPT)* and independent variables can be revealed by the partial regression coefficients obtained in multivariate regression analysis. The estimated correlation coefficients in the log-linear model (cols. 5 and 6) show better results than those in the linear model. The correlation matrices for the explanatory variables given in Appendix Tables A-l (1971) and A-2 (1981) show no serious problem of

TABLE 4: EXPECTED SIGNS OF COEFFICIENIS OF VARIABLES

Var.	*Coeff.*	*Exp. Sign* (H_1)	
DP	b_1	+/-	Higher *density of population* may act as a pull force due to initial economies of scale. But if it results in overcrowding, then diseconomies may begin to operate. So the relationship is open-ended.
SB	b_2		Higher the *social backwardness*, lesser will be migration into the districts. The '*a priori*' sign attached to the coefficient is therefore negative.
CA	b_3	+	The pattern of government expenditure in favour *of centres of administration* acts as a pull force.
DU	b_4	+/-	Inter-district in-migration is expected to be high in districts in which the *degree of urbanization is* relatively high due to economies of migration. Out-migration from the rural sector is also possible due to residual sector hypothesis (i.e., incapacity of agriculture sector to employ growing labour force) or due to rural-urban linkages (because of sustained growth of agriculture). On the other hand, if the diseconomies of urbanization start, then this process may be stopped or it may become reverse. Hence '*a priori*' sign is not predicted for the coefficient of the variable.
PD	b_5	+	If the prospects of development of an area are brighter, the migrants will be having indication of more jobs, higher income and better standard of living. Pull force would work; therefore, positive sign may be attached to the coefficient of the variable.
ED	b_6	+	Availability of *educational facilities* in the destination area more than the origin place, acts as a pull force. As the pull and push forces both work in the same direction, a positive sign is given to the coefficient of the variable.
TP	b_7	+	With the *development of transport* facilities both in- and out-migration rise and a positive sign is expected to the coefficient of the variable.
ID	b_8	+	*Industrial development* is a proxy for the probability of getting job for an individual in destination area. As the value of this variable rises, the pull and push forces operate in the same direction; therefore, a positive sign is assigned to the coefficient.
MF	b_9	+	Development of *medical facilities* serves as pull force for the process of migration. The sign of the coefficient is expected to be positive.
WR	b_{10}	+/-	Scantiness and *uncertainty of rainfall* are the push whereas abundance and certainty of water are pull factors. However, degree of urbanization has been found to be high in districts with scanty and uncertain rainfall in special arid conditions of Rajasthan. So the sign is unpredictable.
MECA	b_{11}	+/-	With the *mechanization of agriculture*, farmers will have more chances to earn more income. At the same-time with the increase in income, they will like to diversify their jobs and may migrate to other

Table 4 (*contd. on* p. 258)

Table 4 *(contd. from* p.257)

Var.	*Coeff.*	*Exp. Sign* (H_1)	
			place. Thus both retention and expulsion forces operate and sign of the coefficient is therefore indeterminate .
AGO	b_{13}	+	Higher *availability of agricultural output* is likely to work as a pull force. The expected sign of the coefficient is positive.
BAC	b_{13}	+	If in the destination place the *number of banks* and *credit facilities* are more than in the source area, then the migrants will have more opportunity to develop. As pull and push forces would work in the same direction, a positive sign is assumed for the coefficient of the variable.
SMR	b_{14}	+	*Past migration* from the same place of origin affects the current migration. The greater is the past migration to an area, the more likely is that a favourable opinion of that area is held by the prospective migrants. The forces of attraction and expulsion both work. Hence positive sign is attached to the coefficient of migrant stock variables.
AA	b_{15}	+	*Average age* reflects the expected duration of a migrant acting as a potential investor. The younger the community is, on an average, the higher would be the probability of out-migration, so a positive sign is given to the coefficient of this variable.
LIV	b_{16}	+/-	*Animal husbandry* works as a main or subsidiary occupation, particularly in the semi-arid and arid areas. The role of the variable in influencing migration is unpredictable. It depends on whether with the increase in income people want to diversify their jobs or not
AL	b_{17}	+/-	*Agricultural labourers* are the poorest section in the rural population. So the percentage of agricultural labourers to total labourers is expected to work as a push factor. However, other things remaining same, large number of agricultural labourers may indicate higher level of development of (agrarian) capitalism, indicating a dynamic economy, attracting migrants. The sign of the coefficient of the variable is therefore unpredictable.
D	b_{18}	—	The greater the *distance* involved, the greater will be the cost of moving. So the retention force operates to reduce out-migration, while at the same time a repulsion force reduces in-migration. A negative sign is expected to the coefficient of the variable.
B	b_{19}	—	Border districts, having border with other Indian States. It is hypothesised that a large population of migrants to/from these districts may be to the neghbouring districts of other states. Hence such districts will show quite low population within the state inter-district migration. So the expected sign is negative.
T	b_{20}	+	Time shift variable. This variable is introduced in pooled data analysis. It is hypothesised that structural change in the migration pattern has occurred in 1971-81 in comparison to 1961-71.

TABLE 5. HYPOTHESISED SIGNS AND ESTIMATED CORRELATION COEFFICIENTS OF INTER-DISTRICT POPULATION TRANSACTION MODEL. *DPT(* 1971.1981)

SI. No.	Expl. Var.	Hypo. Sign	Estimated Correlation Coefficient with			
			DPT		LNDPT	
			1971	1981	1971	1981
	(1)	(2)	(3)	(4)	(5)	(6)
1	DP	7	-0.042	-0.017	-0.020	+ 0.087 *
2	SB	-	+0.055	-0.042	+ 0.108 *	+ 0.087
3	CA	+	-0.032	+0.104	+ 0.028	+ 0.145
4	DU	7	-0.132 *	+0.010	+ 0.165 *	+ 0.016
5	PD	+	+0.037	+0.027	-0.017	+ 0.069
6	ED	+	+0.079 *	+0.038	+ 0.172 *	+ 0.078 «
7	TP	+	+0.063	+0.014	-0.105 *	+ 0.045
8	ID	+	+0.061	+0.063	-0.070	+ 0.166 •
9	MF	+	+0.088 *	+0.011	-0.172 *	-0.099
10	WR	?	+0.035	-0.032	+ 0.057	+ 0.036
11	MECA	+/-	-0.045	+0.099 *	+ 0.035	+ 0.107 *
12	AGO	+	+0.011	+0.035	+ 0.077 *	+ 0.122 *
13	BAG	+	+0.091 *	+0.071 *	+ 0.105 *	+ 0.123 »
14	SMR	+	+0.089 «	+0.024	+ 0.011	+ 0'.171 »
15	AA	+	+0.001	+0.050	-0.133 *	+ 0.022
16	LIV	?	-0.022	+0.052	+ 0.056	+ 0.050
17	AL	7	+0.027	+0.080	-0.035	+ 0.040
18	D	-	-0.059	-0.119	-0.334 *	-0.121 *
19	B	+	+0.102 *	+0.054	-0.164 *	-0.138
	n		650	650		

Critical Value (1 Tail, .05) + or - (0.063) (2 Tail,.059) = +! -(0.075)

*** Denotes 5% level of significance. Sign ? refers to open-ended hypotheses.**

multicollineariry. In some cases collinearity is relatively high but that is less than the overall multiple correlation coefficient. So the problem of multicollinearity is not harmful in the model (Klien 1975).

The model is also estimated for the pooled data for 1971 and 1981. as pooling increases the accuracy of estimates (Hannan and Young 1977). It also helps in testing the stability of relationship overtime.

R^2is0.077,0.057 in linear models with the 1961-71.1971-81 and pooled data (1961-81). TheR^2inthecaseoflog-linearspecificationis0.231,0.416 andO.254 respectively. The results of linear and log-linear specification are not directly comparable. But the residual sum of squares of the two sets of equations can be compared by applying the test suggested by Raw and Miller (1975). When that test is applied it is found that log-linear specification is more appropriate than the linear specification of inter-district population migration model. The double log model gives far superior fits than linear model. Hence, here only the results of log-linear specification are reported (Table 6).

TABLE 6: COEFFICIENTS AND Y VALUES OBTAINED IN ESTIMATING LOG-LINEAR REGRESSION EQUATIONS FOR DECADAL INTER-DISTRICT POPULATION TRANSACTION MODEL. 1,1981 AND POOLED DATA)

SI. No.	Equation No. / Explanatory variable	1 LNDPT (1971)	(2) Dep LNDPT (1981)	3 LNDPT (1971+1981)
1	DP	0.02669 * (2.68)	0.1875 * (2.95)	
2.	SB	3.618 *' (2.18)	-	
3.	CA			
4.	DU	0.4366 ** (-3.32)	0.2351 * (3.44)	
5.	PD	0.2924 * (4.05)		0.2745 * (3.41)
6	ED			0.0505 (1.21)
7.	TD			0.2050 * (5.57)
8.	ID	-0.3813 * (-3.50)	0.1455 * (3.29)	0.2010 ' (3.71)
9.	MF	0.0998 (1.05)		-
10.	WR	0.8262 * (4.79)	-0.2993 * (-2.59)	0.0839 (1.20)
11.	MECA	0.1430 ** (1.85)	0.1785 ** (-1.76)	-
12.	AGO			
13.	BAC	0.5886 * (4.51)		
14.	SMR	0.1972 (1.67)	0.6699 * (4.86)	-
15.	AA	3.1496 * (4.51)	0.4949 ** (1.10)	0.9259 * (2.29)
16.	L1V	-	'-	-
17.	AL	0.2470 ** (2.82)	0.2490 «* (2.03)	-
18.	D	0.3792 * (9.58)	-1.4249 * (19.06)	-1.0201 * (17.79)
19.	B	-0.5427 * {4.51)	-0.3475 * -(3.08)	-0.3539 -(4.51)
20.	T	-	-	0.2609 » (3.69)
	Constant	-3.1850	-1.6263	-2.3538
	R2	0.2301 *	0.4158 *	0.2536 *
	R2	0.2138	0.4067	0.2478
	F-ratio	14.108	45.486	43.797
	N	650	650	1300

t-values are in brackets.

* 1% level of significante; ** 5% level of significance; ***10% level of significance.

By viewing the detailed variable by variable regression coefficients, the following empirical results are obtained. Some results are found to be inconsistent while others are consistent and semi-consistent with the hypotheses.

Traditional and geo-physical variables like density of population *(DP),* water resources (*WR),* average age *(AA)* and stock of migrants *(SMR)* are having mostly positive, significant temporally consistent and strong effect on in-migration in all the three sets of equation (1.2,3) for (1961 -71). 1971 -81 and *(DP)* acts as a relative pull force. Average age *(AA)* of the migrants is hypothesized as having the positive relationship. The results obtained in the three sets of equations (1,2,3) confirm the expected relationship. The variable, stock of migrants *(SMR)* representing previous migrants from the same origin place plays a very important role in the process of migration. The variable has gained in importance in recent period. The coefficient of the variable distance (D) between the districts is as expected having significant negative value. The negative coefficient of dummy variable *(B)* reveals that the migration pattern of the border districts (with other states) is different from the interior districts. Expectedly, border districts are having weaker migration linkage with interior districts of the state, it should be remembered that $B = 1$ for border districts.

The estimated relationship of social and economic infrastructural variables like development of bankings and credit facilities *(BAC).* transport development *(TP),* education development *(ED),* prospects of development, represented by per capita plan expenditure *(PD)* and medical facilities *(MF)* which can be thought to be pull factors, are as expected positive and consistent. However, the parameter estimates are statistically not significant in all the three sets of equations (1, 2. 3). The infrastructural development, like banking and credit facilities *(BAC)* and transport facilities *(TP).* is generally low. hence the effect is weak. Educational development *(ED)* does not seem to be a significant variable in influencing migration behaviour in the state. The result is not surprising, since level of education of an individual affects not only his awareness of other regions and economic opportunities but also his ability to evaluate the uncertainties of migration. The prevalence of medical facilities *(MF)* does not induce migration in the state. This may be because in the post-independence period, district headquarters have been developed as medical health care centres. The variable, prospective development *(PD)* of the districts has positive and significant effect on migration in equations 1 and 3. But it does not enter equation 2. so the result is semi-consistent. The estimated result confirms the hypotheses that migration is human investment for betterment in future.

The role of most of the developmental variables, such as industrial development *(ID),* agricultural development *(AD),* proportion of agricultural labourers *(AL),* mechanization in agriculture *(MEC),* degree ofurabanization *(DU),* influencing migration is revealed to be temporally unstable. But the trend is towards increasing pull effect. The regression coefficient of the variable, industrial development *(ID)* is significant in all the three equations 1,2 and 3. But it is having perverse sign in equation 1 which points out that initial industrial development did not attract migrants. However, the relationship has been found out with proper signs in the latter equations. The availability of agricultural output *(AGO)* does not seem to be an important variable. Due to prevailing proletarisation and more rapid capitalistic development in agriculture myth district relative to the /th district, prospective migrants will

be attracted towards it. Hence the regression coefficients of the variable, agricultural labourers *(AL)* in the set of three equations shows the consistency in the results. Mechanization equations show the consistency in the results. Mechanization of agriculture *(MELA)* exhibited the semi-consistency in the estimated results due to opposite signs in the two equations 1 and 2. The relationship of degree of urbanisation *(DLT)* with migration is unpredictable. In equation. 1. the relationship found is negative but significant whereas in equation 2, the obtained results show the positive but significant relationship: hence the variable may act in both the ways as a relative pull or push force, depending on how other factors variables act. A temporal/structural change in the relationship is observed. The development of animal husbandry (LIV) is an important source of rural income in Rajasthan;
however, other things remaining the same. in this out-migration model, the variable docs not seem to be important as it does not enter in any of the three equation.

Social backwardness *(SB)* representing the relatively larger share of socially backward sectors (SC and ST) in population acts as a push factor exhibited by the negative sign in equation 1. But it does not enter into the regression equations 2 and 3. It is perhaps losing its importance as a push factor. The variable *CA*. representing the seats of former princely states which, because of being centres of administration, attracted migrants in the past. has no effect on migration in the post-independence period, specially post-1961 period.

The dummy variable (7) reveals that there has been a significant structural shift in migration pattern in the census year 1981 in comparison to the census year 1971. Elasticity of migration with reference to stock of migration *(SAIR)* is the largest among all the traditional and geographical variables followed by *(AA)* and *(DP)*. Amongthe infrastructural variables. prospective development *(PD)* and among the developmental variables, industrial development *(ID)* has the stronger effect. Distance is the greatest migration reducing factor.

Comparison with Other Studies

A comparison with different studies is difficult due to different definitions of the dependent variable and the different specifications of the models. However, still a comparison with other works would reveal both differences and similarities in results. And it would also help in identifyingthe different sets of variables influencing migration. Here comparison is with the log-linear model estimates. Some of the notable studies are: King(1978:83-101) onMexico,Beals.LevyandMosess(1967:480-36) on Ghana, Greenwood (1969:273-80)on Egypt and Levy and Wadycki (1972 : 407-15) on Venezuela. Most of the variables of the present study do not appear in these studies. The studies of Beal, and King are based on origin and destination variables. The coefficient of the density of population for the origin region in Beals' study is significant and positive. King found a positive and significant regression coefficient of density of population in combined regression (male and female). The sign in the present out-migration model is consistently positive which shows the variable acts as a push force.

In the region of origin, Beals, and Greenwood found the coefficient of urbanization variable positive and significant. Levy and Wadycki found negative and significant regression coefficient, while in the study of King the coefficient is not significant for the origin. In the present model consistency in the results is not obtained.

All of these studies used a distance variable, with agreement on the results. Like this study. King. Levy and Wadycki used a migrant stock variable and also found a positive and significant coefficient. In this study. index of education is positive but insignificant. Average age of the migrants, i.e.. younger people are more prone to migration, variable is having negative insignificant coefficient, in King's study. But. in'the present study it is found a positive and significant coefficient.

None of these studies used facilities of transport, facilities of medical aid. facilities of banking and credit, centres of administration and prospective development areas as independent variables. These variables are specific to the study of Rajasthan study.

Thus the present study has different approach in studying the migration behaviour. The effects of some new variables are examined. This study is based on the ratios of the independent variables, which emphasize the relative strength of pull and push forces. whereas, until now the studies were based on the difference of the explanatory variables in origin and destination areas or they have included the variables for the origin and destination areas.

The main methodological problems with the study are:

(a) Based on census data
(b) Single equation model is developed
(c) The data base is weak
(d) The data used are highly aggregated and the model can not be used to describe individual person's behaviour.

Conclusion

Despite its main shortcomings the economic approach to migration employed in this study broadly corroborates the view that migration is a rational economic phenomenon. However, asyet, the influence ofgeo-physical and traditional factors like distance and stock of migrants is dominant in determining the quantum and direction of migration. The importance of level of development of infrastructure is increasing but that of economic development is still very weak. This is perhaps due to the fact that the overall level of development of different districts is low and, therefore, inter-district disparities at this low level exert rather very weak net pull and push effects.

Rajasthan is still in the first stage of development wherein socio-economic infrastructure is being built up. Only when on the basis of this development substantial agricultural and industrial development is achieved, creating increased overall opportunities and also increased regional disparities at ever rising level of development, then economic factors would operate as significant factors in influencing migration.

It seems that in Rajasthan, natural and geo-physical conditions still determine regional differentials in the level of economic development. Hence controlling for these conditions, economic development indicators have no independent effect as revealed by the respective partial regression coefficients and their low statistical significance. Similarly, some of the infrastructural variables dominate over the indicators of development.

Better results can be obtained by taking net inter-district migration as the dependent variable and introducing either the final output or the intermediate output variable as the set of explanatory variables. Such an exercise is being attempted by the authors.

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APPENDIX

TABLE A-1 ZERO ORDER CORRELATION MATRIX FOR THE RATIOS OF EXPLANATORY VARIABLES, 1971

	DP	*SB*	*CA*	*DU*	*PD*	*ED*	*TP*	*ID*	*MF*	*WR*	*MECA*	*AGO*	*BAC*	*SMR*	*AA*	*LIV*	*AL*	*D*	*DV*
DP	1,00000																		
SB	.17542	1.00000																	
CA	.13354	–.12127	1.00000																
DU	–.05374	–.23879	.24704	1.00000															
PD	–.14097	–.11723	.10021	.47563	1,00000														
ED	.11891	–.16803	30187	.37581	.07422	1.00000													
TP	.69023	.09427	.29022	.23660	–.11299	.21433	1.00000												
ID	.16780	.08394	.25836	.48927	.35882	.24869	.48727	1,00000											
MF	–.01159	–.08755	.26613	.63378	.41133	41473	14246	.26409	1,00000										
WR	.24074	.18925	02543	.23990	.01740	–08755	.52982	.33542	.09109	1.00000									
MECA	–.08043	.01092	–.01628	.22103	.21576	0.4274	.04657	.14144	.00192	.08579	1.00000								
AGO	.45320	.37973	–.06617	–.29536	–.13373	.01040	.37517	.07982	–.17957	.13908	–.01752	1,00000							
BAC	.53013	–.01041	.38124	.23582	.16398	.29834	.67069	.57524	.08253	.18885	.13493	.33713	1.00000						
SMR	.07647	.33622	–.11562	.08278	.30044	.00127	.12682	.34982	09904	.33001	40598	.23857	.21055	1 00000					
AA	.05045	–.10613	.07850	.36138	.12492	.06419	.41933	.41133	.25095	.49505	.09213	.10123	.18984	.23064	1.00000				
LIV	–.04940	.45636	–.18988	–.26708	.04295	–.21972	–.15473	–.08333	.00379	–.02247	–.19833	.23159	–.21553	.07501	14882	1,00000			
AL	–.04171	.07172	–.4249	–.08509	–.00641	.03493	.03654	–.00591	–.10811	–.02735	.11868	.30092	.12256	.06737	.36649	.04068	1.00000		
D	.13273	.04331	–.5834	.00586	.04727	–.03345	.06705	.00964	–.03500	.01255	.10862	.08746	.10025	.01915	–.00141	.09574	–.02819	1.00000	
DV	.28354	.19268	.07933	–.22333	–.17890	–.02353	.11788	–.14959	–.11250	–.10749	–.08138	.25868	.06913	–.07562	–.19760	–.03530	.18776	–.02578	1.00000

Critical Value (1-Tail, .05) =+ or - .06459
Critical Value (2-Tail, .05) = +/- .07692
***N* = 650**

TABLE A-2 : SERO-ORDER CORRELATION MATRIX FOR THE RATIOS OF EXPLANATORY VARIABLES, 1981

	DP	*SB*	*CA*	*DU*	*PD*	*ED*	*TP*	*ID*	*MF*	*WR*	*MECA*	*AGO*	*BAC*	*SMR*	*AA*	*LIV*	*AL*	*D*	*DV*
DP	1,00000																		
SB	−.06180	1.00000																	
CA	.03869	.02016	1.00000																
DU	.11832	−.04968	.30238	1.00000															
PD	−.16443	−.02967	.46353	.04539	1.00000														
ED	.42839	−.27093	.44770	.38736	.02481	1.00000													
TP	.05272	−.04275	.19654	19699	.41266	−.01413	1.00000												
ID	.34902	−.01410	.42615	.30632	.11960	.56853	.06192	1.00000											
MF	.01562	-.06376	.41538	.52406	.31507	.15719	.52901	.19474	1.00000										
WR	.29374	−.02392	.01268	−.03618	−.23722	.23858	−.10954	.17253	.00397	1.00000									
MECA	−.07678	−.01440	.47496	.19993	.30565	.15523	−.02312	.17935	.00086	−.25202	1.0000								
AGO	.39431	−.10553	.25513	.05675	−.06814	.49613	−.11956	.30748	−.17051	.31236	.19418	1.00000							
BAC	.07507	.04650	.12736	.13329	.20691	.06152	.14927	.28646	.21710	−.12414	.09250	−.12989	1.00000						
SMR	−.07745	.30115	.49904	.31510	.37241	.05484	.05748	.35091	18142	−.05975	.65000	.17883	.21138	1.00000					
AA	.03345	.01001	.20906	.17591	.11647	.26961	−.04661	.28882	.20873	−.00005	.12755	−.04774	.16986	.16325	1.00000				
LIV	−.05491	.55858	.20041	−.09132	.12466	−.03703	−.06320	.07875	.00601	.22652	−.07206	.09802	−11563	.23232	.20949	1.00000			
AL	−.16086	−.03366	.20571	.06025	.02777	.09414	−.22421	.00760	−.06172	−.04705	.20376	−.05840	−.03140	.04790	.32343	.03379	1.00000		
D	.12954	.05023	−.05528	−.00103	.02954	.04436	.00098	.02378	−.04343	.02029	.07409	.08798	−.00162	.03214	−.00361	.04959	.00928	1.00000	
DV	.26442	−.12677	−.03272	−.12542	−.19158	.07869	.01769	−.05912	−.13260	.30016	−.04969	.23302	−.11350	−.12287	−.20080	−.14985	.03092	−.02429	1.00000

Critical Value (1-Tail, .05) = + or - .06459
Critical Value (2-Tail, .05). = +/- .07692
N = 650