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Population Redistribution, Environmental Degradation and Landuse Patterns : A District Level Study of Linkages in Arid and Semiarid Zones of India

Introduction and Background

THE last two decades have seen the emergence of environment related issues as an area of major concern. Population growth, in particular in the under-developed parts of the world, on the other hand has always been the focus of attention. It is however difficult, *a priori,* to arrive at a general conses on the nature of the structural linkages between population growth and the state of the environment Population increases may seem to result in overexploitation of natural resources and aggravate environmental degradation. Environmental degradation in turn stresses the life supporting capacities of natural resources and thus impedes socioeconomic development. This is, however, a very simplistic and somewhat arithmetic view which is now somewhat discredited (World Resources Institute 1994). The nature of relationships between population and environmental degradation is mediated by a number of factors and understanding it requires an in-depth perusal of the kind of threats to the eco-systems. Of the different kinds of threats probably the rapid rates of depletion of the forests, and the degradation of land are perhaps the most relevant in the context of developing countries. The linkages between such degradation and population growth depend on the distribution of population across regions and are in turn affected by the movement of population. It is often claimed that a large part of the rural-urban migration taking place in developing countries is of the nature of a push migration caused by degradation of the hinterland. Such migration could coexist with migration arising out of the developmental 'pull' created by industrialisation.

Recent analyses in the literature of the circumstances under which such 'distress' migration takes place suggests that it can be countered by concerted efforts at property rights alterations in degraded areas. Such creation of property rights creates sources of empowerment with respect to different kinds of nonprivately owned land. At the micro level, the experience of several non governmental organisations corroborates this, thereby suggesting that a reversal of the degradation process and the migration trends is possible. It is often contended that creation of property rights on common lands have depicted improvements in carrying capacity of land and curtailed the distress rural outmigration over several areas in the Indian context (Chopra and Gulati 1994). Several success stories of participatory developmental

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interventions in different agricultural zones over India in the form of joint forest management schemes and watershed development programmes have brought about significant results in terms of land upgradation, afforestation, and better management of natural resources viz. water, land and forests (Kadekodi 1994).

These processes have, however, been studied only at the micro level and it is not clear that they have had any persistent impact that shows up in the analysis of data at the more aggregative level. This paper aims at examining the relationship between environmental degradation and the different kinds of migration that might coexist in acertain empirical situation from a more macro or district level perspective.

It examines the nature and strength of linkages between population growth and its redistribution, changing land use patterns and environmental degradation process over the 1980s in arid and semiarid zones of India. The study accounts for the interactions by formulating a simultaneous structural system, with distress rural outmigration, environmental degradation, and landuse pattern variables being endogenous in the system, and some relevant demographic and developmental predictors being treated as exogenous to the system. The parametric estimates of the structural coefficients are elicited by the 3SLS system estimational procedure. Thereby, the reduced form structural coefficients are elicited to highlight the total effects of exogenous variables on the endogenous variables For highlighting the linkages the data base pertains to 89 districts over arid and semiarid tracts over the Central and the Western parts of India.

Nature of Interlinkages

The following kinds of interrelationships between population levels and changes and inter spatial movements of population and environmental degradation can be identified:

(a) increases in population result in pressures on land and water in rural environments,

(b) degradation of the above kind results in so-called stress migration,

(c) changing property rights in land and common property resources can limit or even end stress out migration,

(d) a parallel stream of 'developmental' migration occurs as a consequence of employment opportunities in the 'urban' 'industrial' sector of the economy,

(e) this has its own impact on urban environments.

Population growth results in increased demand for food, fodder, fuelwood and other agricultural products and thus agricultural intensification with intense use of chemical fertilisers, pesticides, insecticides and higher irrigational intensities. This may lead to land degradation, loss of soil nutrients, overexploitation of surface and underground water, waterlogging and salinisation. Depletion of underground water resources in several water scarcity regions over arid and semi arid zones of India may also take place (Malik 1993). Population driven land fragmentation and degradation, abject rural poverty, and hunger for cropland areas result in spread of agriculture into marginal lands, pasturelands and tropical forests. This implies changing land use patterns as between cropland, pastureland, and forestland areas. This altered land use in arid regions results in degradation in the form of desertification of marginal lands, denudation of hill ranges, and deforestation. The consequent higher runoff of rainwater may result in lower recharge of underground water, soil erosion, siltation of river basins and natural water reservoirs like lakes and ponds. Thus, desertification, deforestation, soil erosion, siltation, depletion of underground water resources may be linked with spread of agriculture into marginal agricultural and tropical forestland areas. This in turn seriously affects agricultural production (Sethi 1994).

Livestock rearing is almost always a subsidiary activity taken up by agriculturists. There exists ample evidence to show that overgrazing in pasturelands, uplands and forestlands lead to forest denudation and environmental degradation. Fodder scarcity in private and common pastureland and lesser need of stall feeding for sheep and goats compared to other milch animals results in a change in the composition of livestock in favour of sheep and goats.The higher grazing potentials of sheep and goats in upland forest tracts encourages this tendency. Thus, shifts in livestock composition in favour of sheep and goats is presumed to characterise the extent of deforestation or environmental degradation in the rural tracts (Bowonder 1987).

Two kinds of environmental impact consequent on the pressure of population can therefore be identified: that resulting from intensification of agriculture and that resulting from neglect of preservation of land or its overgrazing by increasing livestock populations.The nature of the ecological changes vary from region to region (Chopra 1993) though the latter seems to be the quantitatively predominant one in the country as a whole (Chopra and Rao 1992).

Pressure on cropland, depletion of natural resources, rural environmental degradation and consequent rural poverty results in distress outmigration of surplus agricultural workers to urban and industrial centers for wage employment for their subsistence and sustenance. Agglomeration of people and industrial activities in urban and industrial centers has led to overurbanisation and metropolitisation. This, in turn has its own consequences for the urban environment. It has led to proliferation of illegal squatter settlements and urban slums characterised by inadequate infrastructural facilities like housing, healthcare, sewerage, potable and clean water, and liquid and solid waste disposal facilities. The process of overurbanisation and metropolitisation leads to further intensification of urban environmental problems like air and water pollution resulting from hazardous industrial liquid and solid wastes, toxic emissions from increased vehicular traffic, insanitational and unhygienic conditions in illegal squatter and slum settlements (Mathur 1993). This kind of over urbanisation was, however, concentrated more so in the fifties and the sixties. A slight deceleration is observed over the eighties, possibly because of emerging higher capital labour ratios in industrial sectors and thus lesser absorbtion capacities of labour (Rakesh Mohanl992).

Another source of overexploiiation of common property resources such as forests is the increasing commercial demand. In the Indian context, this has led to overexploitation of forest resources for commercial harvesting of timber to cope with the increasing demand of timber for urban housing, shipbuilding, railways, industrialisation; and significantly increased paper production over eighties. The poorer rural population depending mainly on commons like forests and pastures, for their sustenance (Jodha 1986).These factors add to the forces resulting in out migration either on to less productive hill ranges and uplands or towards urban areas in search of subsistence wages for sustenance.

Thus, available empirical evidence seems to indicate that shrinkage of common property resources like forests and common pastures, overexploitation of natural resources like land, water and forests because of increased demands resulting from excessive growth of population and industrialisation, over urbanisation coupled with continuing abject poverty conditions, and distress rural outmigration in search of nonagricultural employment opportunities by the rural poor seem to be strongly interlinked (Bowonder 1987).

Specification of the Model

The simultaneous structural system in the present study has four endogenous variables and eleven exogenous variables. The system formulated comprises four structural relations to highlight the extent of interactions between environmental degradation, property rights and population movements. The four endogenous variables in the system are, (1) environmental degradation represented by change in structural composition of livestock in terms of sheep and goats as percentage of total livestock over 1972-82 (CHSHGOTTLS); (2) change in private ownership rights on agricultural land characterised by change in net sown area to total geographical area over 1974-84 (CHNSATGA); (3) change in commonland area over 1974-84 (CHCOMLAND) characterising extent of change in common property ownership rights over agricultural land; (4) sex-compositional change in favour of females in rural areas to overall change over eighties (CHRSRTOS), characterising distress out-migration from rural tracts to towns, urban agglomerations and metropolitan centers because of push and pull factors.

The system includes eleven socioeconomic and developmental variables. The agriculture related variables are rainfall, irrigation, land-productivity; Industrial development is represented by the extent of non-farm employment activities in factories and in mining and quarrying sectors; demographic pressures on land is characterised by population growth and increase in population densities; and social developmental variable is characterised by the extent of literacy. The detailed specifications of the variables are provided in the Appendix Table A-l, and sources of data are mainly Centre for Monitoring of Indian Economy and Ministry of Environment reports.

Simultaneous Structural System

The simultaneous structural system depicting hypothesised relationships among the variables comprising four structural relations is as follows:

CHRSRTTSR = f (CHSHGOTTLS, CHNSATGA, CHCOMLAND, CHPCFGP, CHADEFPLP, CHWEMQPLP, LITEIG) (1)

CHSHGOTTLS = f (CHCOMLAND, CHRSRTTSR, CHFCA) (2)

CHNSATGA = f (CHCOMLAND, ANR, CHGIATGCA, PCFGP, NADI, CHDEN) (3)

CHCOMLAND = f (CHNSATGA, CHPCFGP, PGRSEV, CHDEN, CHFCA) (4)

A brief discussion of the structured system follows.

Distress Rural Outmigration Equation

The first structural relation depicts extent of distress rural outm igration characterised by excessive change in rural sex composition in favour of females to the district's overall sex ratio (CHRS&TTSR), as a function of the environmental degradation variable represented by changes in proportion of sheep and goats to total livestock (CHSHGOTTLS), change in net sown area to total geographical area (CHNSATGA), and change in proportion of commonland to total geographical area (CHCOMLAND); and four exogenous variables comprising of land productivity variable viz. change in per capita food production (CHPCFGP); two nonagricultural employment variables viz. change in average daily employment in factories per lakh population (CHADEFPLP) and change in employment in mining and quarrying sector (CHWEMQPLP); and a social development variable depicting extent of literacy in the district (LITEIG).

The independent variables in this equation represent the different factors that impact the outmigration from rural areas, outmigration that is of the 'stress* outmigration variety. Both the push and pull factors are included in this. Improvements in land productivity and in net sown area are expected to have a negative effect on out migration.Similarly environmental degradation process is contended to have a strong positive impact on rural-urban migrational patterns. Among the pull factors, availability of employment opportunities in urban and industrial centers may be most significant The non agricultural employment variables depicting extent of employment opportunities that have been included in the set of exogenous variables are the extent of employment in factories (CHADEFPLP) and employment in mining and quarrying sector (CHWEMQPLP).

Furthermore, a social developmental variable, the extent of literacy in the population (LITEIG), is also presumed to have strong bearing on the migrational flows. It is generally contended that rural outmigrational streams are generally dominated by younger age groups and relatively more educated adult members to begin with. Subsequently, the adult outmigrants get joined with other family members comprising spouses and dependents. However, the extent of literacy in the society is also inducted as one of the influencing variables on rural-urban migrational flows.

Environmental Degradation Equation

The functional form of the second structural relation depicts environmental degradation as reflected in change in favour of sheep and goals in the livestock population (CHSHGOTTLS) as a function of two endogenous variables viz. change in commonland area depicting community ownership rights on land (CHCOMLAND), stress migration from the rural tracts depicted by excessive change in rural sex composition to overall sex composition (CHRSRTTSR), and an exogenous variable viz. change in forest covered area (CHFCA).

Traditionally, forests, predominantly owned by the Government, and common pastureland as constituent of commonland, predominantly owned by panchayats and other village bodies, have been the main source of cattle fodder for cattle rearing activities by the tribal communities and agricultural workers (Simon 1986). Cattle grazing on forestland has always been on the rise and thus forests have been the major source of fodder for cattle raising by the tribal communities and the basic source of fodder for upkeeping the livestock in the Indian rural economy (Collins 1991). Thus depletion of forests and common land resources, traditionally being the major source of common grazing of livestock in the village economy, are supposed to affect the sustenance of livestock comprising cows, buffaloes, drought animals, etc. needing larger quantities of fodder for sustenance. Several empirical studies have demonstrated that deforestation in several tracts has been responsible for changing composition of the livestock in favour of sheep and goats, since sheep and goats can be easily sustained on grazing on hilly tracts and upland forests unlike other milch animals like cows and buffaloes depending mainly on stall feeding.

Net Sown Area Equation

The third structural relation depicts change in private ownership of land characterised by change in net sown area to total geographical area (CHNSAPTGA), which is mainly privately owned, as a function of one endogenous variable viz. change in commonland to total geographical area (CHCOMLAND) to capture the tendency towards privatisation. The five exogenous variables that are postulated as affecting changes in net sown area comprise three agricultural resource variables viz. annual normal rainfall (ANR); change in irrigational intensity (CHGIATGCA); and agricultural land productivity variable characterised by per capita food production (PCFGP) and two nonagricultural variables: i.e. non- agricultural development index (NADI) and population pressure on land variable as measured by change in density of population per square kilometer (CHDEN).

Change in net sown area is taken here to stand for the increase in private property ownership. The magnitude of change in privately owned croplands is expected to have a strong relationship with changes in commonland areas. Furthermore, improvements in irrigational facilities and greater availability of rain water are expected to have strong bearing on land productivity and thus facilitate private ownership of land by making it economically more attractive. Similarly higher land productivity or better quality of land also attracts private ownership for obvious reasons.

The nonagricultural development in the district may also influence migration outflows and thus land use patterns in the rural tracts. The non agricultural development index (NADI) for a district is based on a multiciplicity of non agricultural developmental variables such as extent of urbanisation, employment in industrial and service sectors, banking sector activities, among others. The index reflects the district's nonagricultural employment potentials and thus is expected to affect migrational flows from the area (Gulati 1992). The non agricultural development related outmigralional flows from the areas may influence landuse patterns in two ways. By decreasing the pressure of population on land, they lower the need for increased privatisation of land. Simultaneously, this outflow decreases the availability of labour for use on agricultural land and is expected to make it more difficult to manage increased land.

Commonland Area Equation

The fourth structural relation depicts the extent of change in commonland area (CHCOMLAND) as determined by changes in net sown area (CHNSATGA), changes in forest covered area (CHFCA), improvements in land productivity (CHPCFGP), population growth (PGRSEV), and pressure of population on land (CHDEN).

This equation together with the earlier one captures the mutual dependence of common and private property resources in the specific context of land. This emerged as one of the crucial variables in the analysis of the behaviour of the reasons for the protection of common land in the lower Sivaliks (Chopra and Kadekodi 1992). The realisation that common land provides inputs of water (through increased ground water levels, for example) and fodder to improve the productivity of privately owned fields often results in its protection. Such a linkage is however often assumed to be reflected in the quality of the common land. Here, the assumption is that area changes shall also result as a consequence of this linkage. Furthermore, the economies of scale factor may bring around private individuals with small land holdings to get under common property scheme of management (WRI 1995). Small fragments of submarginal land holdings may be uneconomic under private property regimes and may come to be cared for better if institutional change to pool them is made possible. Examples of such change are to be found in recent N.G.O. activities in the states of Rajasthan and Bihar, for instance. Here we have tried to see whether such tendencies get reflected in the macro-level data.

Land productivity can also be an important determinant of property rights structure over agricultural land. Thus land productivity variable (CHPCFGP) has also been inducted as one of the determinants of agricultural land under common property rights regime. Declines in forest covered area may also result into increments in commonland areas.

Similarly, demographic pressures on land characterised by extent of population growth (PGRSEV) and its pressure on land as represented by change in density (CHDEN) have also been included as predictors of land use patterns.

Parametric Estimates of the Model

The functional form of all the four structural relations is assumed to be intrinsically linear i.e. linear in parameters. A perusal of the system reveals that all the structural relations are overidentified and thus the three-stage least squares system estimational procedure (3SLS), is used for eliciting consistent estimates of the structural coefficients. The estimated structural coefficients are presented in Appendix Table A-3. Theoretically, the ordinary least squares (OLS) estimates of the structured parameters are not only biased but also inconsistent (Intriligator,1980). It may be of interest to mention that the OLS procedure yielded estimates (not reported here) depicting directions of influence quite contradictory to the general expectations. However, the system method employed here seems to have eliminated the simultaneity bias and provided consistent estimates. The 3SLS estimates are asymptotically efficient under correct specification conditions. The estimates are discussed below.

A perusal of the parametric estimates in Col. 1 of Appendix Table A-3 reveals that the environmental degradation process in the arid and semiarid zones of India has significant and positive impact on distress rural outmigration. The degradation process accelerates the rural outmigration. The finding seems to be in conformity with the generally agreed and theoretical consistent proposition.

Another factor depicting significant and negative impact on distress rural outmigration turns out to be changes in common property resources. Alternatively, depletion of common property resources or common-ownership rights over agricultural land accelerates the process of distress out-migration from rural areas.

The estimates of the equation for compositional change in livestock (CHSHGOTTLS) our proxy variable for environmental degradation are presented in Col. 2 of Appendix Table A-3. A perusal of the estimates reveals that depletion in common land area has a significant and negative impact on environmental degradation process. Alternatively, districts with similar levels of distress out-migration and changes in forest covered area but with larger land areas under common property rights depict lower environmental degradation. Furthermore, higher out-migration from rural tracts also depicts significant and positive relationship with environmental degradation process. Thus, higher extent of out-migration from rural tracts ceteris paribus depicts higher environmental degradation in arid and semi-arid zones over western parts of India.

A perusal of the estimates provided in Col. 3 of the Table reveals that privatization of land has been significantly at the expense of commonly owned agricultural land. Alternatively, in districts with similar levels of agricultural resources like annual rainfall, land productivity, out-migralion potentials, etc., but with larger common ownership rights have depicted positive changes in private ownership rights over agricultural land. Possibly, the explanation could be in terms of larger encroachments on commonly owned agricultural land over the period. Interestingly, higher normal rainfall districts within arid and semi-arid western zones of India have depicted significantly positive changes in private ownership rights over agricultural tracts.

Among the demographic variables we find that districts with lower nonagricultural development related migrational potentials depict significantly higher changes in privately owned croplands. Alternatively, areas with a higher nonagricultural development potential depict much lower changes in privately owned croplands.

The parametric estimates in Col. 4 of the Table reveals that changes in commonland areas and net sown areas are significantly and negatively associated. Possibly, expansion of privately owned cultivated lands are at the expense of shrinkage of commonland areas. Alternatively, changes in net sown areas, largely privately owned, depict significant and negative impact on changes in commonland areas. Furthermore, encroachment of commonland areas for cultivation purposes is a significant source of shrinkage of commonland areas. Alternatively, it seems that common property resources such as agricultural land under governmental and community ownership rights haj/e often been encroached upon by private individuals. However, there seems lobe lot of complementarity between privately and commonly owned agricultural land areas.

Interestingly, we find that districts with lower land productivity have experienced significantly higher improvements in commonland areas or common ownership rights over agricultural land. Alternatively, regions with higher improvements in land productivity have depicted significant declines in commonland areas.

Impact Multipliers

The structural coefficients provide estimates of the direct effects of different predictors on the response variables in the system. Thereby solving the simultaneous structural system of four equations for the four endogenous variables in terms of the exogenous variables provides the reduced form coefficients of the model. The reduced form coefficient includes interaction effects also and can, therefore, be interpreted as the total effect of the exogenous variable on the endogenous one. In a static model the reduced form coefficients are the same as impact multipliers. Intriligator (1980:499) has explained the procedure of calculation of impact multipliers.

The estimated impact multipliers are presented in Appendix Table A-4. The impact multiplier of an exogenous variable upon any endogenous variable is shown in the corresponding cell. For instance, one percent increase in gross irrigated area to gross cropped area (GIAGCA) will bring about 0.16 percent decline in distress outmigration from the rural tracts (RSRTTSR). Also, it will bring about .03 percent decline in proportion of sheep and goats to livestock composition<<SHGOTTLS) implying improvement in the environment. Furthermore, it brings about .04 percent increase in net sown area to total geographical area (NSATGA), and .15 percent decline in commonland area (COMLAND). Thus, increase in irrigational intensity in arid and semi arid zones will contain distress outmigration, will improve environmental conditions characterised by reduction in sheep and goats to total livestock, will increase cropland or net sown area, and reduce common land area.

Interestingly, we find that total effects of all the agricultural variables on distress rural outmigration is consistent with general expectations such as higher irrigational intensity (GIAGCA), higher land productivity and changes therein (CHPCFGP), and regeneration of forests (CHFCA); depict reduction in the distress rural outmigration (CHRSRTSR) from districts over arid and semiarid zones of India. Furthermore, improvements in non-agricultural employment opportunities viz. employment in factories (ADEFPLP), employment in mining and quarrying sector (WEMQPLP), overall non-agricultural development (NADI); encourages rural outmigration. The results are quite consistent with general push and pull factors affecting rural outmigrational flows.

Similarly, we find that all the agricultural variables viz. annual normal rainfall (ANR), irrigational intensity (GIAGCA), per capita foodgrain production (PCFGP) and improvements therein (CHPCFGP), forest covered area (FCA); depict impacts on environmental conditions, cropland areas, and commonland areas in expected directions. Improvements in irrigational intensities and improvements in per capita foodgrain production, and forest covered area; depict improvements in environmental conditions characterised by reduction in sheep and goats as percent of total livestock population. Furthermore, the improvements depict increase in cropland areas or net sown area and reduction in commonland areas.

Summary of the Main Results

The strong interconnections between the four crucial endogenous variables standing for distress rural outmigration (CHRSRTR), the environmental degradation process as measured by changing livestock composition in terms of proportion of sheep and goats to total livestock population (CHSGGOTTLS), and changes in land use patterns characterised by net sown area (CHNSTGA) and common land area (CHCOMLAND); are revealed through significant structural coefficients estimates of the simultaneous equations system. The multiple influences among the four endogenous variables gets revealed by the structured formulations and estimated parameters of the system. The 3SLS system method of estimation provides consistent and efficient estimates of the structural coefficients. Thereby, the reduced form estimates of the system reveals that total effects of the significant exogenous variables are far more intense than their direct effects characterised by the estimated structural coefficients.

In brief, the distress rural outmigration in arid and semiarid zones over the Central and the Western parts of India seems to be basically because of push factors operative at place of origin such as environmental degradation process (CHSHGOTTLS) and shrinkage of common property resources (CHCOMLAND). Interestingly, we find that pull factors such as employment opportunities in non agricultural sectors such as industrial units or mining and quarrying sectors do not depict significant impact on rural outmigration in the regions.Thus.in a sense, the outmigrational flows from rural tracts in these regions have rightly been classified as distressed outmigration.

Strong interconnections between distress outmigration from rural tracts, environmental degradation process, and land use patterns in terms of changes in croplands and commonlands get depicted by the significant structural coefficients of the formulated system. The system clearly reveals that distress outmigration from rural tracts in the arid and semiarid regions can be contained by regeneration of forests and pasturelands, improving irrigational potentials, and bringing more land under common property regime.

Also we find privatization of agricultural land has been at the expense of shrinkage of commons like forests, woodlands or common pastures or grazing land over the arid and semiarid zones over the Central and Western parts of India. Also the study finds that privatization of common land has occurred more in relatively higher rainfall regions within western deserts. It seems that conversion of common property resources, especially forests, into private ownership rights regime seems to have significantly effected the environmental degradation process which in turn depicts significant impact on distress out-migration from the rural tracts in arid and semi-arid zones of India.

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APPENDIX

TABLE A-l : LIST OF SELECTED VARIABLES

No.	Var.	Abbreviation	Description of the Variable
1	V59	CHRSRTSR	Change in rural sex ratio to total sex ratio (females per 1000 males) Change in sheep and goals as percent of total live stock population
2	V48	CHSHGOTTLS	Change in net sworn area per 1000 sq. km. of geographical area
3	V49	CHNSATGA	Change in common land area as percent of geographical area
4	V52	CHCOMLAND	Population growth rate in eighties
5	V39	PGRE	Nonagricullural development index
6	V41	NADI	Average normal rainfall
7	V42	ANR	Change in forest covered area as percent of geographical area
8	V50	CHFCA	Change in per capita foodgrain production
9	V53	CHPCFGP	Change in average daily employment per lakh population
10	V55	CHADEFPLP	Change in workers employed in mining and quarrying per lakh
11	V56	CHWEMQPLP	population Change in density of population per square km.
12	V57	CHDEN	Change in gross irrigated area to gross cropped area
13	V60	CHGIAGCA	Percent population literate in 1981
14	V45	LJTEIG	Per capita food grain production in 1980
15	V5	PCFGP	

TABLE A-2 : SUMMARY STATISTICS FOR THE SELECTED VARIABLES

No.		Variable	Mean	SD.	C..V. * OO	Skew ness	Min.	Max.
1	V59	CHRSRTSR	98.07	9.23	9.41	-8.80	13.30	105.70
2	V48	CHSHGOTTLS	118.19	94.45	79.91	8.80	53.59	960.30
3	V49	CHNSATGA	99.43	9.95	10.00	-2.26	52.00	120.90
4	V52	COMLAND	120.83	6.31	49.91	1.92	29.13	412.80
5	V39	PGRESEV	26.89	5.93	22.05	1.24	15.00	50.92
6	V41	NADI	-0.36	0.74	211.42	1.36	-1.50	2.24
7	V42	ANR	881.66	310.22	35.18	0.30	164.00	1932.00
8	V50	CHFCA	88.36	104.70	118.49	6.51	6.25	955.70
9	V53	CHPCFGP	119.62	49.23	41.15	2.60	9.50	364.70
10	V55	CHADEFPLP	190.11	177.79	93.47	3.40	21.77	1079.00
11	V56	CHWEMQPLP	194.89	616.05	316.24	8.79	1.44	5850.00
12	V57	CHDEN	130.39	20.59	15.79	3.78	84.29	247.00
13	V60	CHGIAGCA	129.12	32.50	25.17	1.33	59.38	240.20
14	V45	LJT81	30.06	10.79	35.89	0.61	11.00	57.00
15	V5	PCFGP	187.16	63.89	34.13	0.53	47.00	379.00

TABLE A-3 : 3SLS ESTIMATES OF TOE MODEL

Explanatory Variables	*Dependent Variables*			
	CHRSRTTSR V59	*C/ISHGOTTLS V48*	*CHNSATGA V49*	*CHCOMLAND V52*
Endogenous				
CHRSRTTSR(V59)	—	.37* (11.77)	—	—
CHSHGOTTLS(V48)	26.639* (13.93)	—	—	—
CHNSATGA (V49)	2.055 (0.75)	—	—	-3.554* (3.77)
CHCOMLAND(V52)	-4.072* (1.98)	-.174* (2.24)	-0.075* (2.42)	—
Exogenous				
Intercept	-2504.5 (7-61)	83.211 (8.15)	109.00 (7.09)	594.64 (6.07)
ANR(V42)	—	—	.011* (3.06)	—
CHGIAGCA(V60)	—	—	.032 (1.36)	—
PCFGP(V5)	—	—	.010 (0.80)	—
CHPCFGP(V53)	0.241 (1-13)	—	—	-.276* (2.47)
CHFCA (V50)	—	0.003 (0.77)	—	-.115* (2.82)
CHPDEPLP(V55)	-0.033 (0.68)	—	—	—
CHNEMOPLP(V56)	-0.004 (0.34)	—	—	—
NADI(V41)	—	—	-1.957* (1.93)	—
PGRSEV (V39)	—	—	—	-0.015 (0.02)
CHDEN(V57)	—	—	-.035 (0.56)	-.587* (2.11)
LUmG (V45)	-0.314 (0.33)	—	—	—
R^2	0.92	0.91	0.49	0.50
$\bar{R}^2$	0.91	0.91	0.45	0.47

TABLE A-4 : REDUCED FORM COtiFHCIENTS OF THE SYSTEM

Item	*Endogenous Variables*	*CHRSRTSR V59*	*CJISIIGOTTLS V48*	*CHNSATGA V49*	*CHCOMLAND V52*
K	Intercept	289.9390	141.3205	87.80693	282.5741
Exogenous Variables					
V42	ANR	-0.05588	-0.01140	0.014997	-0.05330
V60	CHGIAGCA	-0.16256	-0.03317	0.04363	-0.15506
V5	PCFGP	-0.05080	-0.01036	0.01363	-0.04845
V53	CHPCFGP	-0.40372	-0.08390	0.02822	-0.37630
V50	CHFCA	-0.16590	-0.03110	0.01176	-0.15679
V55	CHADEFPLP	0.00373	0.00138	0	0
V56	CHWEMQPLP	0.00045	0.00017	0	0
V41	NADI	9.94214	2.02858	-2.66821	9.48282
V39	PGRSEV	-0.02046	-0.00401	0.001533	-0.02045
V57	CHDEN	-0.62295	-0.12074	0.012304	-0.63073
V45	LJTEIG	0.03545	0.01312	0	0