together do actually have any significant influence on the dependent variables. We may say that if the independent variables did not truly explain any of the variations in dependent variable, we would expect the numeratur of F to be very small, in other words the F would approach zero. On the other hand, the more significant the relationship denoted by the regression, the higher the value of F. Thus, in general, high value of F suggests significant relationship between dependent and independent variable(s).*1 Accordingly the significant F in the above regressions would imply that government expenditures do have significant impact on the improvement in the distributional welfare.

However, testing the overall significance of the model is just not sufficient. Our basic interest is also to know whether the impact of different government expenditures on the DRR's of different socio-economic indices are positive, negative or zero. Moreover, these impact coefficients are the second derivatives of the basic function between level of welfare and accumulated stock of government efforts (Chapter II) and hence their sign would indicate the increasing, decreasing or constant returns to the government effort in the respective directions. For both these purposes we need to carry out the statistical tests for individual coefficients. A two-tailed t-test is used for this purpose.

*1 See, A. Koutsoyiannis : THEORY OF ECONOMETRICS, The Macmillan Press, Ltd., 1981, pp. 69-97.

Our null hypothesis is;

H_0 : $b_i = 0$ for all i.

That is we hypothesise that individual coefficients are statistically zero implying that there are constant returns to government efforts in all directions. Our alternative hypothesis is;

H_A : $b_i \gtrless 0$ for all i.

i.e. individual coefficients are positive or negative implying that there are either increasing (+ve) or decreasing (-ve) returns to the given government effort in a given direction keeping other things constant.

Alternatively we can say that if 'b' coefficient of any expenditure is zero it would imply that the dependent variable, namely DRR in the indicator index would remain constant with a unit change in the given expenditure variable. If 'b' is positive it would imply that DRR increases with a unit change in the given type of government expenditure which in turn suggests, as discussed in Chapter II above, that level of the respective component index would increase at an increasing rate with respect to the accumulated government effort in the respective direction. Similarly when 'b' is negative it would indicate that DRR in the index falls with a unit increase in the given type of government expenditure. That is, the level of the respective index may increase but at a decreasing rate with respect to the accumulated government effort. It may be recalled here that when we are interpreting the 'b' coefficient of a given independent variable, we keep all other independent variables constant.

2. Results of Unrestricted Regressions

Table 4.1 presents the OLS estimated reduced form results for ten equations. It can be observed from Table 4.1 that in five out of ten equations, the F is statistically significant indicating that the estimated equations fit the data very well. In those five cases, our alternative hypothesis that expenditures do have significant impact on the DRR's of the respective indicator indexes appears to be true. The multiple coefficient of determination namely R^2 is more than 75 percent in each of the five significant regressions, implying that more than 75 percent of variation in DRR of indicators is explained by the variation in independent variables viz., expenditures and level of PCI.

As can be seen from Table 4.1 the equations relating to Male Literacy Rate (DMLR), Female Literacy Rate (DFLR), Birth Rate (DBR), Death Rate (DRR), and Child Worker Participation Rate (DCWPR) are significant whereas the equations relating to Infant Mortality Rate (DIMR), Poverty (DPBP),

Table 4.1 : Results of Unrestricted Regressions, 1971-81.

Independent Variables	Dependent Variables									
	DMLR		DFLR		DIMR		DBR		DDR	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
1	2	3	4	5	6	7	8	9	10	11
1) Constant term	0.2599	0.3600	-0.6073	-1.082	-1.131	-0.680	0.5905	1.444	2.6442	1.646
2) EPE	0.3530*	4.191	0.3037*	4.642	-0.0265	-0.078	0.0973	1.169	-0.1372	0.419
3) EOE	-	-	-	-	0.7252	1.200	0.2906	1.958	2.7689*	4.747
4) EMHF	-	-	-	-	0.1978	0.242	-0.3824	-1.902	-1.7439**	-2.206
5) EOSCS	0.0653	-0.449	0.0776	0.686	-0.3413	-0.602	0.0262	0.188	-0.1662	-0.304
6) EAG	0.0533	0.746	0.0485	0.875	-0.2726	-1.093	-0.1250**	-2.040	-0.6066**	-2.519
7) EIM	-0.1335	-0.597	0.1881	1.083	0.4619	0.890	0.2082	1.634	1.0067**	2.011
8) EWPD	-0.0026	-0.020	-0.1636	-1.610	0.2039	0.493	0.1374	1.353	0.6990	1.750
9) ETC	0.0790	0.582	0.1508	1.43	-1.067	-1.560	-0.2453	-1.46	-2.1192*	-3.210
10) PCI	-0.0013	-0.414	-0.0015	-0.601	0.0078	0.840	0.0035	1.513	0.0056	0.627
R^2	0.7600		0.8554		0.8151		0.9064		0.9608	
$\bar{R}^2$	0.5224		0.7104		0.4824		0.7379		0.8902	
F	3.19** (7,7)		5.92* (7,7)		2.45 (9,5)		5.38* (9,5)		13.61* (9,5)	

Note : * Significant at 5% level; ** Significant at 10% level.

Contd..

Table 4.1 (Contd.) :

Independent Variables	Dependent Variables									
	D F M A M		D P B P		D C W P R		D C R		D M P R N A	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
1	12	13	14	15	16	17	18	19	20	21
1) Constant term	2.0278	1.567	2.194	1.008	5.1903*	3.537	2.3371	0.525	-0.8326	-0.591
2) EPE	-0.1536	-0.606	-	-	0.3173	1.104	-1.1581	-1.328	-	-
3) EOE	0.3264	0.743	-	-	0.5654	1.134	1.9203	1.270	-	-
4) EMHF	-	-	-	-	-	-	-	-	-	-
5) EOSCS	0.0139	0.032	0.5459	1.224	-0.3656	-0.740	-0.0617	-0.411	-	-
6) EAG	-0.0241	-0.133	-0.2345	-1.074	-0.6144*	-2.994	-0.8668	-1.392	0.0988	0.7016
7) EIM	0.2597	0.643	0.6730	1.085	-0.4936	-1.077	-0.8020	-0.577	0.1440	0.0362
8) EWPD	-0.1690	-0.533	-0.0171	-0.043	0.2922	0.812	-0.0758	-0.0694	-0.0105	-0.043
9) ETC	-0.1118	-0.210	0.8184**	1.977	-0.1745	-0.290	-1.1761	-0.643	0.0536	0.2450
10) PCI	-0.0004	-0.644	-0.0111	-1.183	-0.0066	-0.848	0.0013	0.0563	0.0017	0.406
R^2	0.3810		0.6129		0.8806		0.6736		0.2908	
$\bar{R}^2$	0.4444		0.3225		0.7214		0.2385		-0.1032	
F	0.46	(8,6)	2.11	(6,8)	5.53*	(8,6)	1.55	(8,6)	0.74	(5,9)

Note : * Significant at 5% level; ** Significant at 10% level.

Female Mean Age at Marriage (DFMAM), Crime Rate (DCR) and Male Participation Rate in Non-A sector (DMPRNA) are statistically insignificant even at 10 percent level, implying that there does not exist a high linear correlations between the government expenditures and DRR in those indicators. There could be a number of reasons for obtaining the poor fit of these regressions. Some of the reasons could be possibly as follows.

(a) It can be observed from Table 4.1 that the regression fit are poor in case of variables like infant mortality rate (IMR), crime rate (CR) and poverty which are having the data problems. The data on these variables are likely to have relatively higher measurement errors on account of underreporting or due to inadequate methods of measurement.

(b) Another reason for the poor fit could be that all our endogenous variables are the change variables and not the level variables. The total variations in these change variables across the states are usually very small.

(c) The third possible reason for the poor fit of the regressions like DIMR, DFMAM etc. could be the specification bias which might have arisen due to exclusion of some important explanatory variables from the equations.

DIMR, for instance, is also likely to be affected by factors like age of mother, years of schooling, availability of drinking water, period of breast-feeding, etc.. Similarly DFMAM may be affected by factors like religion, ethnicity, etc.. Now if the role of those factors which are excluded from the equations is more important than the role played by those included in the model, we are most likely to get poor fit of these regressions. In several other studies like the studies by Preston (1985) and Wheeler (1985) also, the equation of IMR gives a poor fit. This only confirms our contention that the change in IMR is too complex a process to be explained by a few limited number of factors. However, looking to the size of our sample, namely only fifteen observations, we had to restrict the number of explanatory variables to be included in the model.

(d) The fourth possible reason for the poor fit of the five regressions could be the assumption of linearity. For all our regressions we have assumed that independent variables are linearly related to the dependent variable. This assumption however, may not be true for all the equations. In some of the regressions the relationship between the two sets of variables may be systematic but non-linear (quadratic, exponential, etc.) under which circumstance a fit of linear regression may obtain a poor F ratio. A poor F - statistic should, therefore, not be interpreted to mean lack of relationship in general but only as lack of linear relationship between the two sets of variables in particular. In short if the variables of DIMR, DFMAM etc. are systematically but non-linearly related to government expenditures then the linear form of regressions would not yield a proper fit.

However, we have not attempted to fit the non-linear curves on these data, firstly because we cannot test returns to government effort directly from such non-linear regressions and secondly because the non-linear form would not allow us to perform various econometric tests which are quite useful for the detailed economic analysis. Nevertheless, we have tried to improve the fit of the above regressions by eliminating unnecessary details regarding expenditure categories.

There is often a problem of choosing the level of aggregation for any regression. If the data are highly aggregated there may arise a specification bias. On the other hand, if the data are highly disaggregated it may reduce the degrees of freedom and hence the reliability of the estimates too. It is necessary therefore, to consider all the a priori information available from economic theory to build a fairly good econometric model. The information may be regarding the sign of the coefficients or it may be regarding the magnitude of the various impact coefficients.

Incorporation of such information may help us optimise the number of explanatory variables to be included in the equations. This may, in turn, help us to increase the degrees of freedom and also the relative precision of the individual parameters.

One of the ways of incorporating such information is to put restrictions on the parameters for which a technique of Restricted Least Squares (RLS) is often used. The technique of RLS and its application is discussed in the following section.

3. Restricted Least Squares And Some Results

4.3.1 Describing The Method : As the name suggests, in this method (RLS) we impose linear restrictions on some of the parameters of the equation on the basis of some extraneous information or on some a priori considerations.*2 After incorporating the restrictions in the model we then obtain the restricted form of the equations. Each of this restricted equation will therefore, have greater degrees of freedom. We then estimate through OLS, the restricted as well as unrestricted (original) equations of the model. In order to compare the unrestricted and the restricted equations, i.e. in order to know whether the restrictions imposed on the parameters

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* 2 The method is described in detail in, A. Koutsoyiannis, Ibid., pp. 399-402.

are valid or not, we carry out the F^* test by applying the following formula :

$$F^* = \frac{\left[\sum e_R^2 - \sum e_{UR}^2\right]/m}{\sum e_{UR}^2/(N-K)}$$

Where

$\sum e_R^2$ = Residual Sum of Squares (RSS) of restricted equation

$\sum e_{UR}^2$ = RSS of unrestricted equation

m = number of linear restrictions

N = number of observations

K = number of parameters including the intercept.

The above F^* test is carried out under the null-hypothesis that all the restrictions are true, against the alternative hypothesis that not all the restrictions are true. If the computed F^* value is statistically insignificant, one may accept the hypothesis that the linear restrictions are valid. If on the other hand the F^* value is statistically significant it implies that the restricted and unrestricted equations are different, hence we may reject the null-hypothesis that the parameters obey the linear restrictions. In other words if the stated F^* ratio is statistically insignificant one may substitute RLS equation for URLS equation since statistically they are the same.[*3] On the other hand, if the stated F^* is statistically significant we may conclude that the restrictions are not valid and that the level of specification in the unrestricted equation is important in explaining the variation in the dependent variable and hence should be retained.

4.3.2 Linear Restrictions - On The Parameters : By looking at our Reduced Form (RF) equations (Ch. III), we find that eight different expenditures appear on the right hand side of the equations, out of which four expenditures viz. EAG, EIM, ETC and EWPD represent a specific kind of broad category viz. the expenditure on Economic Services (EOECS). Out of these four the last three expenditures determine the development of economic infrastructure in any region.

On Economic a priori consideration we may say that in developing economies, the three subsectors viz.,(a) industries and minerals (b) transport and communication and (c) water and power development are likely to be highly correlated even though the expenditures of the government on them may not be highly correlated. Suppose the government has invested in transport and communication then such an act may encourage the establishment of various industries in that region. On

*3 See, Damodar Gujrati, BASIC ECONOMETRICS, McGraw-Hill Kogakusha, Ltd., 1978, p. 326.

the other hand, if the government spends on industries and minerals then shortly it is followed by the development of other subsectors viz., transport & communication and water & power development. In other words, the expenditure by the government on one of these three subsectors may eventually lead to the expansion of the other sectors due to linkage effects. We may therefore, expect that these expenditures will have almost similar impact on employment, income, health and some other socio-economic variables.

The most relevant implication of the above for our exercise is that we may assume their (expenditures') impact parameters to be statistically equal. Accordingly, we have hypothesised that impact coefficients (b's) of the three Expenditure Categories viz. EIM, ETC and EWPD are statistically equal. Thus, we have imposed two linear restrictions on the value of parameters :

(i) Impact coefficient of ETC = Impact coefficient of EIM and;

(ii) Impact coefficient of EIM = Impact coefficient of EWPD.

If we incorporate these two restrictions in our unrestricted original equations we will obtain a set of restricted equations. Let us illustrate this with one of our equations. Let us take the equation of DMLR which can be specified as follows :

$$DMLR = b_0+b_1x_1 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_4 + u_1 \quad - (1)$$

Where x_1 = EPE, x_4 = EOSCS, x_5 = EAG, x_6 = EIM, x_7 = EWPD, x_8 = ETC and x_9 = PCI and b_1, b_4, b_5, b_7, b_8 and b_9 are their respective coefficients. b_0 = intercept coefficient. As can be seen, b_6, b_7 and b_8 are the impact coefficients of EIM, EWPD and ETC in which we are interested we now impose two linear restrictions on the above equation :

(1) $b_6 = b_7$ and (2) $b_7 = b_8$.

We then incorporate these two restrictions in the above equation (1) and obtain the restricted form of the equation which can be written as follows.

$$DMLR = b_0+b_4x_4+b_5x_5+b_6(x_6+x_7+x_8) + b_9x_9+u_1 \quad (2)$$

As can be seen, in the restricted equation instead of separate variables viz. x_6, x_7, x_8 we have a variable which is the sum total of x_6, x_7 and x_8. But total of x_6, x_7 and x_8 is nothing but the expenditure on economic services excluding agriculture sector. This implies that in restricted equation three separate variables are replaced by a new variable, viz. Expenditure on Other Economic Services (EOECS), which is the sum total of EIM, ETC and EWPD. In similar way we have

Table 4.2 : Results of Restricted Regressions, 1971-81.

Independent Variable	Dependent Variables									
	D M L R		D F L R		D I M R		D B R		D B R	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
1	2	3	4	5	6	7	8	9	10	11
1) Constant term	0.1689	0.243	-0.6856	-1.10	-1.092	-0.528	0.6592	1.287	2.5493	0.832
2) EPE	0.3203*	4.660	0.3349*	5.44	0.4785	1.598	0.2405*	3.240	1.0938*	2.463
3) EOE	-	-	-	-	0.0178	0.398	0.5673	0.512	1.2904**	1.948
4) EMHF	-	-	-	-	0.1448	0.149	-0.3448	-1.43	-1.6488	-1.145
5) EOSCS	-0.0923	-0.777	-0.0153	-0.144	0.3178	0.759	0.2166**	2.090	1.1418	1.842
6) EAG	0.0368	0.548	0.0072	0.120	-0.0231	-0.885	-0.0690	-1.148	-0.0538	-0.150
7) EOECS	0.0156	0.400	0.0026	0.750	-0.0957	-0.612	0.0331	0.854	-0.1132	-0.489
8) PCI	0.0001	0.003	0.0004	0.182	0.0037	-0.488	0.0002	0.083	-0.0174	-1.555
R^2	0.7328		0.7853		0.6180		0.8032		0.8092	
$\overline{R}^2$	0.5843		0.6661		0.2359		0.6064		0.6185	
F	4.94*	(5,9)	6.59*	(5,9)	1.62	(7,7)	4.08*	(7,7)	4.24*	(7,7)

* Significant at 5% level; ** Significant at 10% level.

Contd...

Table 4.2 (Contd.) :

Independent Variable	Dependent Variables									
	DFMAM		DPBP		DCWPR		DCR		DMPRNA	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
1	12	13	14	15	16	17	18	19	20	21
1) Constant term	1.9833	1.596	2.7366	1.338	5.3085*	3.76	1.5242	0.385	-0.7193	-0.549
2) EPE	-0.0881	-0.543	-	-	0.3436**	1.867	-1.0500**	-2.035	-	-
3) EOE	0.3432	1.432	-	-	0.3114	1.144	1.6521**	2.165	-	-
4) EMHF	-	-	-	-	-	-	-	-	-	-
5) EOSCS	-0.0170	-0.073	0.3490	0.972	-0.0958	-0.362	0.2984	0.402	-	-
6) EAG	0.0061	0.504	-0.4785*	-2.380	-0.6089*	-4.464	-0.5284	-1.383	0.0811	0.743
7) EOECS	-0.0989	-1.05	0.3722*	3.216	0.1060	0.9960	-0.4984	-1.670	0.0273	0.405
8) PCI	-0.0013	-0.312	-0.0058	-0.846	-0.0090**	-1.887	-0.0054	-0.404	0.0018	0.525
R^2	0.2706		0.5907		0.8591		0.6710		0.2835	
$\bar{R}^2$	-0.2764		0.4269		0.7533		0.4245		0.0881	
F	0.50	(6,8)	3.61*	(4,10)	8.13*	(6,8)	2.72**	(6,8)	1.45	(3,11)

* Significant at 5% level; ** Significant at 10% level.

obtained the restricted equations for DFLR, DIMR etc. and then estimated all the restricted equations through OLS. The estimated restricted equations are presented in Table 4.2.

4.3.3 Test of Equality Between Restricted And Unrestricted Equations : Having obtained the impact parameters of restricted equations we have carried out the stated F^* test to establish the statistical equality or inequality between the restricted and unrestricted equation of each dependent variable. Table 4.3 gives the required F^* ratio.

Table 4.3 : Results of Restricted v/s Unrestricted Regressions, 1971-81

Dependent Variable	Residual Sum of Squares		Calculated F-value	Degrees of Freedom
	Restricted Form $\sum e_R^2$	Unrestricted Form $\sum e_{UR}^2$		
1	2	3	4	5
1) DMLR	18837.5	16833.2	0.417	2, 7
2) DFLR	15075.5	10152.8	1.697	2, 7
3) DIMR	127566	61725.9	2.667	2, 5
4) DBR	7821.38	3721.52	2.754	2, 5
5) DDR	279811	57508.0	9.664*	2, 5
6) DFMAM	52970.4	44955.6	0.535	2, 6
7) DPBP	190890	180542	0.229	2, 8
8) DCWPR	68246.9	57814.7	0.541	2, 6
9) DCR	536457	532401	0.023	2, 6
10) DMPRNA	87454.1	86564.4	0.046	2, 9

* Significant at 5% level.

It follows from Table 4.3 that except the regression on DDR, for all other regressions the F^* ratio is statistically insignificant. This implies that except DDR for all other regressions the restricted equation is statistically equal to unrestricted equation. That is, except DDR in all other cases we accept the null hypothesis that our restrictions ($b_6=b_7=b_8$) are valid. Now, if the restricted equation is statistically equal to unrestricted equation of the same dependent variable then one can compare the $\bar{R}^2$ of these two equations and choose the best among them. However, if the restricted equation is different from unrestricted equation they cannot be substituted since the restrictions are not valid. Accordingly, we can say that in case of DDR we cannot replace the restricted equation for the unrestricted since they are statistically different, but for all other variables they can be substituted.

The next section discusses the criteria for selecting the regressions out of the two sets and discusses the detailed economic implications of impact parameters of those selected regressions.

4. Analysis of Regression Results

4.4.1 Regression Results of DMLR : The restricted equation of DMLR is statistically equal to the unrestricted equation as indicated by the insignificant F^* ratio of Table 4.3.

Since the $\bar{R}^2$ of restricted equation is greater, we consider the estimates of the restricted regression to be more reliable between the two. It can be seen from Table 4.2 that R^2 of this restricted equation is statistically significant and is 73 percent indicating that out of total variation in DMLR almost 73 percent is explained by the expenditure variables. As far as the individual coefficients are concerned, following things emerge: Out of all expenditure variables, the impact coefficient of expenditure on primary education (EPE) is positive and significant. The estimated impact of EPE on DMLR is 0.32 indicating that one rupee increase in per capita expenditure on primary education at constant (1960-61) prices would increase the DRR of male literacy index by 0.32 units. Thus it becomes clear that the government effort on primary education not only increases the consumption of education by the poor but also increases it at an increasing rate.

Impact coefficients of all other expenditures as well as PCI are statistically zero implying that marginal returns to these government efforts are constant during 1971-81. In other words, the government efforts in those directions have increased the index of MLR at a constant rate.

4.4.2 Regression Results of DFLR : For this function also the restricted equation is statistically equal to unrestricted equation as suggested by insignificant F^* in Table 4.3.

However, on the basis of $\bar{R}^2$ we have selected unrestricted equation, Since $\bar{R}^2$ is higher in this equation. It may be observed from Table 4.1 that R^2 of this equation is 85 per-cent implying that out of total variation in DFLR almost 85 percent is explained by the variations in expenditure variables.

The t-values of the individual coefficients suggest that there were increasing returns to efforts on primary education (EPE) whereas returns to other efforts were constant during 1971-81. The estimated impact coefficient of EPE in this regression is 0.30 suggesting that keeping other variables constant a rupee increase in per capita expenditure of 1960-61 prices on primary education would increase the disparity reduction rate in FLR index by 0.30.

4.4.3 Regression Results of DBR : The F^* ratio of Table 4.3 suggests that unrestricted equation of DBR is statistically equal to restricted equation. Between the two, the unrestricted equation has higher $\bar{R}^2$ implying that the variables of EIM, ETC and EWPD are individually important for explaining the variation in DBR. The R^2 of unrestricted equation (See, Table 4.1) suggests that 91 percent variation in DBR is explained by the variation in government expenditures and PCI.

All the impact coefficients except EAG are statistically zero indicating that except in agriculture we cannot reject the null hypothesis of constant returns to the government efforts. In this case, what is more interesting to note is that impact coefficient of EAG is statistically significant but negative suggesting that a unit increase in EAG would reduce the DRR of the index of birth rate. As already discussed in Chapter II above, this finding implies that returns to the government effort in agriculture are diminishing as far as index of birth rate is concerned.

The estimated value of the Impact Coefficient of EAG is - 0.12. This means that the increase on EAG on margin reduces the DRR of the index of BR by 0.12. In simple terms we may say that though the index of BR itself did not fall due to EAG, the rate of increase in this index fell during 1971-81.

This decreasing impact of EAG on BR is not unexpected. It is because additional expenditure in agriculture implies the investment in traditional sector where children are treated as the assets or security for the future and 'labour value' of the children is also very high. Further, unlike other sectors, the indirect benefits in terms of education, diffusion of health knowledge and use of family planning practices, are not likely to increase in the same proportion as the increase in investment in agriculture. Thus additional efforts in the agriculture sector are likely to yield diminishing marginal benefits in terms of population control over years.

4.4.4 Regression Results of DPBP : For this function, although unrestricted equation is statistically equal to restricted equation the latter is selected on the basis of $\overline{R}^2$. The regression is statistically significant at 5 percent level of significance(Table-4.2).

Two results are very interesting here. One is, that impact of EAG on the DPBP is negative and significant. The estimated value of its coefficient is - 0.48 implying that returns to efforts in agriculture are diminishing in terms of the index of poverty. Second is, that the impact of EOESC - which includes the expenditure on industries and minerals, water & power development, and transport & communication was positive (=0.37) and significant on the DRR of poverty. This clearly implies that returns to additional efforts in non-A sector in terms of reduction in the poverty ratio are increasing. The efforts in agricultural sector, on the other hand, yield diminishing returns. In both the cases, however, the marginal effect of increasing government efforts would lead to a positive improvement in the poverty index. Our finding merely suggests that the rate of improvement in the poverty index is declining for efforts in agriculture, but increasing for efforts in non-agricultural sector. This finding is not surprising since the indirect impact of efforts on Non-A sector are reinforcing whereas the indirect effects of efforts on agriculture are unfavourable on poverty index as per the structural form of our model presented in Chapter III above.

4.4.5 Regression Results of DCWPR : For this function also the restricted fit gives better fit as suggested by the higher $\bar{R}^2$. It can be observed from Table 4.2 that R^2 is as high as 86 percent suggesting that a considerable proportion of variation in DCWPR is explained by our regression.

The impact coefficient of EPE is positive and significant indicating that during 1971-81 the additional effort on primary education had a significant role to play in terms of reduction in child labour. On the other hand, the impact coefficient of EAG and PCI had negative significant impact on DCWPR indicating that these variables did not allow the index of CWPR to improve substantially.

What is most important to note is that the intercept (b_0) coefficient of this function is positive and significant indicating that if all the explanatory variables assume the value zero then the total effect of other factors not included in our model had the tendency to improve the index of CWPR.

The negative impact of EAG on DCWPR suggests that keeping other things constant the additional effort in agricultural sector may lead to a declining rate of improvement in the index of CWPR.

4.4.6 <u>Regression Results of DCR</u> : Although unrestricted equation is statistically equal to restricted equation of DCR the later is preferred on the basis of the higher $\bar{R}^2$. <u>Table 4.2</u> reveals that except the coefficient of EPE and EOE all other coefficients are statistically zero. This implies that the government effort on all directions except primary education and other education improved the index of CR at constant marginal rate.

What is most significant is that coefficient of EPE is negative whereas that of EOE is positive. This implies that on margin, the additional efforts on primary education may yield decreasing returns whereas that on higher education yields increasing returns in terms of the index of crime rate.

4.4.7 <u>Regression Results of DDR</u> : The significant F^* ratio in <u>Table 4.3</u> suggests that unrestricted equation is statistically different from restricted equation and hence cannot be replaced by the latter. The unrestricted equation of DDR is fitted very well as indicated by the significant R^2 which is as high as 96 percent.

The results suggest that impact of EOE and EIM on DDR is positive and significant implying that marginal returns to the government efforts in these directions were increasing during 1971-81. This is quite in line with some of the other studies which suggest that on margin the higher education plays a greater role in terms of reduction of death rate. Similarly positive and significant coefficient of EIM indicates the greater emphasis on secondary sector which generates larger benefits in terms of health.

On the other hand, slower improvement in the index of deaths is expected when the additional effort goes into the agriculture sector. The impact coefficient of EAG is negative and significant which clearly supports this hypothesis.

Two more results are quite interesting and have quite important implications on the policy. It may be believed generally that relatively larger and larger investment in health sector is necessary to increase the life expectancy and reduce the death rate at a faster rate. Similarly it is felt that relatively larger investment in the transport sector is required to improve the utilization of existing primary health services. However, in our regression the impact coefficients of both these types of expenditures are negative and significant implying that returns to the government efforts in these directions are diminishing. However, this in turn, may imply any of the following three things :

i. One is, that the level of death index has reached such a high level (i.e. death rate has reached a very low level) that further improvement in this index cannot be brought about only through efforts in health sectors. But this does not appear to be so much true in case of India.

ii. Another more relevant implication of the above is regarding the inefficient functioning of the health and related sectors which appears to be quite true in case of India. It is observed by several authors that the epidemic control measures such as vector control programmes, qurantine, immunization, etc. can potentially have a powerful impact on mortality but their implementation is subject to various constraints. The developing countries characteristically are overburdened by 'enforced' but ineffective laws and this limitation is coupled with the corruption and inefficiency within the health department which have obvious detrimental consequences for the health of populations (See Mosely and Chen, 1984). The 'Narangwal' experience very clearly demonstrated that if the health programmes are well linked and consistent then better health results could be achieved at a lesser per capita cost than the cost incurred in the existing health centres.

iii. The third reason for the diminishing returns to health and medical efforts in terms of death rates could be the unequal distribution of benefits in favour of relatively better off section. If this is so then it would be reflected through the slower improvement of our death index with a given increase in expenditure.

It is very well recognised that in India there is a concentration of health resources in the urban areas implying that selectively the most advantaged segments of the population is being subsidized and benefitting. Moreover, the cost structure and emphasis of the health sector is biased towards better off section and needs substantial revision.

It would be relevant to quote Dr. Antia (1985) here, who feels that "The chief beneficiaries of the present system of medicine is the medical profession and not the public despite the fact that the latter contributes Rs. 80,000 for the education of each doctor... let it be quite clear that vast majority of the medical profession has neither by training nor interest, the ability or the desire to deliver the type of health services that the vast majority of the people of this country evidently need. What the country needs is a simple, cheap but effective community health service with emphasis on prevention and health education and not a sophisticated, personalised and expensive 'illness service' which is being provided".*4

The above discussion clearly suggests that there does exist a good potential for increasing the marginal returns to the health sector, at least for the next few years.

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* 4 Dr. N.H.Antia; Cited in, Basic Statistics Relating to Indian Economy, Vol. 2, 1985, Centre for Monitoring Indian Economy, Bombay.

Similar result was obtained in case of expenditure on Transport and Communication (ETC). The coefficient of ETC was negative and statistically significant, implying that efforts on Transport and Communication sector have decelerating impact on the index of death rate, keeping other things constant.

4.4.8 Regression Results of DIMR, DFMAM and DMPRNA : The fit of all these regressions are statistically insignificant as indicated by their respective F ratio in Table 4.1 and Table 4.2. This implies that variations in these variables are not very well explained by our explanatory variables. As noted above, there could be various reasons for the poor fit of these regressions. However, we have not gone into further details regarding them. At this juncture what we may say is that we should not draw any inference on the basis of these regression results since they are likely to be highly unreliable.

5. Summary And Implications of The Above Results

The detailed empirical exercise of this sort appears to yield quite satisfactory results. Out of the two sets namely, the set of restricted and unrestricted equations, we find that seven out of ten regressions are explained by our expenditure variables. Looking to the fact that on both the sides we have rates rather than absolute magnitudes, which is a more stringent condition, the regression fit could be considered quite good.

Since the model holds good for the entire economy, one may apply it to any part of the same, say states or regions. The only thing one needs to do is to prioratise the objectives for the state under consideration and then use the appropriate goal equation (indicator equation) of the model.

At policy level the question is not of stopping or scrapping the existing expenditures, it is to give relative emphasis to one vis-a-vis others on the margin. Take for example, the case of Kerala which has achieved a fairly high level of health index but needs more attention to the poverty reduction. The equation of DPBP suggests that returns to government efforts in industries, minerals etc. are increasing whereas those in agriculture are diminishing on margin. Thus, a relatively higher emphasis may be placed on increasing efforts in Non-A sector than in agriculture if the goal is to achieve a higher rate of reduction in poverty. Similarly if the reduction in birth rate is the priority, then the equation of DBR suggests the greater emphasis to primary education and less to agriculture on margin.

The magnitude of impact coefficient would also help to calculate the amount required for reaching the given target.

Thus, depending upon the main objective, the equation can be selected to decide as to where the additional effort should flow and to what extent. However, these policy solutions need not be treated as once and for all types of solutions. They may be restricted to short-term scenario, preferably, because in the long run the structural relationships between government expenditure and socio-economic variables would have changed. This implies that such an exercise should be done on a continuous basis for taking in to account the structural change in the relationship between endogenous (objectives) and exogenous (policy) variables.

Unfortunately, we could not carry out such a detailed empirical exercise for 1961-71. Availability of the data as well as quality and comparability of the available data on certain variables put an effective constraint on the meaningful empirical exercise of this sort for 1961-71. For instance, it is a well known fact that in India, the usable data on demographic variables like birth-rate and death-rate became available only after the late sixties, when the sample registration system (SRS) effectively started functioning in different states. The data on these variables for 1961-71 could therefore, be treated as only the crude estimates and hence should not be used for the detailed estimation purpose. Similarly the reporting machinary for crimes became more effective only after late sixties. Moreover, due to change in definition of a 'worker' between 1961 and 1971 censuses, the data on MPRNA and CWPR also contain some unknown degrees of errors and hence cannot solely be relied upon. The state wise estimates on poverty during 1961-71 are also subject to measurement errors. This implies that it is desirable to use the group of indicators rather than considering them individually to reflect upon the specific aspect of welfare such as health and general socio-economic conditions.

Since the data on MLR and FLR for 1961-71 are fairly reliable and individually quite important we have not combined them into a group. The logic behind combining a few health indicators and socio-economic indicators is that though individually they may be containing some measurement errors combining them into a composite index may reduce the extent of errors, assuming that they are random. This appears to be a better alternative than not using the data at all.

For 1961-81 analysis, therefore, we would consider the equations relating to the five major indexes viz. MLR, FLR, HI, GSEC and CWI out of which the first four are major components of X (W) and the last one is the composite index of all the four indexes.

Two kinds of exercises are carried out for these five indexes. In the first exercise, we have considered only two broad expenditure categories viz. expenditure on Human capital (EHK) and expenditure on Physical Capital (EPK), which is presented in Chapter V and in the second exercise we have considered eight different subcategories of these two broad expenditure (EHK and EPK) categories, the results of which are presented and discussed in Chapter VI.