CHAPTER VI

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IMPACT PARAMETERS AND STRUCTURAL SHIFT

1. Introduction

Having obtained the impact coefficients of two main expenditures viz. Expenditure on Human Capital (EHK) and Expenditure on Physical Capital (EPK) in the previous chapter, we now go over to the estimation of impact coefficients of more disaggregated expenditure variables, keeping dependent variables the same. Specification of these equations can be obtained from the last five reduced form equations of our model (See Ch. III). These are the equations of DMLR, DFLR, DHI, DGESC and DCWI respectively. However, unlike previous exercise, independent variables are different subcomponents of the expenditures on human capital and physical capital.

The rationale behind estimating the impact coefficient of various disaggregated expenditures is obvious, namely, to find out that out of various subcomponents of expenditures on physical and human capital, which have positive, negative or zero impact on the disparity reduction rate in the above mentioned indexes.

Thus, purpose of the present exercise is two fold : first is to obtain the impact coefficients of different

disaggregated government expenditure for 1961-71 and 1971-81 and thereby study the direction of marginal returns to the government efforts in those directions, in terms of welfare indices. Second is, to test whether the functional relationship between welfare and government efforts have significantly changed between 1961-71 and 1971-81 or remained more or less stable. For this purpose regressions for 1961-71 and 1971-81 are separately estimated and tested with the help of the Chow-test. But, in order to measure the possible change in intercept as well as individual slope coefficients of the functions an exercise with dummy variables is also carried out. Section 2 presents the OLS estimates for 1961-71 and 1971-81 respectively. Both unrestricted as well as restricted form of the equations are estimated. In section 3 results of the Chow-test carried out for testing the overall stability of the functions are produced. Section 4 is devoted to the estimation and discussion of pulled regressions with dummy variables and section 5 finally presents the summary and conclusion of the above exercises.

2. Regression Estimates of The Two Sub-Samples

6.2.1 Regression Estimates of 1961-71 Sample : As has been noted above, both unrestricted as well as restricted equations are estimated through Ordinary Least Squares (OLS) method for both the periods viz. 1961-71 and 1971-81.

Table 6.1 gives the estimated impact parameters of unrestricted equations for 1961-71. As can be observed from the table, regressions of DMLR, DFLR and DCWI are statistically significant, whereas regression of DHI and DGESC are statistically insignificant even at 10 percent level, as implied by their respective F ratio. In order to remove the specification errors, if at all, by removing unnecessary details regarding expenditures, we put two linear restrictions on the impact parameters of unrestricted equations. As has been done in Chapter IV, linear restrictions are put on the impact coefficients of EIM(Expenditure on Industries, Minerals), EWPD (Expenditure on Water and Power Development) and ETC (Expenditure on Transport and Communication). The restrictions are, that impact coefficients of EIM, ETC and EWPD are statistically equal.*1 This would increase the degrees of freedom and thereby, may improve the reliability of the estimates, if the restrictions are valid.

Table 6.2, produces the OLS estimates of restricted equations obtained after incorporating the two linear restrictions on the parameters of unrestricted equations. In order to test the validity of these restrictions, required F^* is calculated for each function and presented in Table 6.3. The F^* ratio indicates the statistical equality between the

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*1 Similar kind of an exercise was carried out in Chapter IV.

Table 6.1 : Results of Unrestricted Regressions, 1961-71.

Independent Variables	Dependent Variables									
	DMLR		DFLR		DHI		DGESC		DCWI	
	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	- 1.2046	-0.903	-0.9477	-1.03	-1.3192	-0.834	-2.9228	-1.65	- 1.8291 *	- 2.579
2) EPE	0.5922*	3.583	0.4899*	4.227	0.3862	1.620	-0.1572	-0.765	0.2881 *	2.696
3) EOE	-	-	-	-	0.3408	0.780	-0.1739	-0.540	0.2137	1.091
4) EMHF	-	-	-	-	-0.2524	-0.249	-	-	-0.1044	-0.230
5) EOSCS	0.0805	0.246	-0.0092	-0.040	-0.3395	-0.620	0.1863	0.362	-0.2563	-1.044
6) EAG	0.1201	0.597	0.0311	0.220	0.6967**	2.412	0.0382	0.153	0.2931**	2.264
7) EIM	0.0955	0.328	0.0653	0.319	0.0365	0.105	-0.1667	-0.433	-0.0804	-0.518
8) ETC	-0.4092*	-2.460	-0.1817	-1.557	-0.0406	-0.198	0.1816	0.829	- 0.0979	-1.067
9) EWPD	0.1607	0.845	0.0847	0.635	-0.1202	-0.545	0.1512	0.637	0.0342	0.346
10) PCI	0.0011	0.294	0.0015	0.587	0.0007	0.143	0.0096	1.834	0.0035	1.647
R^2	0.7186		0.7569		0.8011		0.5388		0.8729	
$\bar{R}^2$	0.4725		0.5442		0.5028		0.0118		0.6824	
F	2.92**	(7,8)	3.55*	(7,8)	2.69	(9,6)	1.02	(8,7)	4.58*	(9,6).

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

Table 6.2 : Results of Restricted Regressions, 1961-71.

Independent Variables	Dependent Variables									
	DMLR		DFLR		DHI		DGESC		DCWI	
	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	- 0.7574	-0.478	-0.7292	0.4600	-1.4176	-1.044	-3.0887**	-2.026	-1.8806*	-2.833
2) EPE	0.5256*	2.864	0.4600*	4.159	0.3968**	1.926	-0.1432	-0.794	0.2391*	2.373
3) EOE	-	-	-	-	0.2282	0.641	-0.3050	-0.983	0.1334	0.767
4) EMHF	-	-	-	-	-0.0502	-0.062	-	-	0.0243	0.061
5) EOSCS	0.0637	0.163	-0.0200	-0.085	-0.3553	-0.715	0.3141	0.683	-0.2507	-1.031
6) EAG	0.0600	0.203	0.0154	0.086	0.6017**	2.122	-0.0971	-0.337	0.2696**	1.943
7) EOECS	-0.0318	-0.343	-0.0136	-0.2442	0.0075	0.074	0.1244	1.105	-0.0182	-0.370
8) PCI	0.0004	0.095	0.0012	0.467	0.0007	0.177	0.0188*	2.598	0.0040**	2.012
R^2	0.4925		0.6742		0.7906		0.5279		0.8407	
$\bar{R}^2$	0.2387		0.5143		0.6073		0.3121		0.7014	
F	1.94	(5,10)	4.18*	(5,10)	4.31*	(7,8)	1.68	(6,9)	6.03*	(7,8)

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

restricted and unrestricted equation and thereby indicates the validity of the restrictions.

Table 6.3 : Results of Restricted v/s Unrestricted Regressions, 1961-71

Dependent Variable	Residual Sum of Squares		Calculated F-value	Degrees of Freedom
	Restricted Form (e_R^2)	Unrestricted Form (e_{UR}^2)		
1	2	3	4	5
1) DMLR	94383.5	52322.6	3.216	2, 8
2) DFLR	34274.4	25729.9	1.328	2, 8
3) DHI	50548.0	47993.6	0.160	2, 6
4) DGESC	71842.8	70178.9	0.083	2, 7
5) DCWI	12093.1	9648.09	0.760	2, 6

As can be observed from Table 6.3 all the F^*s are statistically insignificant implying that restricted equations of 1961-71 are statistically equal to unrestricted equations and hence can be substituted for each other. It follows from the Table 6.1 and Table 6.2 that unrestricted equations of DMLR gives better fit than restricted equations, whereas in case of DFLR, DHI, and DCWI, restricted form gives better fit as indicated by their respective $\bar{R}^2$ (See, Table 6.1 and Table 6.2).

As regards DGESC both the forms yield poor fit as indicated by their insignificant R^2 (Table 6.1 and 6.2), hence the regression cannot be used for drawing any reliable statistical inference.

Looking at the selected regressions of DMLR, DFLR, DCWI and DHI, we find that in first three equations impact parameter of expenditure on Primary Education (EPE) is positive and statistically significant, suggesting that during 1961-71 there were increasing returns to the government efforts on primary education, in terms of basic literacy, health as well as total basic welfare.

Another important result, which must be noted is that impact of Expenditure on Agriculture (EAG),on DHI and DCWI, during 1961-71 turns out to be positive and statistically significant. This implies that during 1961-71, government efforts on agriculture increased the health and composite welfare index of the poors at an increasing rate. However, all other impact coefficients are statistically zero implying constant returns to the government efforts in respective directions during 1961-71. However, detailed discussion of these parameters will be taken up only in section 4, where the impact coefficients are obtained on the basis of larger number of observation (due to pulling of the data for 1961-71 and 1971-81) and therefore, are

Table 6.4 : Results of Unrestricted Regressions, 1971-81.

Independent Variables	Dependent Variables									
	DMLR		DFLR		DHI		DGESC		DCWI	
	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	0.360	-0.6073	-1.082	-0.0046	-0.742	1.2285	1.227	0.3059	0.563
2) EPE	0.3530*	4.191	0.3037*	4.642	-0.1181	-0.933	0.0739	0.377	0.1083	0.980
3) EOE	-	-	-	-	0.9236*	4.090	0.3671	1.079	0.3715	1.88
4) EMHF	-	-	-	-	-0.4442	-1.451	-	-	-0.0776	-0.291
5) EOSCS	-0.0653	-0.449	0.0776	0.686	-0.3694	-1.744	0.0773	0.229	-0.0932	-0.504
6) EAG	0.0533	0.746	0.0485	0.875	-0.2230**	-2.390	-0.2790**	-1.992	-0.1430	-1.758
7) EIM	-0.1335	-0.597	0.1881	1.083	0.0141	0.744	-0.1314	-0.420	-0.0049	-0.029
8) EWPD	-0.0026	-0.020	-0.1636	-1.610	0.3919**	2.534	0.1199	0.488	0.1342	0.994
9) ETC	0.0790	0.582	0.1508	1.43	-1.2121*	-4.741	-0.0111	-0.027	-0.2976	-1.33
10) PCI	-0.0013	-0.414	-0.601	-0.0078	0.0144*	4.047	-0.0039	-0.731	0.0016	0.530
R^2	0.7612		0.8554		0.9510		0.7340		0.8768	
$\bar{R}^2$	0.5224		0.7109		0.8628		0.3800		0.6549	
F	3.19** (7,7)		5.92* (7,7)		10.78* (9,5)		2.07 (8,6)		3.95** (9,5)	

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

Table 6.5 : Results of Restricted Regressions, 1971-81.

Independent Variables	Dependent Variables									
	DMLR		DFLR		DHI		DGESC		DCWI	
	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	-0.5601	-0.403	1.2667	1.393	0.2937	0.5330
2) EPE	0.3203*	4.66	0.3349*	5.44	0.3520	1.746	0.0716	0.603	0.2191*	2.744
3) EOE	-	-	-	-	0.1156	0.384	0.2997	1.708	0.1516	1.273
4) E MHF	-	-	-	-	-0.4232	-0.647	-	-	-0.0565	-0.218
5) EOSCS	-0.0923	-0.777	-0.0153	-0.144	0.3885	1.380	0.1481	0.868	0.1097	0.984
6) EAG	0.0368	0.548	0.0072	0.1200	0.0768	0.470	-0.2812*	-3.197	-0.0724	-1.120
7) EOECS	0.0156	0.3988	0.0026	0.750	-0.0918	-0.873	0.0555	0.808	-0.0052	-0.125
8) PCI	0.0001	0.003	0.0004	0.182	0.0017	0.329	-0.0043	-1.396	-0.1552	-0.771
R^2	0.7328		0.7853		0.6723		0.7202		0.8302	
$\bar{R}^2$	0.5843		0.6661		0.3445		0.5103		0.6605	
F	4.94* (5,9)		6.59* (5,9)		2.05 (7,7)		3.43** (6,8)		4.89* (7,7)	

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

likely to be more reliable. Before we proceed for the 'pulled exercise' in section 4, we present the regression estimates of 1971-81, which are obtained on the basis of 1971-81 sample.

Regression Estimates of 1971-81 Sample : As has been done for the earlier period, five functions viz. DMLR, DFLR, DHI, DGESC and DCWI are estimated through OLS. Table 6.4 and Table 6.5 give the estimates of unrestricted and restricted equations respectively, for the above functions. Table 6.6 produces the required F^* ratio for testing the statistical equality between restricted and unrestricted equation of each of the above five functions.

Table 6.6 : Results of Restricted v/s Unrestricted Regression, 1971-81.

Dependent Variables	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) DHI	57677.7	8622.26	14.223*	2, 5
4) DGESC	28368.0	26925.1	0.161	2, 6
5) DCWI	9045.97	6566.22	0.944	2, 5

* Significant at 5% level.

Table 6.6 reveals that except the function relating to health, namely DHI, the F^* ratios for all other functions are statistically insignificant at five percent level. This implies that except DHI, for rest of the four functions restrictions on the parameters of EIM, ETC and EWPD are valid. The F^* ratio for the function of DHI is statistically significant implying that during 1971-81, impact coefficients of the above three expenditures are statistically different in this case. Moreover, a significantly higher $\bar{R}^2$ of unrestricted equation of DHI suggests that these variables (EIM, ETC, EWPD) are individually quite important for explaining the variation in DHI during 1971-81 and hence must be retained in the equation for this period.

As regards the functions of DMLR, DGESC and DCWI a relatively higher $\bar{R}^2$ is obtained from the restricted form and hence it may be selected between the two sets. In case of DFLR, however, the unrestricted equation yields better fit and hence must be selected between the two.

It follows from Table 6.4 and Table 6.5 that selected regressions of the above functions fit the data quite well as indicated by their statistically significant F ratio. A cursory look at the individual coefficients of the above selected regressions reveal that like 1961-71, expenditure on primary education had positive, and statistically significant

impact on some of the variables like DMLR, DFLR and DCWI. Whereas unlike 1961-71, expenditure on agriculture had negative and statistically significant impact on the variables like DHI and DGESC during 1971-81. However, a more detailed discussion regarding individual parameters has been attempted only in respect of pulled regressions of 1961-71 and 1971-81 in section 4, for the reasons already mentioned above.

3. Testing The Stability Of The Functions With The Chow-Test

Functional relationship between government efforts and welfare indices are likely to change over a long period of time due to change in several geographical, socio-economic and demographic factors denoted by $Z_1, Z_2 \ldots Z_t$ (See, Ch. II). In order to find out whether changes in the above factors have significantly changed the functional relationship between $\dot{X}$ and $\dot{G}$ over a period 1961-71, first we have carried out the 'Chow-test'. For this test, we not only require the sample regression estimates for 1961-71 and 1971-81 separately but we also require pulled regression estimates of both these sub-samples. Table 6.7 presents the OLS estimates of the 'pulled' regressions of 1961-71 and 1971-81 sample.

Table 6.8 and Table 6.9 provide the required F^{**} ratio for testing the stability of the above unrestricted as well as restricted functions respectively, between the two periods.*2

*2 For the formula for calculating F^{**}, see, Ch.V, Sec. 3.

Table 6.7 : Results of pulled Regressions, 1961-81.

(a) Unrestricted Regressions

Independent Variables	Dependent Variables									
	DMLR		DFLR		DHI		DGESC		DCWI	
	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	0.3121	-0.487	-0.4822	-1.0358	0.5958	0.5407	-0.8521	-0.961	-0.3414	-0.7296
2) EPE	0.4216*	5.337	0.3297*	5.744	0.1835	1.073	0.0767	0.680	0.2217*	3.054
3) EOE	-	-	-	-	0.2680	1.009	0.1726	0.972	0.2143**	1.899
4) EMHF	-	-	-	-	-0.6545	-1.046	-	-	-0.2270	-0.854
5) EOSCS	0.1620	-1.372	-0.1484**	-1.7315	0.0718	0.263	0.1623	0.914	-0.0528	-0.455
6) EAG	0.0186	0.2464	-0.0030	-0.054	0.1435	0.909	-0.1358	-1.288	0.0130	0.194
7) EIM	0.0015	0.667	0.0022	1.329	0.0045	1.078	0.0012	0.370	0.0024	1.409
8) EWPD	-0.0711	-0.399	0.1170	0.905	0.5851**	1.904	-0.2612	-1.051	0.0685	0.525
9) ETC	0.1515	1.416	0.0232	0.298	-0.2482	-1.373	0.0606	0.414	-0.0195	-0.254
10) PCI	-0.1480	-1.638	-0.0776	-1.184	-0.1086	-0.620	0.0452	0.320	-0.0827	-1.112
R^2	0.6311		0.6828		0.3656		0.3883		0.6244	
$\bar{R}^2$	0.5189		0.5863		0.0937		0.1659		0.4634	
F	5.62*	(7,23)	7.073*	(7,23)	1.344	(9,21)	1.745	(8,22)	3.87*	(9,21)

Contd..

Table 6.7 : (Contd.) :

(b) Restricted Regressions.

	Dependent Variables									
	DMLR		DFLR		DHI		DGESC		DCWI	
	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	-0.2347	-0.384	-0.2426	-0.5634	1.5432	1.396	-1.2079	-1.491	-0.1495	-0.342
2) EPE	0.3861*	5.074	0.3428*	6.399	0.4130*	2.234	0.0480	0.425	0.2648*	3.634
3) EOE	-	-	-	-	0.1748	0.597	0.1353	0.728	0.1642	1.418
4) EMHF	-	-	-	-	-0.9073	-1.362	-	-	-0.2865	-1.088
5) EOSCS	-0.1227	-1.014	-0.1448	-1.699	0.1981	0.659	0.2137	1.199	0.0032	0.0267
6) EAG	0.0618	0.791	0.0015	0.0278	0.0303	0.184	-0.1410	-1.372	0.0024	0.0366
7) EOECS	-0.0075	-0.196	-0.0011	-0.0424	0.0594	0.673	0.0226	0.346	0.0058	0.1675
8) PCI	0.0007	0.3275	0.0012	0.765	0.0010	0.241	0.0024	0.797	0.0016	1.005
R^2	0.5785		0.6563		0.2038		0.3542		0.5918	
$\bar{R}^2$	0.4894		0.5876		-0.0857		0.1928		0.4676	
F	6.75*	(5,25)	9.54*	(5,25)	0.840	(5,25)	2.19**	(6,24)	4.76*	(7,23)

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

Table 6.8 : Results of The Chow-Test for Structural Constancy, 1961-81 (Unrestricted Form)

Dependent Variables	Residual Sum of Squares			Calculated F-value	Degrees of Freedom
	Pulled Regression (1961-81)	Regression-I (1961-71)	Regression-II (1971-81)		
1	2	3	4	5	6
1) DMLR	108200	52322.6	16833.2	1.059	8,15
2) DFLR	57078.7	25729.9	10152.8	1.108	8,15
3) DHI	281095	47993.6	8622.26	4.361*	10,11
4) DGESC	193990	70178.9	26925.1	1.441	9,13
5) DCWI	50716.0	9648.09	6566.22	2.341	10,11

* Significant at 5% level.

Table 6.9 : Results of the Chow-Test for Structural Constancy, 1961-81 (Restricted Form)

Dependent Variables	Residual Sum of Squares			Calculated F-value	Degrees of Freedom
	Pulled Regression (1961-81)	Regression-I (1961-71)	Regression-II (1971-81)		
1	2	3	4	5	6
1) DMLR	124813	94383.5	18837.5	0.324	6,19
2) DFLR	61851.2	34274.4	15075.5	0.802	6,19
3) DHI	352806	50548.0	57677.7	4.237*	8,15
4) DGESC	204802	71842.8	28368.0	2.535	7,17
5) DCWI	55114.9	12093.1	9045.97	3.014*	8,15

* Significant at 5% level.

The required F^{**} ratios, namely the Chow-test for all functions suggest that except the function relating to health (DHI) no significant changes have occured in the structural relationship between government efforts and welfare indices. However, as has been discussed in Chapter V, limitation with the Chow-test is that it does not indicate whether the slope or intercept or both the parameters of the functions have changed. Moreover, we had observed in the previous chapter that results of the 'Chow-test' are not necessarily consistent with the results with dummy variables, particularly when only few parameters of the equation have changed, even though the change may be statistically significant. Since our interest is also in the direction and magnitude of change in the individual coefficients between the two periods we have carried out an exercise with the dummy variables, results of which are presented and discussed in detail in the next section.

4. Estimating The Change in Impact Coefficients Through Dummy Variables

6.4.1 Estimating The Pulled Regressions : As previously noted, dummy variables introduced on the right hand side of equations would measure the change in respective individual impact parameters due to change in several socio-economic demographic factors denoted by Z_1, $Z_2 \ldots Z_n$ etc., over a period of time.

Estimates of impact parameters for 1961-71 and estimates of dummies can be read directly from the estimated 'pulled' regression with dummies, whereas estimates for 1971-81 can be obtained by adding the value of dummy variables to 1961-71 estimates.*3 If dummy variable is statistically zero, it would imply no statistical change in impact, between 1961-71 and 1971-81.

Table 6.10 provides the estimated impact parameters and corresponding dummies of pulled unrestricted regressions. Except the regression of DGESC all other regressions are statistically significant as suggested by their F ratio. In order to increase the degrees of freedom, we imposed two linear restrictions on the parameters of unrestricted equation, as has been done in Chapter IV.

Table 6.11 presents the estimated restricted regression equations including dummies for the period 1961-81. As can be seen all the restricted regressions are statistically significant at 5 percent level, implying that the model is very well fitted to the given data. Variations in disparity reduction rate in composite welfare index as well as component indices are very well explained by the variations in government expenditures in different directions.

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*3 For discussion on this see, Damodar Gujrati, BASIC ECONOMETRICS, McGraw-Hill, Kogakusha, Ltd., 1978.

Table 6.10 : Results of Unrestricted Pulled Regressions with Dummy Variables

Independent Variables	Dependent Variables									
	DMLR		DFLR		DHI		DGESC		DCWI	
	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value
1	2	3	4	5	6	7	8	9	10	11
1) Constant	-1.2046	-1.075	-0.9477	-1.174	-1.3192	-1.040	-2.9228**	-1.913	-1.8291*	-2.693
2) EPE	0.5922*	4.268	0.4899*	4.902	0.3862**	2.020	-0.1572	-0.886	0.2881*	2.816
3) EOE	-	-	-	-	0.3408	0.9728	-0.1739	-0.6261	0.2137	1.140
4) EMHF	-	-	-	-	-0.2524	-0.3109	-	-	-0.1044	-0.240
5) EOSCS	0.0805	0.2929	-0.0092	-0.0465	-0.3395	-0.7734	0.1863	0.420	-0.2563	-1.091
6) EAG	0.1201	0.7109	0.0311	0.255	0.6967*	3.007	0.0382	0.178	0.2931*	2.364
7) EIM	0.0955	0.3901	0.0653	0.370	0.0365	0.132	-0.1667	-0.501	-0.0804	-0.541
8) EWPD	0.1607	1.007	0.0847	0.737	-0.1202	-0.680	0.1512	0.738	0.0342	0.362
9) ETC	-0.4092*	-2.930	-0.1817**	-1.806	-0.4057	-0.247	0.1816	0.960	-0.9795	-1.115
10) PCI	0.0011	0.3506	0.0015	0.6812	0.0007	0.179	0.0096**	2.125	0.0035	1.721
Dummy Variables										
11) Constant	1.4645	0.975	0.3405	0.3147	0.8577	0.5157	4.1513**	2.075	2.1349*	2.399
12) EPE	-0.2392	-1.320	-0.1862	-1.426	-0.5044	-1.736	0.2312	0.748	-0.1798	-1.156
13) EOE	-	-	-	-	0.5829	1.112	0.5410	1.042	0.1578	0.562
14) EMHF	-	-	-	-	-0.1918	-0.1978	-	-	0.0268	0.052
15) EOSCS	-0.1458	-0.4278	0.0867	0.354	-0.0299	-0.0523	-0.1091	-0.175	0.1631	0.533
16) EAG	-0.0668	-0.3414	0.0175	0.124	-0.9196*	-3.259	-0.3172	-1.129	-0.4362*	-2.888
17) EIM	-0.2290	-0.580	0.1228	0.432	0.1077	0.248	0.0353	0.0675	0.0754	0.324
18) EWPD	-0.1633	-0.676	-0.2483	-1.427	0.5122	1.599	-0.0312	-0.083	0.1000	0.583
19) ETC	0.4882*	2.0855	0.3325**	1.972	-1.1716*	-2.486	-0.1928	-0.342	-0.1996	-0.792
20) PCI	-0.0024	-0.4457	-0.0030	-0.773	0.0134**	1.888	-0.0135	-1.643	-0.0019	-0.489
R^2	0.7642		0.8006		0.8722		0.6938		0.8799	
$\bar{R}^2$	0.5285		0.6012		0.6515		0.2934		0.6725	
F	3.24*	(15,15)	4.01*	(15,15)	3.95*	(19,11)	1.733	(17,13)	4.24*	(19,11)

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

Table 6.11 : Results of Restricted Pulled Regressions with Dummy Variables

Independent Variables	Dependent Variables									
	DMLR		DFLR		DHI		DGESC		DCWI	
	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	-0.7574	-0.601	0.7292	-0.877	-1.4176	-0.977	-3.0887*	-2.357	-1.8806*	-2.934
2) EPE	0.5256*	3.604	0.4600*	4.778	0.3068**	1.803	-0.1432	-0.924	0.2391*	2.4573
3) EOE	-	-	-	-	0.2282	0.600	-0.3050	-1.144	0.1334	0.794
4) EMHF	-	-	-	-	-0.0502	-0.058	-	-	0.0243	0.063
5) EOSCS	0.0636	0.205	-0.0200	-0.097	-0.3553	-0.669	0.3141	0.7953	-0.2507	-1.067
6) EAG	0.0600	0.255	0.0154	0.0993	0.6017**	1.985	-0.0971	-0.392	0.2696**	2.012
7) EOECS	-0.0318	-0.4323	-0.0136	-0.280	0.0075	0.0696	0.1244	1.286	-0.0182	-0.383
8) PCI	0.0004	0.1201	0.0012	0.5359	0.0007	0.1655	0.0118*	3.024	0.0040**	2.083
Dummy Variables										
9) Constant	0.9263	0.538	0.0436	0.0384	0.8575	0.440	4.3554*	2.477	2.1743*	2.524
10) EPE	-0.2053	-1.102	-0.1252	-1.017	-0.0448	-0.155	0.2148	0.9863	-0.0200	-0.1563
11) EOE	-	-	-	-	-0.1127	-0.238	0.6047	1.730	0.0181	0.0868
12) EMHF	-	-	-	-	-0.3731	-0.350	-	-	-0.0809	-0.1728
13) EOSCS	-0.1560	-0.422	0.0046	0.0189	0.7438	1.254	-0.1660	-0.367	0.3604	1.374
14) EAG	-0.0233	-0.0890	-0.0082	-0.048	-0.5250	-1.547	-0.1841	-0.676	-0.3420*	-2.280
15) EOECS	0.0474	0.480	0.0163	0.249	-0.0992	-0.681	-0.0689	-0.5256	0.0130	0.202
16) PCI	-0.0004	-0.075	-0.0008	-0.232	0.0010	0.1489	-0.0161*	-2.896	-0.0055**	-1.948
R^2	0.6140		0.7258		0.7557		0.6840		0.8434	
$\bar{R}^2$	0.3905		0.5670		0.5115		0.4424		0.6869	
F	2.74*	(11,19)	4.57*	(11,19)	3.09*	(15,15)	2.83*	(13,17)	5.39*	(15,15)

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

6.4.2 Test of Equality Between Restricted And Unrestricted Pulled Regressions : In order to test whether the pulled unrestricted regression equations are statistically equal to their corresponding restricted equations, we carried out the required F^* test for each function, results of which are given in Table 6.12.

Table 6.12 : Results of Restricted v/s Unrestricted Pulled Regressions (With Dummy Variables), 1961-81.

Dependent Variables	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	113221	69155.8	2.389	4, 15
2) DFLR	49349.9	35882.7	1.407	4, 15
3) DHI	108226.0	56615.9	2.507	4, 11
4) DGESC	100211.0	97104.9	0.104	4, 13
5) DCWI	21139.0	16214.3	0.834	4, 11

F^*'s of the above Table are statistically insignificant at five percent level implying that each restricted pulled regression is statistically equal to corresponding unrestricted pulled regression. Selection of the final set of regressions is made on the basis of their individual $\bar{R}^2$.

In what follows therefore, we would discuss the results of the selected set of pulled regressions only.

6.4.3 Estimated Changes in Impact Coefficients

Functions of DMLR and DFLR : For these two functions we have selected unrestricted form since they give higher $\bar{R}^2$ (Table 6.10). Unrestricted pulled regressions of these functions are fitted very well to the data on 1961-81. Almost 76 percent of variations in DMLR and 80 percent of variation in DFLR are explained by the expenditure variables.

Dummy variables of almost all variables except ETC are statistically insignificant. This implies that between the two periods, impact of all other expenditures except ETC remained statistically unchanged. The impact coefficient of ETC during 1961-71 is statistically negative (See, Table 6.10) in case of both DMLR and DFLR but the dummy for ETC is statistically positive and significant suggesting that over a period the impact of ETC or DMLR and DFLR has substantially increased in positive direction. As has been mentioned, impact coefficient for 1971-81 can be obtained by adding the value of significant dummy to the respective coefficient for 1961-71.

Thus,

Impact of ETC on DMLR during 1961-71 = -0.4092

Dummy for ETC = 0.4882

∴ Impact of ETC on DMLR for 1971-81= -0.4092+0.4882=0.0792.

If follows from the above that during 1961-71 there were diminishing returns to the government effort on transport and communication but after that there is a turn and there appears to be a clear tendency towards increasing returns.

As regards other efforts, we find that there are increasing marginal returns to the government effort on primary education in terms of these output indexes during both the periods, whereas marginal returns to the government efforts on higher education, health, etc. remained constant during both the periods.

Function of DHI : Unrestricted equation of DHI appears to fit the data well, as indicated by higher $\bar{R}^2$ and F ratio. R^2 is also as high as 87 percent (Table 6.10) indicating that quite a large part of variation in DHI is explained by the government expenditure variables.

In this function, two dummy variables namely the dummy for expenditure on agriculture (EAG) and expenditure on Transport and Communication (ETC) are statistically significant but negative. This implies that impact of these two, namely, EAG and ETC, on disparity reduction rate in health index had substantially declined over a period of time. What is more important to point out is that during 1961-71 EAG had statistically positive and significant

impact on DHI but after it there is a clear change in the relationship.

Impact of EAG on DHI during 1961-71 = 0.6967

Estimated Dummy for EAG =-0.9196

$\therefore$ Impact of EAG on DHI during 1971-81 = (0.6967)+(-0.9196)

= (-0.2229)

This clearly indicates that marginal returns to government efforts on EAG were increasing during 1961-71 but diminishing during 1971-81, keeping all other things constant. Similarly, marginal returns (in terms of health) to government efforts on transport and communication were increasing during 1961-71 but diminishing during 1971-81.

What is most significant is that impact of EPE on DHI is positive and significant during both the periods suggesting that government efforts on primary education increased the health index of the poors at an increasing rate. Rest of the expenditures viz. EOE, EMHF, etc. have statistically zero impact on DHI during both the periods, implying constant returns to government efforts in respective directions.

Function of DGESC : Estimated restricted equation of DGESC (Table 6.11) has a relatively higher $\bar{R}^2$ as compared to the unrestricted one and hence the former is preferred over the latter. The F ratio of this restricted pulled regression,

containing dummies, is statistically significant at 5 per-cent level, implying that government expenditures do have significant impact on the disparity reduction rate in the index of GESC.

Two results are quite important to be noted here. One is, that estimated intercept of this function was statistically negative and significant during 1961-71 but the differential intercept (dummy) is positive and statistically significant.

Estimated intercept of DGESC for 1961-71 = -3.0887

Differential intercept of DGESC = 4.3554

∴ Estimated intercept for 1971-81 = -3.0887 + 4.3554 =1.2667

Economic implication of the above result is that during 1961-71 basic factors in the system were against and hence, but for the government expenditure, the index of general economic and social conditions of the poors might have declined in absolute terms. Whereas positive dummy of the intercept suggest that during 1971-81 the socio-economic demographic factors in the system have become some what favourable and may not lead to absolute decline in the index of GESC, even if government expenditures are reduced or become zero.

Another interesting result arises in case of impact of

Per Capita Income (PCI) on DGESC. Table 6.11 reveals that impact of economic development (PCI) on DGESC was positive and significant during 1961-71, implying that relatively better off states had relatively higher rate of improvement in GESC and vice-versa during 1961-71.

But statistically significant and negative differential slope (dummy) of PCI suggest, that after 1961-71 rate of improvement in the index of general economic and social conditions is relatively higher in worse off states and lower in better off states as desired. Table 6.11 reveals that all other expenditures viz. EPE, EOE, EMHE had statistically zero impact on DGESC during both the periods implying constant returns to government efforts in these directions.

Function of DCWI : Regression of disparity reduction rate in composite (basic welfare) welfare is the most crucial regression of our model. Both restricted as well as unrestricted form of this function yield statistically significant F implying that government expenditures did have significant influence on the rate of improvement in basic welfare of the economy during both the periods, viz. 1961-71 and 1971-81. The restricted form of this function, however, gives higher $\bar{R}^2$ and hence could be preferred over the unrestricted one. R^2 of this selected regression (Table 6.11) is as high as 84 per-

cent. Looking to the fact that dependent variable is a change variable and not the level variable, this fit should be considered as quite good !!

It may be observed from Table 6.11 that substantial structural changes have occured in this function. Statistically significant and positive differential intercept (dummy) of this function suggests that the function of DCWI has bodily shifted in the upward direction. Moreover, statistically significant dummy for EAG, and PCI also indicate that the slope of the function has also changed substantially over a period of time.

What is more important to note is that during 1961-71, intercept of this function was negative and significant but became positive after this period. Economic implication of this result is that during 1961-71, inter play of various socio-economic-demographic factors would have reduced the welfare of the poors in absence of government expenditure. However, after this period the above factors have improved in favour of the welfare of the poors, such that even in absence of government expenditures welfare of the poors may not decline in absolute terms.

Another worth noting result of this regression is regarding the impact of expenditure on agriculture (EAG). During 1961-71 EAG had positive and statistically significant

impact on DCWI, implying that government efforts in this direction increased the welfare of the poors at an increasing rate. Whereas, the negative and statistically significant dummy for EAG indicates that this impact has substantially declined over years and that during 1971-81 government efforts on agriculture did not yield increasing marginal returns in terms of basic welfare.

Similar result as the above also arises in case of per capita income (Table 6.11). For 1961-71 coefficient of PCI is positive and statistically significant implying that relatively better off state had a higher rate of improvement in basic welfare and vice-versa during that period. However, the negative differential slope of PCI in the regression (Table 6.11) indicates that after 1961-71, there is a substantial change in this relationship, in the sense that economically developed states are not necessarily the states with higher rate of improvement in the basic welfare.

An impact coefficient which is not only positive and significant during 1961-71 but also during 1971-81 is the coefficient of expenditure on primary education (EPE), implying that marginal returns (in terms of basic welfare) to government efforts on primary education were increasing during both the periods. Government expenditure on EOE, EMHF, EOSC etc. however had statistically zero coefficient indicating constant marginal returns to government efforts in these directions.

5. Conclusion

We may conclude from the above results that government expenditures do have significant influence on the distributional welfare of the poors. The exercise with dummies show that in almost all cases more than seventy percent variations in the disparity reduction rate in welfare indices are explained by the government expenditures (Table 6.10 and Table 6.11).

Out of different categories of government expenditures, expenditure on primary education has positive and significant impact on the four out of five dependent variables viz., DMLR, DFLR, DHI and DCWI, implying that government efforts on primary education were yielding increasing marginal returns in terms of basic welfare and its components.

Secondly, expenditure on agriculture (EAG) had statistically positive impact on the rate of improvement of basic welfare index and health index during 1961-71 but had negative impact on the rate of improvement in them during 1971-81. However, on all other indexes it had statistically zero impact during both the periods.

Thirdly, expenditure on Transport and Communication (ETC) had negative and significant impact on the rate of improvement in male and female literacy during 1961-71 but positive impact on the rate of improvement in them during 1971-81. Whereas, ETC had zero

impact on disparity reduction rate in health during 1961-71 but negative and significant impact on rate of improvement in health during 1971-81.

All other expenditures viz. EOE, EMHF, EOSCS etc. had statistically zero impact on the disparity reduction rate in all the five indexes, implying that government efforts in these directions yielded constant marginal returns, in terms of these output indexes during both the periods.

Finally, we may say that all our regressions do show significant relationship between government efforts and welfare of the poors and that the role of various expenditures in this respect is changing over a period of time.