CHAPTER SIX
THE EMPIRICAL RESULTS

6.1 Introduction

The social development index is calculated using a simple methodology of sub index for each of the two components. These two components are health and education indices. Performance in each dimension is expressed as a value between 0 and 1. Thus, we define social development in terms of these two vital sectors. In this section we report the empirical results of the investigation model of the impact of public expenditure and the other variables on social development index in Sudan during the research period (1980-2009). As we stated earlier in the previous chapters, there is some quantitative change in various dimensions in social development components. Our model is consists of three equations summarizing the various changes in the most important aspects of social development in Sudan. Consequently, our results report confirms the hypothesis assumed earlier. We examine the actual role played by the public expenditure on providing social services, i.e, what variables can be attributed to the level of social development index? Most important, what are the fiscal policy measures that could be adopted toward enhancing social services delivery?

As has been mentioned earlier, social development index is investigated on the basis of three stages of social development aspects; these three stages are consisting of three equations, namely: health index equation, education index equation and then social development index equation. Each of these three equations is measured by the central variables and factors that we are considered to have a significant role in these equations. However, the rest of this chapter organized as follows: following the introduction, in section (6.2) we report descriptive statistics analysis for indicators and the explanatory variables of health, education and social development indices was discussed. Section (6.3) and (6.4) apply regressions methods to the major variables that determine health and education indices. While in section (6.5) we repot the overall social development index results and test the hypothesis. Section (6.6) concludes the chapter and the research with some final remarks.

6.2. Descriptive Statistics Analysis

In this section we display the descriptive statistics for all variables, indicators and indices that were considered in our investigation model so as to discover the trends and the growing path over time to these variables.

6.2.1. Descriptive Statistics of Health Physical Infrastructure Component

From the appendix (A.7) we can observe the trends of the variables that are used in calculating the health physical infrastructure in Sudan. These variables tended to show some changes in their values during the last three decades. The average number of hospitals per100000 population (Ho) tends to increases from 0.083 to 0.093 to 0.097 during the last three decades, respectively, by coefficient of variation (CV) of (0.06), (0.07) and (0.18), respectively. While the number of beds per100000 population (Be) showed decreasing rate during the same period by average 86.25 to 79.12 to 73.58, respectively, with coefficient of variation (CV) of (0.10), (0.05) and (0.04), respectively. The number of dispensaries per100000 population (Di) is fluctuated during the study periods, because of upgrade some dispensaries to hospitals and merge some of them to health centers. In general, however, these indicators showed that; initially there are steadily increases in number of hospitals and beds during (1990-2009) by 94.7% and 49.6%, respectively. Hence, the number of beds per100000 population in 1990 recorded 75 beds, while it recorded only 72 beds in 2009, table (6.1) below summarize these trends.

Table (6.1) Descriptive Statistics of Health Physical Infrastructure Component 1980 - 2009

period	Number of Hospital per100,000 populations (Ho)			Number of Beds per100,000 populations (Be)			Number Dispensaries per100,000 populations (Di)		
	Stdev	Average	CV	Stdev	Average	CV	Stdev	Average	CV
1980-1989	0.00	0.083	0.06	8.84	86.25	0.10	0.04	0.44	0.10
1990-1999	0.01	0.093	0.07	4.32	79.12	0.05	0.02	0.50	0.03
2000-2009	0.02	0.097	0.18	3.05	73.58	0.04	0.07	0.44	0.17

Source: Own calculations based on appendix (A.7).

6.2.2 Descriptive Statistics of Health Manpower Component (1980 – 2009)

Going on the same way, and from appendix (A.8), we observe that, there is a fluctuation in the numbers of doctors, specialist and nurses per doctor during the same period. We attributed these fluctuations in the number of nurses to nurse's admission into the academic health sciences of nurses in recent years. Also we attributed the fluctuations into the numbers of doctors and specialist to the migration abroad (brain-drain). In addition to the, bad conditions, low incentives of works and the absences roles of law sometimes face. Thus, the average number of doctor's per100000 population (Do) is fluctuated from 11.28, to 10.75 to 21.7 with coefficient of variation (CV) of (0.07), (0.25) and (0.25) respectively; the higher coefficient of variation interprets this fluctuation. Also the average number of specialist per100000 population (Sp) fluctuated from 2.53 to 2.14 to 3.68 by coefficient of variation (CV) of (0.09), (0.10) and (0.22), respectively. While the number of nurses per doctor (Nu), registered decreased average. It declined from 6.39 to 6.16 to 2.47 by coefficient of variation (CV) of (0.05), (0.26) and (0.23), respectively, because of admission nurses into academic health sciences of nurses in recent years. Appendix (A.8) provides some details of these tendencies during this period, thus, we recapitulates these trends in these indicators into table (6.2)

Table (6.2): Descriptive Statistics of the Health Manpower Component during the Period 1980 - 2009

period	Number of Doctors per100,000 populations (Do)			number of specialist per100,000 populations (Sp)			Number of Nurses per Doctor (Nu)		
	Stdev	Average	CV	Stdev	Average	CV	Stdev	Average	CV
1980-1989	0.83	11.28	0.07	0.23	2.53	0.09	0.30	6.39	0.05
1990-1999	2.63	10.75	0.25	0.22	2.14	0.10	1.60	6.16	0.26
2000-2009	5.57	21.9	0.25	0.79	3.68	0.22	0.57	2.47	0.23

Source: Own calculations based on appendix (A.8).

6.2.3 Descriptive Statistics of Health Attainment Component (1980 – 2009)

From appendix (A.9) we observed that, the theoretical number of years of life expectancy at birth recorded a significant rate and gradual increasing during the last three decades in Sudan. These figures confirmed the assertion by World Health Organization, in where there is a global improvement in the health circumstance during the past three decades. Consequently, this implies that, health care services are going better off decade following by decade. For decade's analysis, from table (6.3) we notice that; the average years of life expectancy at birth (Le) was registered gradual increases throughout the last three decades; it increased from 50.46 to 53.49 to 57.42 by (CV) of (0.02), (0.03) and (0.03), respectively. The increase in life expectancy at birth, confirmed by the deceased average of infant mortality rate (In) which it is recorded a decrease from 83.44 to 75.49 to 69.51, by (CV) (0.04), (0.03) and (0.02), respectively. Also, the average of the under-five mortality rate (M) reported decreasing rate during these three decades by 133.94 to 119.58 to 108.9 with (CV) of (0.04), (0.03) and (0.02), respectively. These decreases in statistics explore the fact that, the spread of health culture among many people in Sudan raised public senses. Table (6.3) reports the main points of these development occurred in this respect.

Table (6.3): Descriptive Statistics of the Health Attainment Component during the Period 1980 - 2009

period	life expectancy at birth (Le)			infant mortality rate (In)			Under-five mortality rate (M)		
	Stdev	Average	CV	Stdev	Average	CV	Stdev	Average	CV
1980-1989	1.12	50.46	0.02	2.97	83.44	0.04	5.38	133.94	0.04
1990-1999	1.48	53.49	0.03	1.99	75.49	0.03	3.59	119.58	0.03
2000-2009	1.78	57.42	0.03	1.74	69.51	0.02	3.10	108.9	0.02

Source: Own calculations based on appendix (A.9).

6.2.4. Descriptive Statistics of Gross Enrollment Rate and Adult literacy Rate

Based on appendix (A.10) and (A.11), we summarized the trends of the gross enrollment rates and adult literacy rates during the period (1980-2009).

Table (6.4): Descriptive Statistics of the Gross Enrollment Rate and Adult literacy Rate in Sudan during the Period 1980 - 2009

year	Gross Enrollment Rate			Adult literacy Rate		
	Stdev	Average	CV	Stdev	Average	CV
1980-1989	1.56	24.18	0.06	3.35	37.99	0.09
1990-1999	1.76	31.98	0.06	5.48	47.90	0.11
2000-2009	3.13	38.22	0.08	1.99	60.61	0.03

Source: Own calculations based on data on appendices (A.10) and (A.11) .

The trends of gross enrollment rate and adult literacy rate during the past three decades reflects the accumulation efforts that has been made in the field of education infrastructure, therefore the averages of gross enrollment rates and adult literacy rates registered increases as an impacts of education revaluation in Sudan, the quantity expansion in building new schools and appointment of new teachers. From table (6.4) we observe the increasing rates in the average of both indicators from 24.18 to 31.98 to 38.22 and from 37.99 to 47.90 to 60.61, respectively. These increases in averages indicate that, the promotions resulted from the careful devotion to education infrastructure and recent expansion in basic and secondary schools, beside the expansion in appointment of teachers has been played an important role.

6.2.5 Descriptive Statistics of Education Infrastructure Component (1980 – 2009

Table (6.5): Descriptive Statistics of Education Infrastructure Component in Sudan 1980 - 2009

period	Number of Educational Institutions per 100,000 populations (Y_1)			Pupil / Teacher Ratio(Y_3)		
	Stdev	Average	CV	Stdev	Average	CV
1980-1989	0.12	4.00	0.03	2.22	30.60	0.07
1990-1999	0.20	4.39	0.05	2.37	32.50	0.07
2000-2009	0.54	4.66	0.12	1.26	25.40	0.05

Source : Own calculations based on data on appendix (A.12).

Table (6.5) summarizes the trends of the component of education infrastructure index during the period 1980 – 2009. The figures in this table showed a steady

state growth in the number of educational institutions throughout the past three decades, whereas the educational institutions per 100000 populations moved in average from 4.00 to 4.39 to 4.66 with (CV) of (0.03), (0.05) and (0.12), respectively. This means that, the yearly increases of populations were upgraded by the yearly increase in educational institutions. In the other part, the average of teacher/pupils ratio showed a decreasing rate during these periods except the period (1990-1999) registered a 33 pupil per teacher in average whereas not far from the optimum average of teacher/pupils ratio. Adversely, the period (2000-2009) reported 25.40 pupils per a teacher in average which is consist with optimum ratio in this respect. Therefore, these primary analyses of the growing path of the component of the composite health and education indices throughout the past three decades reflects the facts about the status of overall social services delivered in Sudan during the past three decades. However, these primary analyses confirmed by the assertion of the United Nations in its Human Development Report published in 1999, in which it declare that "the insufficient access to appropriate and quality of social services for health, education, water sanitation and nutrition present the major causes of poverty in Sudan, for instance the low access to social services is mainly due to a deficient physical infrastructure (such as primary health care centers, dispensaries, rural hospital and health centers, primary and secondary schools, wells and latrines". The poor quality of these services is mainly due to insufficient equipment, materials and human resources (such as medical equipment, trained medical staff, water engineers and teachers, medicines, basic food ingredients). Both poor quality and poor physical infrastructure of social services are a consequence of decreasing public expenditures on health and education sectors. Hence table (6.6) explore these low levels of achievement reported in average of the composite health and education indices, in where the average of health index was spans between (41.65 to 37.56) with decreasing rates variation of coefficients by (0.04, 0.02 and 0.02), and education was between (32.22 to 24.19), with (CV) of (0.05, 0.06 and 0.04).

Table (6.6): Descriptive Statistics of Health and Education Indices during the Period (1980-2009)

year	HI			EI		
	stdev	average	CV	stdev	average	CV
1980-1989	1.81	41.65	0.04	1.28	24.19	0.05
1990-1999	0.86	38.59	0.02	1.69	29.19	0.06
2000-2009	0.70	37.56	0.02	1.50	32.22	0.04

Source: Own calculations based on data presented on appendices (A.6) and (A.12).

In view of practice adopted by United Nations in calculating Human Development Index (HDI), we followed the same procedure taking the simple arithmetic mean of these relevant achievements in health and education indices to constructing the composite social development index in Sudan.

6.2.6. Descriptive Statistics of Explanatory Variables of Health Index Equation (1980-2009)

To achieve the research objectives, we firstly begin with some descriptive statistics for explanatory variables that are considered into health index equation, these are: public expenditure as percentage of GDP (HE), real GDP per capita (Re) and under-five mortality rate (M) as it displayed in table (6.7):

Table (6.7) Descriptive Statistics of Explanatory Variables of Health Index Equation

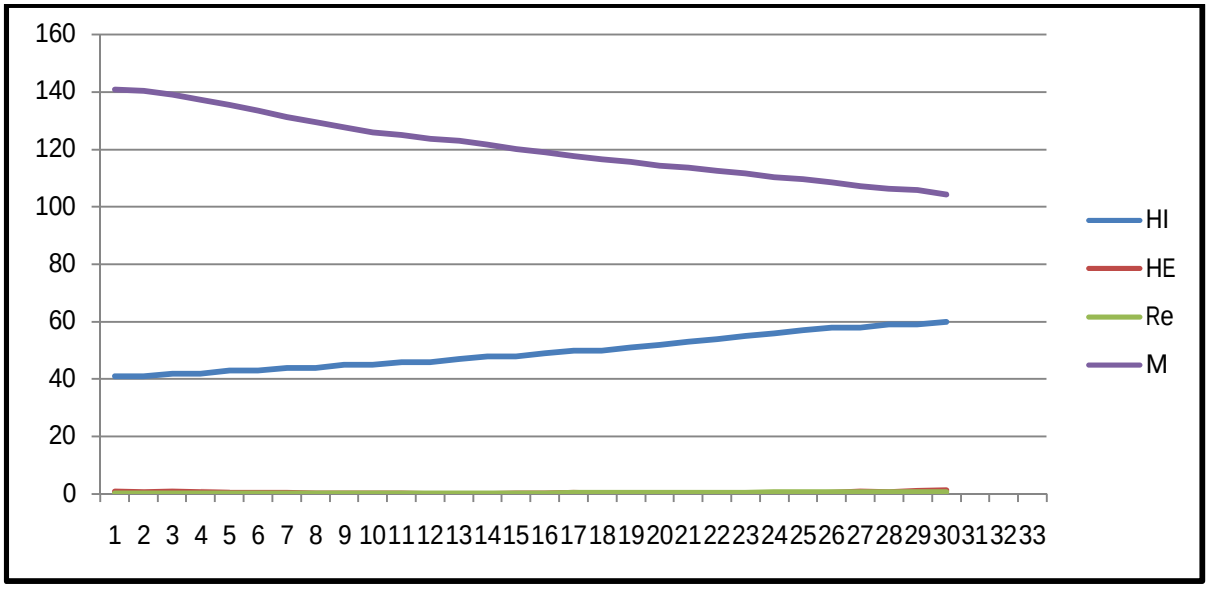
Indicator	Average	Standard Deviation (SD)	Coefficient of Variation (C.V)
HE	0.52	0.33	0.64
Re	0.43	0.09	0.23
M	120.8	11.17	0.09

Source: Own Calculations based on data on appendices.

From table (6.7), we observed that, health expenditure as percentage of GDP (HE), real GDP per capita (Re) and under- five mortality rates (M) reported only 0.52, 0.43 and 120.8 in average respectively, with variation of coefficient of (0.64), (0.23) and (0.09), respectively. This means that, the accumulation efforts of health authorities and others health partners (health organizations) and concerned NGOs in Sudan does not succeeded to meet 50% level of health performance in average due to many factors among these factors, the reductions occurred on public expenditure as the results of (SAPs) procedures in the year

1992, which led in decreasing the percentage of public heath expenditure that devoted to funding health services (commercialization services policy) register 0.52 in average. In addition to that, real GDP per capita registered, low rate in spite of recent economic growth rate (6% above), this may attributed to higher poverty prevalence in Sudan due to complex factors (poverty circulation) as it examined by many researchers in chapter two. The figure (6.1) shows the trend of target health index equation variables during the research period.

Figure (6.1): the Graphical Trend of health index variables during the period (1980- 2009)



Source: Based on data of the various appendices.

6.2.7. Descriptive Statistics of Explanatory Variables of Education Index Equation (1980-2009)

The following table (6.8) summarized the descriptive and statistical analysis of explanatory variables for education index equation:

Table (6.8): Descriptive Statistics of Education Equation Variables (1980-2009)

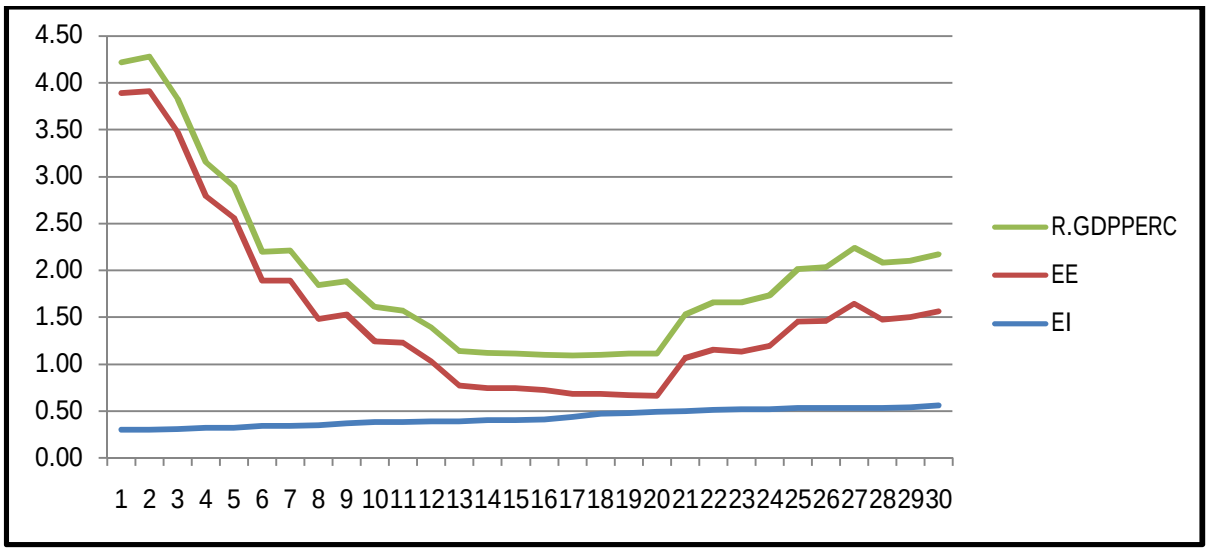
Indicator	Average	Standard Deviation (SD)	Coefficient of Variation (C.V)
Re	0.43	0.09	0.23
EE	1.11	0.97	0.87
Y_1	45.23	3.84	0.08
Y_2	393.71	66.02	017

Source: Based on data of the various appendices.

The statistical analysis of education index equation variables in table (6.8) revealed some important indicators for interprets the behaviors of these variables throughout the research period. Thus, real GDP per capita (Re) and public expenditure on education as percentage of GDP (EE) reported 0.43 and 1.11 in average respectively, with variation of coefficient (0.23) and (0.87) hence, these low levels of spending variables (private and public) reflects the low levels of education performance, and this may due to the structural adjustment programs (SAPs) and liberalization policies adopted in Sudan since 1992, which resulting in reducing public spending on social services significantly, in addition to the high prevalent of poverty in Sudan (in spite of the considerable recent economic growth rates resulted from oil production) and others factors led to inequality in income distribution in Sudan.

Consequence, these low levels of spending variables (private and public), education infrastructure (physical infrastructure Y_1) and the number of teachers (education manpower Y_2) on basic and secondary schools reported 43 and 394 in average, with variation of coefficient (0.08) and (0.17) respectively. Also these low levels of education infrastructure (physical and manpower) explored the facts that, the gradually deteriorated on the quality of education infrastructure resulted from deteriorations in (text books, classrooms, experimental syllabuses (curriculums), environment, teachers training and other factors), since there was no enough priority from government to this vital sector. However, due to deteriorations in affordability and accessibilities factors for population to realize their social services, this index registered below 50% on average, the following figures illustrate the trends of these variables

Figure (6.2) the Graphical Trend of Real GDP and public Expenditure with Education Index in Sudan (1980-2009)



Source: Based on data on various appendices.

The graph on figure (6.2) illustrates the carve of education equation index, and it is obviously, education index is responsive more to the changes on real GDP per capita (Re) rather than public expenditure on education. These figures explain how fare education index are influences by the expenditure variables.

6.2.8. Descriptive Statistics of the Explanatory Variables of Social development Index Equation 1980 -2009

In this subsection we embark on descriptive statistics for the explanatory variables of social development equation, hence, we calculated the average (mean) and standard deviation (S.D) and then the coefficient of variation (C.V) as it identified in the following table:

Table (6.9) Descriptive Statistics of Social Development Equation in Sudan 1980 -2009

	SDI	Re	HPI	Y_1	SDE
Average	0.46	0.43	9.11	45.23	1.63
SD	0.07	0.10	0.93	3.84	1.17
CV	0.16	0.23	0.10	0.08	0.72

Source: Own Calculations based on data various appendices.

The statistical analysis of the variables that were considered on our equation, revealed some important facts about social development index during the

research period, among these facts that, the low average rates that was calculated on real GDP per capita (Re) and the health's and education's physical infrastructure in which those reported only 43, 9 and 45 with coefficients of variations (0.23), (0.10) and (0.08), respectively.

Also, public expenditure as percentage of GDP that devoted to finance social services placed behind the minimum level required, however, the statistical analysis revealed only 1.63 in average of total public expenditure in Sudan was released, with coefficients of variations (0.72). Clearly this low level in allover considered variables and factors in terms of their performances in average reflects its impacts on social services delivered in Sudan during the past three decades, and as a result of these impacts, social development index reported only 46 in average with coefficients of variations of (0.16).

However, to conduct our analysis, the data should be in real terms to avoid spurious regression, thus, all considered variables was transformed in term of natural logarithm to attain a constant variance in the series, and then this logged data was used in the empirical analysis.

6.3. The Results of Health Index Equation

In this subsection and as it mentioned before, health index is a function of many variables and factors, among these variables are, public expenditure on health as percentage of GDP (HE), under five mortality rate (M) and real GDP per capita (Re). These variables remain the main determinants of health index in Sudan. By applying the Ordinary Least Squares technique (OLS), we estimated the log linear form of equation (5.9). The estimated results are shown in table (6.9), where the figures inside the parentheses are the t-ratios of the estimated parameters (elasticities) and those inside the square brackets are the significance levels as in the following table:

Table (6.10): the Effects of Real GDP Per capita, Public Expenditure on Heath and Under-Five Mortality on Health Index in Sudan (1980- 2009)

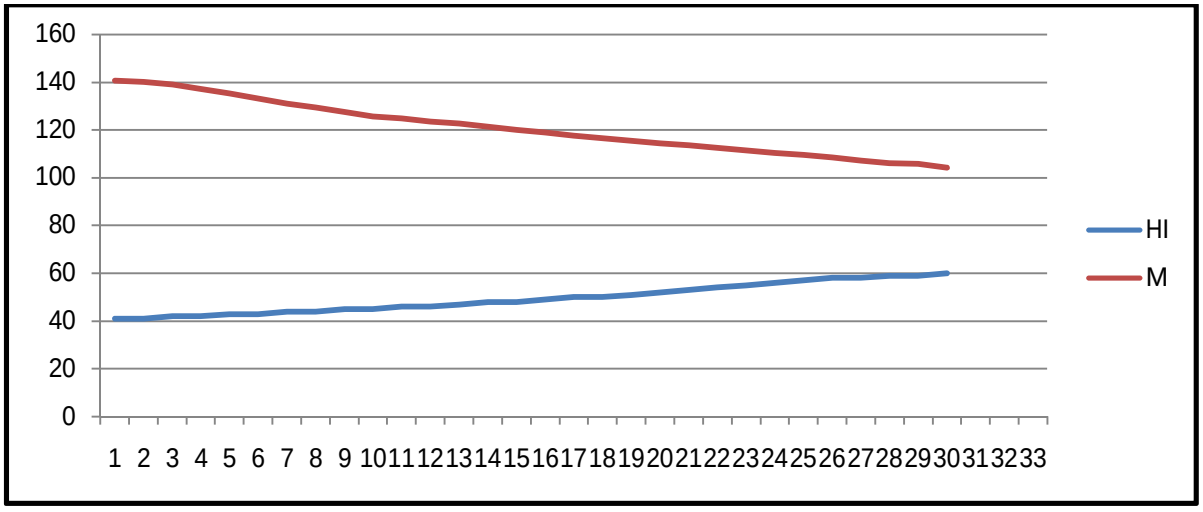
Estimated Coefficient (Elasticity) of				F-Ratio	R^2	D.W
Constant	lnRe	lnHE	lnM			
8.42	0.123	0.008	-1.044	1141.95		
(20.17)	(4. 31)	(1.83)	(-15.64)	[0.000]	0.99	1.34
[0.000]	[0.000]	[0.078]	[0.000]			

Source: Own Calculations based on data on various appendices.

The estimated results of table (6.9) suggest that, the explanatory variables taken into consideration explain 99% of the variations in the health index in Sudan. All expected signs are confirmed by the empirical results, and overall model is significant at 1% as indicated by F-ratio. All estimated coefficients (elasticities) are statistically significant at 1% except the coefficient of health expenditure as percentage of GDP, which is significant at 10% as indicated by the t-ratio. No autocorrelation problem exists in the estimated model. The results obtained indicate that, real GDP per capita (Re) impact level on progressing health index significantly at 1%, while under-five mortality rates (M) affects the level of health index negatively and significantly at 1% percent. This indicates that the major important changes on this index are due to these two variables. While the health public expenditure as percentage of GDP (HE) impact significantly at 10%, hence, the estimated result of this variable revealed implicitly the role of private expenditure when the (SAPs) measures were valid. Therefore, the elasticities of health index with respect to the changes in under-five mortality rates (M) and real GDP per capita (Re) are estimated at (-1.044) and (0.123), respectively. This means that, the decrease in under-five mortality rates by 1% will increase health index by 1.044%, while the increase of real GDP per capita by 1% will increase the health index by 0.12%. In other hand, an increase in health public expenditure as percentage of GDP by 1% will increases health index only by 0.008%. This result confirms that due to the measures of structural adjustment programs (SAPs) and liberalization policies adopted in Sudan since 1992, public spending on social services has been reduced. Also these results reveal that, health index in Sudan is more responsive to the changes in under-five mortality rates rather than to real GDP per capita and

heath public expenditure as percentage of GDP. Figure (6.3) illustrate the trends of health index with respect to under -five mortality rates over time:

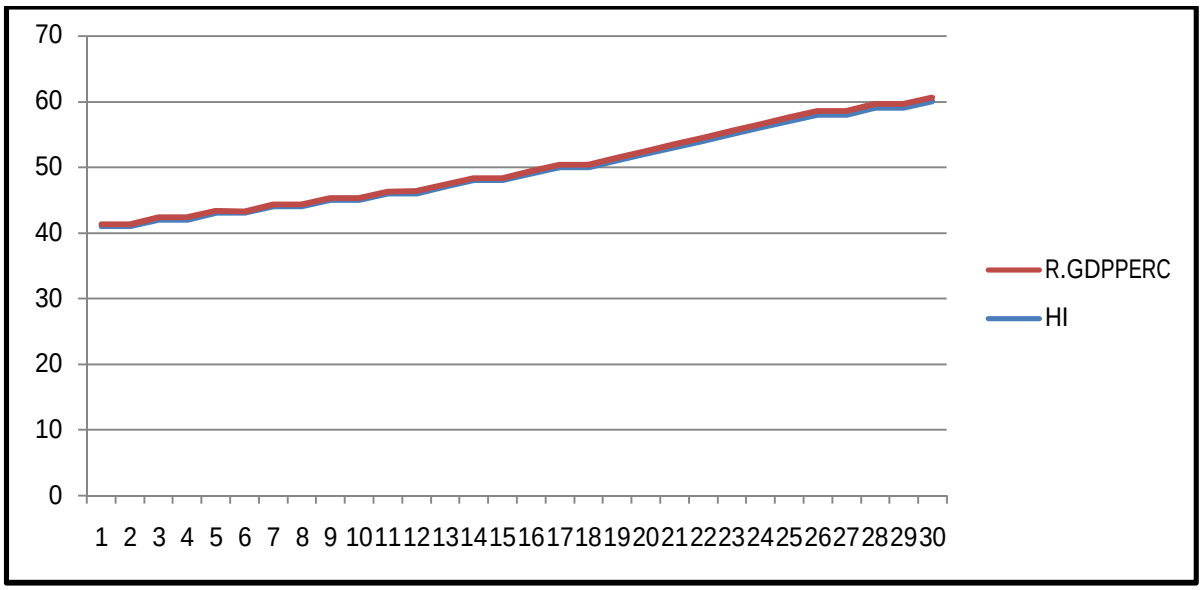
Figure (6.3) the Graphical Trends of Under-Five Mortality rate and Health Index (1980- 2009)



Source: Based on data on appendices.

Figure (6.3) illustrates the significant relation between under-five mortality rates and health index during the study period. Thus, the policy-makers and the health authorities must draw their attention to the most important factors that determinate under-five mortality rates in Sudan. Among other policy variables, especial health care must be devoted to infant mortality through sanitation, early vaccination of neonatal and clean water facilities and good nutrition to those new born and their mothers that are crucial for susceptibility of infants to water-borne diseases. In other hand, the relation between health index and real GDP per capita during the past three decades can illustrate by the following figure (6.4):

Figure (6.4) the Graphical Trends of Real GDP Per capita and Health Index in Sudan (1980-2009:

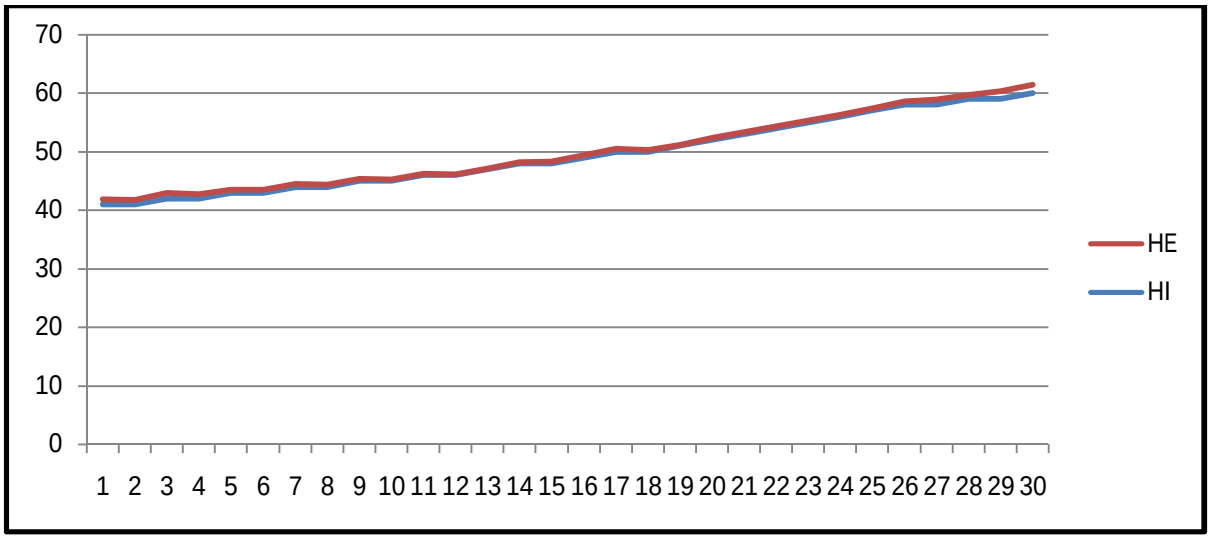


Source: Based on data on appendices.

Figure (6.4) demonstrate the relation between real GDP per capita and heath index. The figure suggests that, in view of the structural adjustment programs (SAPs) and liberalization policies that were adopted in Sudan early1992, public expenditure on social services has been reduced significantly. Thus, in view of these policies and measures, real GDP per capita tack constitutes an important role in enhancing the private expenditure as alternative source for affording social services fees, however it support family's affordability to basic social services they need. When there is a considerable economic growth rates as it happened in the last two decades in Sudan by (6% above), and when there is a good nation income, the real GDP per capita will enhance health index strongly. This main that health index is affected considerably by economic growth rates and good mechanisms of national income distribution. Therefore, as we can observe in figure (6.4), there is steadily state growing of health index in view of the recent steadily growing rate of real GDP per capita (Re). Also, the relation between health index and health public expenditure as percentage of GDP that devoted to funding various health operations and activities through the figure (6.5), we can observe that, the two curves are tended to go together closely, this suggest that, despite of considerable reduction in public expenditure on social services in Sudan in the last two decades, health public expenditure as

percentage of GDP remain ones of significant variables that can play an important role in enhancing health index, we illustrate this tendency by the following figure:

Figure (6.5): the Graphical Trends of Health Public Expenditure and Health Index in Sudan (1980- 2009)



Source: Based on data on appendices.

6.4. The Results of Education Index Equation

In this subsection, we reveal the estimated results of education equation. As we reported in our model early, however, education index is a function of real GDP per capita (Re), public expenditure on education as percentage of GDP (EE), education physical infrastructure (Y_1) and the number of teachers per 100000 populations (Y_2). These variables constitute the most important ones on illustrating the changes in education index during the study period. Thus, the estimated equation results of these variables under our thoughtfulness revealed highly significant in exploring the changes in education index. To avoid the correlation which was existed between our selected variables, we computed the Pearson correlation matrix of explanatory variables of education index as the following table (6.11):

Table (6.11): Pearson Correlation Matrix of Explanatory Variables of Education Index Equation in Sudan 1980 -2009

	Re	Y_1	Y_2	Y_3	EE
Re	1	.399	**.924**	**-.614**	-.218
Y_1	.399	1	.487	.141	-.261
Y_2	**.924**	.487	1	**-.673**	-.403
Y_3	**-.614**	.141	**-.673**	1	.083
EE	-.218	-.261	-.403	.083	1

Source: Based on data on appendices.

From table (6.11), it is clear that there is high correlation between real GDP per capita (Re) and the number of teachers per 100000 populations (Y_2) registered about (0.92), also the correlation existed between real GDP per capita and teacher /pupils ratio (Y_3) reported at(-0.61), for these reasons we omitted these variables from our estimated model. We estimated the log linear form of equation (5.10) by applying the Ordinary Least Squares technique (OLS), we estimated the log linear form of equation (2). The estimated results are shown in table (6.11), where the figures inside the parentheses are the t-ratios of the estimated parameters (elasticity) and those inside the square brackets are the significance levels.

Table (6.12) the Estimated Results of Education Equation (1980 -2009)

Estimated Coefficient (Elasticity) of			F-Ratio	R^2	D.W
lnRe	lnEE	lnY_1			
0.4082	0.013	0.580	45950.65		
(2.909)	(0.365)	(4.134)	[0.000]	0.93	1.88
[0.0077]	[0.7178]	[0.004]			

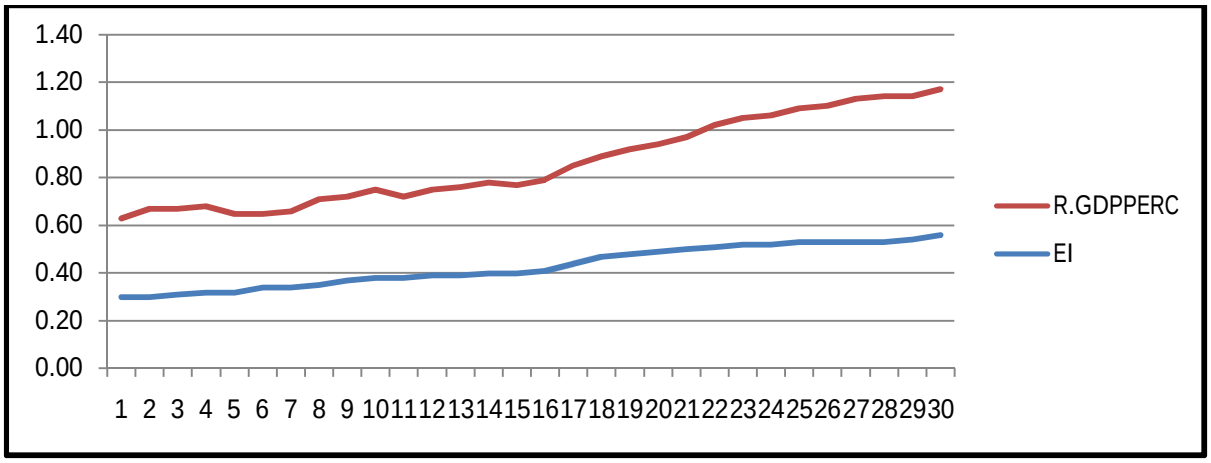
Source: Own Calculations based on data on various appendices.

The estimation results in table (6.12) reveal that, the explanatory variables taken into consideration explain 93% of the changes in the education index. All the expected signs are confirmed by the empirical results. Overall model is significant at 1% as indicated by the F-ratio, no autocorrelation problems existed in the estimated model. The results obtained indicate that, real GDP per capita (Re), education infrastructure (Y_1) and public expenditure on education

affected the education index significantly at 1% level, this indicate that the major changes on education index are mainly due to real GDP per capita and education infrastructure variables respectively. Hence the estimated results revealed implicitly the vital and important role played by the private expenditure, when the (SAPs) were valid, the elasticity of the education index with respect to the changes on real GDP per capita at 41% and 58% infrastructure respectively.

Thus, an increase in real GDP per capita by 1% will increase the education index by 0.40%, while an increase by 1% in education infrastructure will increase the education index by 0.58%. Public expenditure on education as percentage of GDP has a weak effect on the index as it is clear from table (6.12), the increase in public expenditure on education as percentage of GDP by 1% will increases education index only by 0.01%. This result comes consistent with the measures of structural adjustment programs (SAPs) and liberalization policies adopted in Sudan in early 1992s, public spending on social services has been reduced, and hence, these results confirmed the trends of public funding. However, the estimated results reveal that, education index in Sudan respond quickly to the changes in real GDP per capita than to education infrastructure and public expenditure on education as percentage of GDP. Figure (6.6) illustrate the graph of education index with real GDP per capita separately:

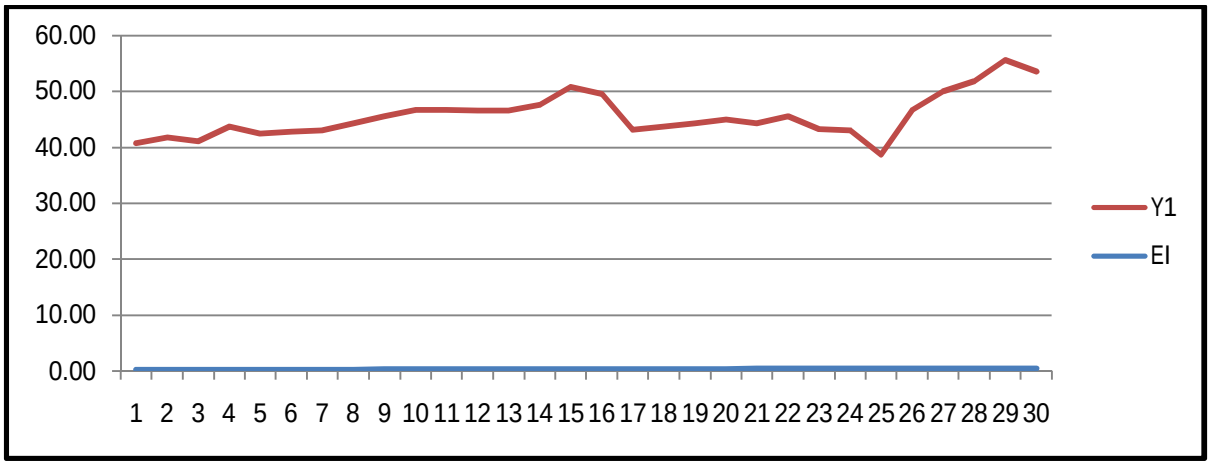
Figure (6.6): The Graphical Trends of Real GDP with Education Index in Sudan (1980 -2009)



Source: Own Calculations based on data on appendices.

As we could observe from the figure (6.6), the trends of education index with respect to the changes in real GDP per capita goes upward, reflecting the importance of the real economic growth rates that supports the real income per capita, which suggest implicitly that, increases in the social benefits. However, the effects of real GDP per capita on education index will support by the effects of education infrastructure as it presented by the following figure:

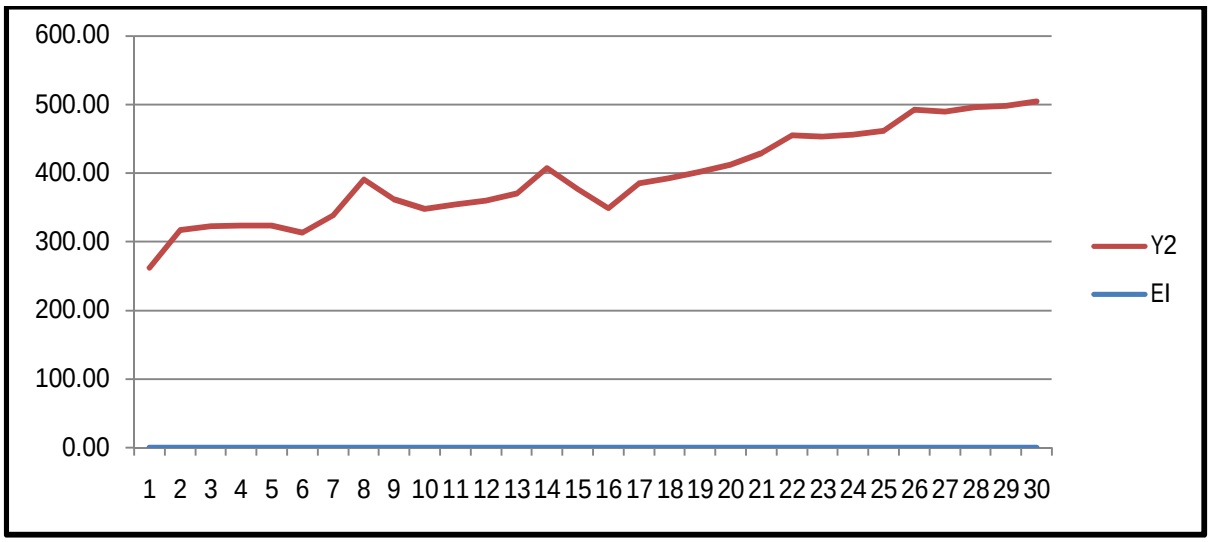
Figure (6.7): The Graphical Trends of Education Infrastructure (Y_1) with Education Index in Sudan (EI) (1980 -2009



Source: Own Calculations based on data of the appendix.

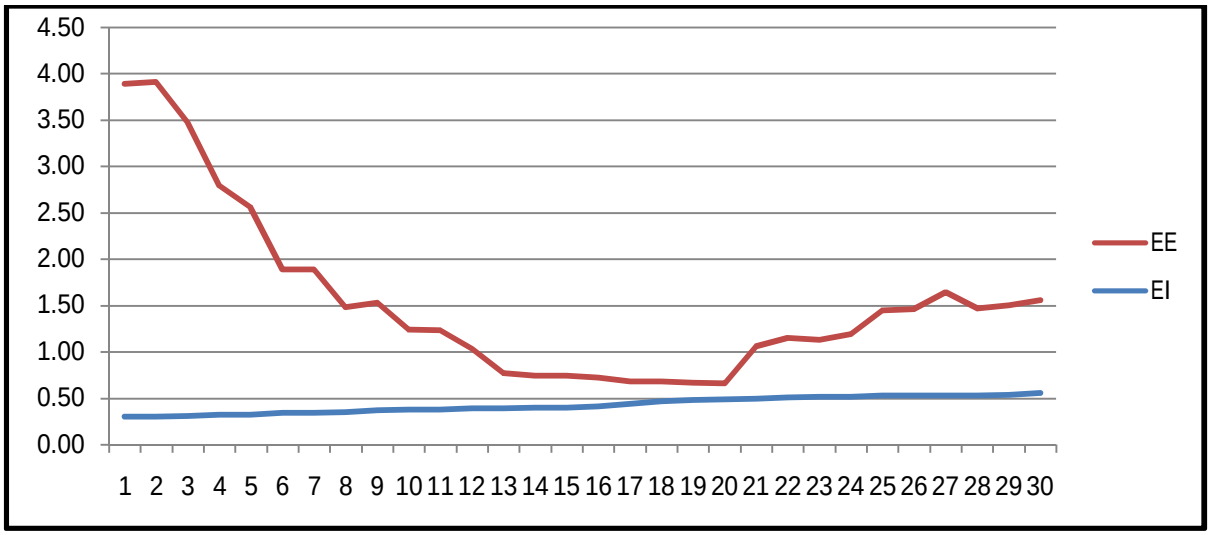
Figure (6.7) illustrates the trends of education index with respect to education infrastructure in Sudan. As we reported early in this subsection, the elasticity of change in education index with respect to education infrastructure registered at 58% level. However, education infrastructure during the past three decade witnessed some fluctuations, when the education authorities changed the education ladder by merging the intermediate schools to primary schools constructing basic schools, beside the rabid demand of schooling, the beside some deterioration that happened in some educating elements and changing curriculum more than twice. Also, the trend of education index with regard to the changes in teachers per 100000 populations and public expenditure on education can be shown by the following figures:

Figure (6.8): The Graphical Trends of Teachers Per100000 Populations (Y_2) with Education Index in Sudan (1980 -2009)



Source: Own Calculations based on data on appendices.

Figure (6.9): the Graphical Trends of Public Expenditure on Education (EE) with Education Index (EI) in Sudan (1980 -2009)



Source: Own Calculations based on data of the appendix.

6.5. The Results of Social Development Index Equation

The objective of this study is to investigating the impact of public expenditure on social development in Sudan throughout the period mentioned early, and as we determined the most important variables and factors that has been played a significant role in delivering social services. This subsection tends to investigate the overall social development index in Sudan. As it mention in previous chapters, social development defined "exclusively" by the social progress achieved in the two main vital sectors in Sudan, these are health and education sectors. The progress in these sectors reflects its impacts on various dimensions of people's life, because these sectors are constitutes the main source of creating capacity buildings and enlighten peoples in various diminutions and then replay these capacity buildings and enlightenment are generating and obtaining social services on health and education for people to realize their social welfare. So social services is subordinate to spending variables and infrastructure variables, among other variables, real GDP per capita, public expenditure on social services, health and education infrastructure (physical and manpower). These variables comprise the main variables that determine the availability and accessibility of social services. We excluded the heath manpower and the number of teacher's per100000 populations from the estimated model since there was correlation with real GDP per capita (Re), as it presented in the following table (6.13):

Table (6.13) Pearson Correlation Matrix of Explanatory Variables of Social Development Index in Sudan 1980 -2009

	Re	EE_3	HPI	HMp	Y_1	Y_2
Re	1	.323	-.222	.867	.399	.924
EE_3	.323	1	-.375	.596	.200	.087
HPI	-.222	-.375	1	-.413	.240	-.076
HMp	.867	.596	-.413	1	.372	.731
Y_1	.399	.200	.240	.372	1	.487
Y_2	.924	.087	-.076	.731	.487	1

Source: Own Calculations based on data on appendices.

However, table (6.13) showed higher correlation between real GDP per capita and health manpower where it registered at (0.87), also there is higher correlation between real GDP per capita and the number of teachers per100000

populations (Y_2) which registered at (0.924). For these reasons these tow variables excluded from the estimated model. Also there is higher correlation between public expenditure variables as it is reported in table (6.14) where it was calculated at (0.99%). Therefore, we used the estimated education expenditure in term of health expenditure as instrumental variable denoted by (EE_3), then it used as explanatory variable.

Table (6.14): Pearson Correlation Matrix between Social Development Expenditure Variables 1980-2009 in Sudan

Pearson Correlation	HE	EE
HE	1	0.991
EE	0.991	1

Source: Own Calculations based on data on appendices.

By applying the same procedure adopted in equation (5. 9) and equation (5.10), we were estimated the log linear form of equation (5.11). The estimation results are shown in table (6.15), where the figures inside the parentheses are the t-ratios of the estimated parameters (elasticities) and those inside the square brackets are the significance levels.

Table (6.15): The Estimated Results of Social Development Equation 1980 -2009

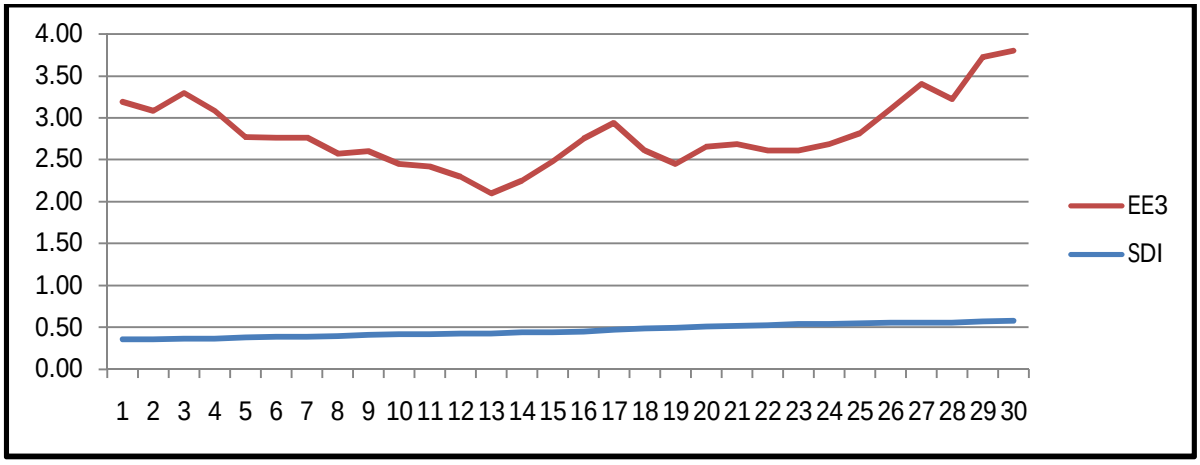
Estimated Coefficient (Elasticity) of				F-Ratio	R^2	D.W
lnRe	$lnEE_3$	lnHPI	lnY_1			
0.2239	1. 1418	0. 1299	0.2197	53673.75		
(2.1010)	(4. 3896)	(1. 8154)	(1.9911)	[0.000]	0.94	1.28
[0.000]	[0.003]	[0.027]	[0.009]			

Source: Own Calculations based on data on appendices.

The estimation results in table (6.15) reveal that, the independent variables that examined explained 94% of the changes in the social development index. Overall model is significant at 1% as indicated by the F-ratio. Also, all estimated coefficients (elasticities) are statistically significant at 1% level except health physical infrastructure (HPI) is significant at 5% level, as it indicated by the t-ratio. No autocorrelation problem between the estimated variables. The results obtained signify that, real GDP per capita (Re), social expenditure (EE3) and education infrastructure (Y1) impacts significantly at the 1% level while health physical infrastructure (HPI) impact significantly at the

5% level on progressing social development index. These results indicate that the major changes on social development index are due to variables, hence the estimated result revealed implicitly the role of private family's expenditure. Also, these results implicitly said that the pressure and the burden of realizing social services in Sudan during this period focused on the family's budget. Consequently, the elasticity of the social development index with respect to real GDP per capita was calculated at 0.22% level. These means that, an increase in real GDP per capita by 1% will increase social development index by 0.22%, while an increase in social expenditure by1% will increases social development index by 1.14%, an increase in health physical infrastructure by 1% will increase social development index by only 0.13% and increase in education infrastructure by 1% will increase social development index by 0.22%. These results reveal that social development index in Sudan is highly responsive to social expenditure rather than real GDP per capita, education infrastructure and health physical infrastructure variables. The highly relation between social expenditure and social development index can be illustrated by in the following figure (6.10):

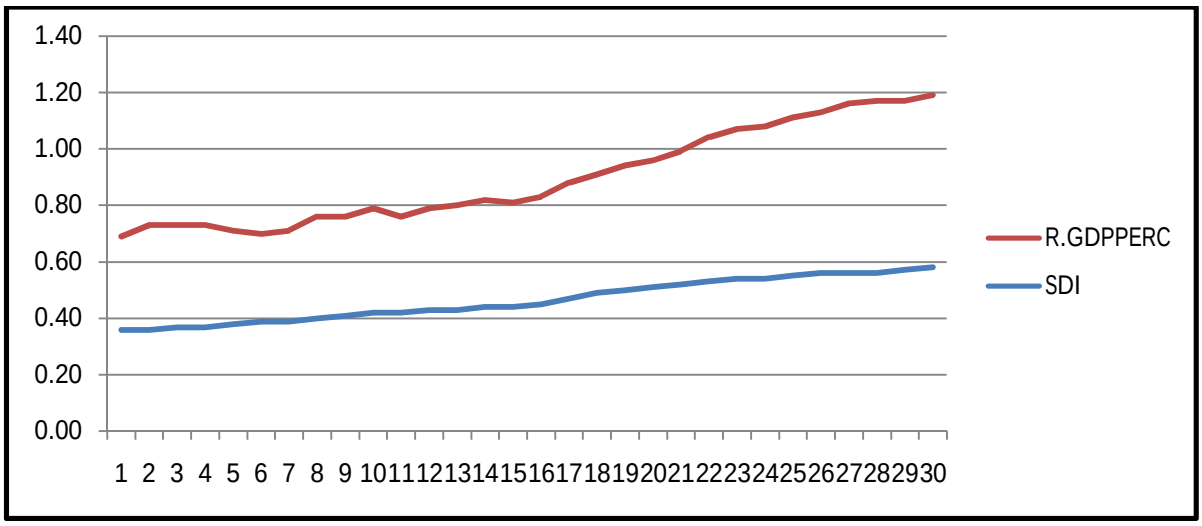
Figure (6.10): The Graph of Social Development Expenditure with Social Development Index in Sudan 1980 -2009



Source: Own Calculations based on data on appendices.

While the relation between real GDP per capita and social development index illustrated by in the following figure (6.11):

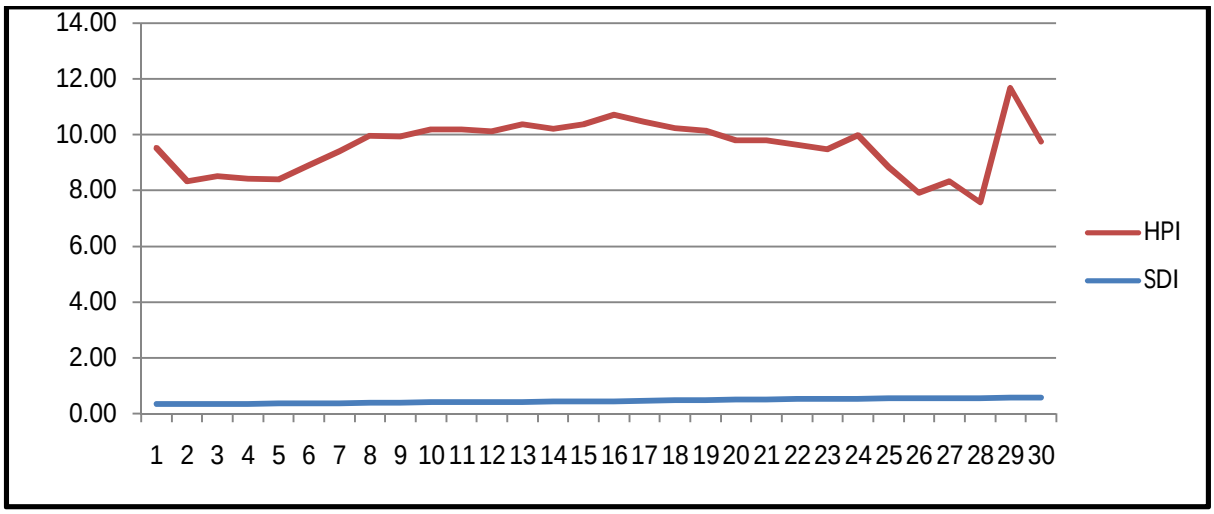
Figure (6.11) The Graph of Real GDP Per capita with Social Development Index 1980 -2009



Source: Own Calculations based on data of the appendix.

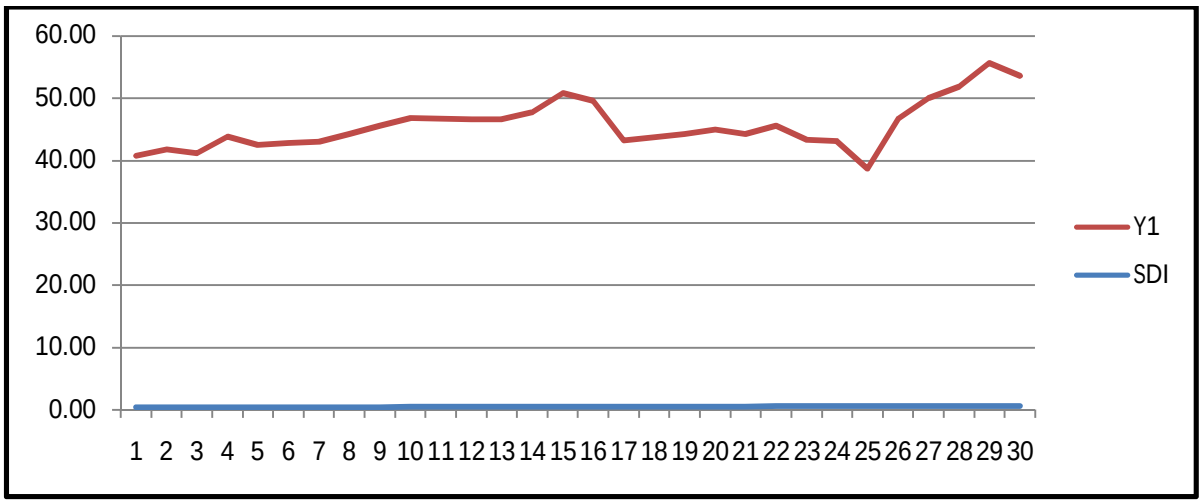
Also, the relations between health and education physical infrastructure (HPI) and (Y_1) with social development index explored by the following two figures (6.12) and (6.13):

Figure (6.12): The Graph of Health Physical Infrastructure with Social Development Index in Sudan 1980 -2009



Source: Own Calculations based on data on appendices.

Figure (6.13) the Graph of Education Infrastructure with Social Development Index in Sudan 1980 -2009



Source: Own Calculations based on data on various appendices.

The finding in this chapter is directly answered the study questions that presented in chapter one, we verify the first question concerned with "whither government public policies succeeded in improving the social development indicators?" That, the government of Sudan is still in need to utilize pro-poor public policies, to enhance the accessibility and affordability of poor to public services, due to deficiencies of their income, especially those located in the marginal areas. Despite there is an expansion in public and private health and education institutions recently, but the adequacy standard criterion as measured by the ratios of public spending on health and education is not only still very low, but also still focus on quantity rather than quality in Sudan. However, the successful of public policies in this since in recent years concerning these expansions seemed as political acceptable rather than strategic orientations. Therefore, reforms of income distributions mechanisms are greatly needed.

We prove the second question concerned with "main factors affecting basic social services", the main barriers to conducting considerable level of social services was social expenditure, real GDP per capita, under-five mortality rates and the quality of health and education infrastructure in Sudan. Thus, unless public policies adjusted to overcome the problems associated with these variables, the level of social development will be ambiguous. Finally, the third question concerned with the "accessibility of poor to public services". That in

terms of the (SAPs) measures adopted early in 1990s which focused sharply on reduction public expenditure, with the recent orientation of services commercialization policies and instability in public responsibility concerned with public services, with the widespread of poverty in Sudan, these are led to deprive poor from access social services especially those located in remote areas in Sudan.

According to the final results, the research confirms and accepts all hypothesis, the first hypothesis is that, "given the positive economic growth achievements over a relatively long time period, perhaps it is not more straightforward to establish a link between public spending and social services", the second is "public expenditure is directly linked with social services in Sudan given the positive economic growth for the long period of time" and then the third one is "poor people dose not benefit more as rich ones from public expenditure on social services" as it is clear from the results.

However, the chapter discussed descriptive statistics analysis for indicators and the explanatory variables of health, education and social development indices. A regressions method was applied then we examined and reported the most important results and the major variables that determinants health and education indices then, we reported the overall social development index results. Finally, we tested the hypothesis and concluded the chapter.

6.6 Summary, Conclusion and Recommendations

The study investigated the impact of the macroeconomic policies mainly public expenditure on social development index in Sudan during the period 1980-2009. The research calculated and examined the impact of the components of social development index in Sudan. These components constitutes from health index and education index. The study used secondary time-series data gathered from different sources, namely, Sudanese Census 2008, Federal Ministry of Health, Federal Ministry of Education, and States support Fund, Ministry of Finance and National Economy, Sudan Central Bureau of Statistics and from UN, the Level & Trends in Child Mortality, Report 2011. Estimates Developed by the UN Inter-agency Group for Child Mortality Estimation (UNICEF, WHO, World Bank, UN DESA, UNPD).

For the purpose of investigating the impact of public expenditure on social development index in Sudan, the standard methods are applied to calculate the values of sub-indices (Health Index (HI) and Education Index (EI)) which were thereby used to compute the social development index for Sudan during the study period.

Thus, based on the values of public expenditure on health and education for the years 1986, 1995 and 1999, 2002 and by using the growth rate of two end points, public expenditure on health and education as a percentage of GDP was estimated for the period under consideration since there were no accurate continuous time series data available. For our purpose, simple regression methods are applied at three stages. In the first stage, the main variables and factors that determinants the levels of health index in Sudan were examined, while in the second stage we examined the main variables and factors that determinants the levels of education index and then, the third stage were investigated the overall level of social development index in Sudan.

The first stage results revealed that, under-five mortality rate was considered to have major and significant variable on health index during the past three decades. However, the policy-makers and health authorities in Sudan must draw their attention on the factors that determine under-five mortality rates. Among the other policy variables that determine the level of health index, especial health care must be devoted to combat infant mortality through sanitation, early vaccination of neonatal and clean water facilities and good nutrition to those new born and their mothers that are crucial for combating under- five mortality rates in Sudan. Also the results in this regard revealed that, health index in Sudan is more responsiveness to the changes in under-five mortality rates and real GDP per capita rather than to heath public expenditure as percentage of GDP as it examined. Thus, when there is a considerable economic growth as it happened in the last two decades in Sudan by the rates of 6% above, and when there is a good distribution mechanism of national income, then the real GDP per capita will enhance health index strongly. Moreover, policy makers and health authorities in Sudan should pay attentions mainly on national income distribution mechanism. Thus, an increase in income per capita through

increase economic growth rates will enhance people's affordability for various health services.

The second stage results explored the most important variables and factors in education index in Sudan that has been examined, thus, among these estimated variables are real GDP per capita (Re) has been played a significant role in determine the actual level of education index. This explores implicitly that, recently education services in Sudan depended highly on families funding (out of pockets) while the public expenditure and other organizations and government partners covered the rest resources needed. However, the investigation results revealed that, the public expenditure on education as percentage of GDP has less effects on the level of education index. Owing to the fluctuations in political circumstance and the early wars in 1983 and the igniting wars prevalent in most parts of Sudan (Darfur, Blue Nile and Sought Kordfan conflicts) and in view of the early (SAPs) procedure and liberalization policies adopted in Sudan since 1992 and recent economic dilemma (economics boycott), these circumstance, led us to observe the poverty in the eyes and faces of people due to the widespread of famine and starvation in Sudan. Also, the higher reliance of education services into private funding, this putted more pressures on families' accessibility to realize their education services. However, these issues led to low level in education attainment and deterioration in the education quality. Therefore education index reported only 43% with only (0.20) coefficient of variation (C.V). Therefore, increased attention should give to education infrastructure; schools infrastructure and environment which had have significant in promoting education quality. Among other policy variables that enhance education index, increases real GDP per capita is highly recommend to facilitates accessibility of people to various social services.

Moreover, these results confirmed Suleiman (2007) finding, in which he find that, "the explanation of poor quality of education in Sudan is related to several reasons, the first reason is the low public spending on education as a proportion of total public spending , the second reason for the low quality of education in Sudan is that despite the expansion in public and private education but the adequacy standard criterion (as measured by the ratios of spending on education and enrolment in education) is not only still very low, but also still focus on quantity over quality in Sudan".

The third stage investigated the level of social development index in Sudan, in this stage, four policy variables was examined, the results of these variables suggest that, to achieve a considerable level of social development in Sudan, policy makers should focus their attention on the policies that increases family's income through various policies. The key policy variables were social expenditure and the real GDP per capita. Thus, a considerable share of public expenditure should devote to funding social services, in addition to that, an increase in real GDP per capita will enhances and enables many of the poor families to realize their health and education services they wants, when there was public policies aimed at reduces public expenditure on social services since early 1990s. However, the effort of policy-makers should focuses on the procedure that enhances the increase the income of families through various economic policies.

Also, especial attention should give to education infrastructure, by increase the quality of basic and secondary schools to enhance good knowledge intake. As we observed in the last two decades the claps on education in Sudan due to public and political pressure that forced many states in Sudan to swap the quality of education by quantitative expansion, while this swap seem politically acceptable in the short term but it will have serious repercussions on educational trends and economic and even political directions in the medium and long terms. Thus, good education infrastructure and environment provisioned by (facilities, equipments, sufficient classrooms, textbook) will supports educational efficiency then good schooling, good educated people, and by the way, good educated people will led to good healthy people and then good educated healthy people will generates(creating and utilizing capacity building) a suitable income that utilize in various social benefits. In addition to the two policy variables above, health infrastructure has had significant role in provision considerable level of social development in Sudan, through establishing and facilitating health institutions. Therefore, the provision of hospitals with complete medicine departments provides health services every day every way. Increases hospitals, beds health centers and dispensaries will provide important health services to the populations. Hence, population's growth should upgrade with growing rates in health services. Furthermore, there is a critical problem in Sudan in reporting public affairs; data of public

actions, public funding in public sectors was interrelated with the states and local community funding, donations and other NGOs resources. However there was no accurate public expenditure data available, so this research is attempting to examine the impact of public expenditure on social development indicators based on available data.

Finally, among all other variables that have been examined, social expenditure, under-five mortality rate (M) and real GDP per capita (Re) variables are constituted the major effects on the level of social development achieved in Sudan. Based on these results, the researcher recommends the following:

1. Policy makers in health sector should focus their major attention on the policies that promote and develop primary health care to those new born, sanitation, safe drinking water, neutrinos of neonatal, infants and their mothers.
2. Priority in macroeconomic policies should give to the policies that aim at creating jobs through utilizing microfinance projects and attracting more foreign direct investment and encouraging income generations activities. It is also recommended that a fair share of public social expenditure should be allocated for the main pillars of social development, particularly, health and education.
3. Policies and programs should be designed and implemented by local government institutions to build human development capacities and capabilities at local levels.
4. More attention should be given to the policies that aim at reducing the prevalence of poverty especially in the rural areas to reduce the burden of access to basic health and education services access. Also, poverty reduction strategies should include specific direct interventions aiming at enhancing peace and security in conflict areas.
5. Raising the rates and the numbers of target poor people whom should benefit from social funds like (zakat and Social Security funds) to reduce inequality in income distribution. Also, Zakat funds should complement other safety nets such as the national health insurance, social insurance fund and national solidarity funds to work as tools for human development.
6. Peace settlement in Sudan is the essential key factor and starting point to undertake strategic planning to overcome poverty, inequality and low social development problems.

7. Social capital and human skills should be given higher priority and restoring experts and elites migrated abroad in all social sectors especially in health and education sectors.
8. Collaboration efforts of government, community and private sector together with economic growth will achieve all goals of development, and then can make an enormous difference in the lives of poor people.