

The Effects of Social Spending on Growth in Sudan

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Abstract: This paper have investigated the effects of social spending benefits on economic growth for the Sudan. The paper tries to answer the following questions: i) whether economic growth and social spending are cointegrated, ii) whether social spending Granger causes economic and a VAR was constructed. The results show that in the short run social spending lead to increase the GDP per capita output equal on average 0.5% and an increase in primary education enrolment by 1% is associated with an increase in the growth of 0.8%, in contrast the health capital have negative and insignificant impacts

Keywords: Social Spending, Growth, Cointegration, causality, Sudan

1. Introduction

Sudan is the largest country in Africa, officially Republic of the Sudan, 967,494 sq. mi (2,505,813 sq. km). According to the 2009 population census Sudan was inhabited by some 39 million people with annual growth rate 2.3 per year, 51% male and 49% female, 29% lived in urban areas, 68% in rural areas, and 3% were nomads; 22% of the total population lived in central states, 20% in the southern states, 18% in Western states, 13% in Khartoum states, 11% in Kordofan states, and 5% in Northern states, Sudan seems to have a young population structure. 44% of its population are under the age of 15 years [21].

Over the period (1970-1990) Sudan's economy was characterized by low growth rates, high level of inflation, high budget deficit, deteriorating balance of payment situation, high level of unemployment and low level of investment. Sudan economic performance has undergone. It has been the trend that the growth in GDP has been cyclical, since it depends on the growth in agricultural sector. However, in the 1990s Sudan witnessed relatively high positive rate of growth in GDP with an average of 7.5% for the period 1992/07 (a recorded high of 11.3%, 10.2% in 1991 and 2006 respectively) (Sudan in Figures, 2010).[22], growth is estimated at 4.9% in 2009 and projected to be around 5% in 2010 (Medani, 2010) [23], the per capita GDP (PPP) was US\$ 817 in 1970 increased to US\$ 2,100 in 2007, the percentage change equal 169%.

Based on information presented in Annex 13 for the period 1970-1989 showed that the social services spending on education and health activities, have received on average only 4 % of total current expenditures, for education sector have received on average 1.2% less than health sector on average 2%. The break-down of social services reveals that health services have received on average only 2.8 % and education on average about 1.2 % for the same period, it's clear that these ratios are very low. The running expenses of the social services show how little resources were indeed being allocated to these essential social development sectors and also indicate how small these sectors were in the government budget. Therefore, in the logic of service delivery and expenditure assignment, social spending ranked very low as government priorities in the Sudan in the period under consideration.

However, Annex 14 shows that the situation improved in the period 1990-2007, social expenditure, increased from 5% in 1990 on average to about 10% of total current spending in 2000, Annex 15 shows that the period 2005-2007 witnessed a noticeable increase in spending on social services as ratios to total expenditures reflected the government's efforts and concerns to pay attention to spending more on education and health and other social activities. This was partly in response to an ambitious plan launched by the social sectors' ministries to improve the social conditions of people. This mean that more attention and concern have been given to the social spending sectors as a result of internal and external concerns and pressure to improve the wellbeing of the people and to allocate more resources to pro-poor sectors in the effort to reduce poverty.

Annex 16 shows that the government spending on the pro-poor sectors, namely education, health and water as ratios of GDP, but these figures are still very small. All three sectors received only 0.3% of GDP in the period 2000-2006. For instance, education expenditures are extremely low in the years (2000-2003), not exceeding 0.1%, and increased slightly to 0.3% in 2004-2006; the health sector received slightly higher ratios of GDP, amounting to 0.2 % in 2003, and 0.3 % in 2006.

The main aim of this paper is to examine the impact of social spending on the Sudanese economy growth by clarify the empirical evidence about the trad-off between social spending and economic growth (in the short and long runs) and its effects on human capital components' education, and health capitals; based on assumption that social spending mechanism is not only protective factor it also productive factor, enhancing economic growth and socio-political stability for the Sudan.

This paper organised in four sections, following the introduction the second section discusses briefly the theories and empirical evidences about the effect of social expenditures on economic growth. The third section describes the methodology and data used in the estimation and presents the empirical results. Finally offers some concluding remarks.

2. Theoretical and Literature Review

There are several theories that refer to the trade-off between social spending and economic growth and do directly relate social spending with growth. The link between social spending understood as expenditure on basic social services and growth has attracted much attention recently.

There are several reasons to believe that social spending and growth may be related. One of the important arguments in this context is social assets argument “high transfer cause high growth” through institutional assurance individuals, and hence, social spending may lead to cohesion society better able to take more risks in their economic decisions because they are insured against failure through social spending system and this may foster growth (Ahmed et al, 1991) [24].

A number of additional considerations suggest that social spending can be good for economic growth; Korpi [25] who have tended to highlight that greater social spending expenditure not only generates more equal and cohesive societies, but also greater economic growth. Korpi mentioned that “in a glaring contrast to the predictions of the market liberal hypothesis, the Golden Age of economic growth coincided with the extension of the welfare state, with decreasing income inequality, and with increasing political and organizational intervention into market processes” (Korpi, 1985).

Social spending for developing countries is an important dimension in the reduction of poverty and multidimensional deprivation (Shephred, et al, 2004) [26]; it aims to enhance the capacity of poor and vulnerable people to manage socioeconomic risks, such as unemployment, exclusion, sickness, disability and old age. Policy interventions can improve their well-being by, among other things, moderating the impact of shocks causing sharp reductions in their income or consumption. Social spending can also enhance the productive capabilities of poor, reducing poverty and inequality and supports economic growth (UNDP, 2006) [27]. The numbers of economists have also become increasingly influenced by this argument.

Krzyszto, et al. (ILO, 2008)[28] for example pointed out the importance of social spending for low income countries: through it can achieve sustainable development; moreover by provision of basic social security is an investment in country's development giving not only reduced poverty but also increased demand and expanded domestic markets, healthier, better educated, empowerment and more productive workforce as well as peace, stability and social cohesion, less conflict and politically more stable societies and hence increasing economic growth.

On the other hand, the study on promoting pro-poor through social spending recommended that the best way towards achieving pro-poor growth is social spending, in which poor participate directly, as both agents and beneficiaries, is essential directly reduces poverty through improved health outcomes, increased school attendance, hunger reduction and livelihoods promotion. Social spending can provide essential support and recurring crises expose the

vulnerability of poor individuals and families as well as their jobs and livelihoods. Moreover, ongoing challenges of population growth, price volatility, food insecurity, highlight the need for more effective social spending (OECD, 2009) [29].

An alternative set of arguments revolved around the idea of the relation between social spending and growth for example Arjona et al.[30] for example point out that if benefit system (social spending) discourage people from working, therefore, the amount of labour supplied in the economy is lowered, so reducing the level of output and the level of capital investment and hence economic growth. On the other hand if social provisions discourage people from savings then, there is a reduction in the capital available for reinvestment unless public savings rises by the equivalent amount; and they suggested that a bit more passive spending bad for growth (Arjona et al. 2002).

Fan and Rao [31] for example analysed the public spending in developing countries, their main finding results indicated that the impact of various types of government spending on economic growth is mixed; they found that In Africa, government spending on agriculture and health was particularly strong in promoting economic growth. Asia's investments in agriculture, education, and defence had positive growth-promoting effects. However, all types of government spending except health were insignificant impact on growth in Latin America (Fan et al, 2003).

Moreover, using panel data from 118 developing countries in 1971–2000, Emanuele and et al [1] explored the channels linking social spending, human capital, and growth and compares the effects of alternative economic policy interventions. With separated modelling for education and health capital, explicit control for governance, and incorporation of nonlinearity, they found that both education and health spending have a positive and significant impact on education and health capital, and thus support higher growth. Also, other policy interventions, such as improving governance and taming inflation, achieved similar results.

Herce et al.[2] used data for European Union (1970-1994) and panel data techniques and following production function approach they found a positive growth effect of social spending expenditure on growth. When they analysed the effects of the different categories of social spending benefits, they found a significant and positive effect for the health, old age and family programmes. In contrast, such significant effect was not found for the employment and housing programmes. Moreover, in other study by Herce et al.[3] they find that a positive correlation between welfare state and economic performance, their results points towards statistically significance Granger causality running from social spending expenditure towards growth.

Moreover, McCallun and Blais [4] find that social expenditure plays a positive role towards economic growth below a certain level and a negative one beyond it – *as long as the welfare is not too large-*; one possible interpretation of these result runs as follows: along welfare state may related economic growth by reducing the incentive to work, to save, to move, and to change. On the other hand, in a

situation where special interest groups have a required significant power to block change if they so desire, the welfare state which offers assistance to those who are the victims of change may play a growth-enhancing role in reducing the incentive to block change.

An alternative evidence; for example Gwartney et al. (1998) indicate that social spending expenditure is bad for growth and social spending expenditure may trigger a trade-off between equity and efficiency and contribute to an overall loss of economic, innovative, and entrepreneurial capacity [5].

In summary most of studies find that social spending can have a positive impact on growth in developing countries in a number of ways [6]. It can reduce poverty through financing investment in health and education, protecting assets that help people earn an income, encouraging risk taking, promoting participation in the labour market, and ease the pain of economic transaction.

Moreover social spending can lead to greater social integration (inclusion), political stability, human right objectives, and stable environment for individual to work, save and invest. In the other hand government must be careful to strike an appropriate balance between economic incentives and greater provision of social spending (if taxes are raised to pay for spending on social spending, tax payers may have less incentive to work and save or if government with limited revenues is not able to distribute between direct productive sectors and social sectors). Indeed government

must alter the balance between apply passive (pure cash transfer of consumption) and active polices in order to encourage increased employment by the beneficences of such spending [7].

3. The Model and The Method

The theories attempt to test empirically links between social spending and growth, in practice estimation has nearly used a simple model of the causes of economic growth and augmenting it with measures of social spending, and have used empirical model proposed by Solow and Swan (1956) with two factors: labour and capital others add human capital as a third variable of production as proposed by Romer and Weil (1992) pointed by Benank and Reft [8]. Bassanini and Scarpetta [9] determine the growth in GDP per capita modelled as a function of: investment in physical capital (more investment means more capital assets per capita, so more growth); growth rate of the population (more population growth means slower growth in income per capita, given the level of physical capital); the level of human capital (more human capital means greater efficiency in using physical capital; here we have been divided into: education capital and health capital), and income.

Based on the above discussion, the model to investigate the interaction of social spending on economic growth is assumed taking the following forms:

$$y_t = a_0 + \beta_1 \ln(Y_{C_{t-1}}) + \beta_2 S_{E_{t-1}} + \beta_3 I_{N_t} + \beta_4 P_{G_t} + \beta_5 E_{C_t} + \beta_6 H_{E_{C_t}} + \beta_7 P_{O_t} + \delta_t + \varepsilon_t \quad t = 1, 2, 3 \quad [1]$$

where, (Y) denotes GDP per capita economic growth in percentage; (Yc) denotes the lagged real GDP per capita (PPP\$) its coefficient is expected to be negative, because it is expected that the population increase at a faster rate than total income and the capital did not grow as fast ; (Se) denotes social spending proxies by the government expenditure on social services as a percentage of total expenditure, its coefficient is expected to be positive, social spending enhance economic growth through different channels; (In) denotes the investment ratio, measured in terms of gross fixed capital formation to GDP, to captures an increase in the physical capital its coefficient is expected to be positive; (Pg) denotes the annual average rate of growth of the population in percentage its coefficient is expected to be negative; (Ec) refers to the Education Capital (human capital), proxies by primary education enrolment rate, human capital promote growth its coefficient is expected to be positive; (Hec) denotes health capital and the logarithm of under-five child mortality rate is used to proxy the stock of health capital as proposed by Gyimah, Wilson and Emanuele et al [10] to facilitate interpretation, the signs of the coefficients on mortality rates are reversed so that the positive coefficients correspond to improvement in health status; (Po) denotes working age population 15-64 years of total population age structure can affect labour force and enhance growth its coefficient is expected to be positive; and (δ_t) refers to time dummy is used to know time shock

that affect the social spending during the study period, there is incident in one year (turning point) 1992 where Sudan reform the economy by adopted liberalization and free market its coefficient is expected to be positive for the second period.

It is expected that the impact of the GDP per capita (YC), and social expenditures (SE), will be distributed over one year, which here used lagged variables. The coefficients of the model can be estimated by the Generalized Method of Moments (GMM).

The specification of above system is consistent with previous studies and it can help us for the identification of the channels through which social expenditures and other variables affect growth in Sudan. For more elaboration for the relation between social spending, human capital and growth we consider to use Granger causality as proposed by Engle and Granger (1969) [11,12], and check the stationary and if there is presence of unit root in the series, the most famous of the unit root tests are the ones derived by Dickey and Fuller and described in Fuller (1976) [13], also Augmented Dickey-Fuller (ADF) has been mostly used within a Vector autoregression (VAR) [14] model which is an econometric model used to capture the evolution and the interdependencies between variables, generalizing the univariate AR models. Sims advocates the use of VAR

models as a theory-free method to estimate economic relationships, thus being an alternative to the "incredible identification restrictions" in structural models [15].

For examining the cointegration apply (ECM) (Engle and Granger, 1987) [16] we can rewrite the long-term relationship between Y, SE and HC as follow:

$$\Delta \ln Y_t = a_{0Y} + \sum_{i=1}^n b_{iY} \Delta \ln Y_{t-i} + \sum_{i=1}^n c_{iY} \Delta \ln SE_{t-i} + \sum_{i=1}^n d_{iY} \Delta \ln HC_{t-i} + \sigma_{1Y} \ln Y_{t-1} + \sigma_{2Y} \ln SE_{t-1} + \sigma_{3Y} \ln HC_{t-1} + \varepsilon_{it} \quad [2]$$

$$\Delta \ln SE_t = a_{0SE} + \sum_{i=1}^n b_{iSE} \Delta \ln SE_{t-i} + \sum_{i=1}^n c_{iSE} \Delta \ln Y_{t-i} + \sum_{i=1}^n d_{iSE} \Delta \ln HC_{t-i} + \sigma_{1SE} \ln SE_{t-1} + \sigma_{2SE} \ln Y_{t-1} + \sigma_{3SE} \ln HC_{t-1} + \varepsilon_{it} \quad [3]$$

$$\Delta \ln HC_t = a_{0HC} + \sum_{i=1}^n b_{iHC} \Delta \ln HC_{t-i} + \sum_{i=1}^n c_{iHC} \Delta \ln SE_{t-i} + \sum_{i=1}^n d_{iHC} \Delta \ln Y_{t-i} + \sigma_{1HC} \ln HC_{t-1} + \sigma_{2HC} \ln SE_{t-1} + \sigma_{3HC} \ln Y_{t-1} + \varepsilon_{it} \quad [4]$$

Here Δ is the first difference operator.

4. Data

All variables over the period cover (1970-2007) [17] are from World Economic Development Database, World Africa Database, and UN statistics; published by IMF, WB, and UN. The data of government social expenditure as a percentages of current total expenditures from annual reports; Central Bank of Sudan, Ministry of Finance and National Economy (MoFNE), and Central Bureau of Statistics (CBS) Sudan; for the period 1970-1990; social services namely spending on education and health services only, while over the period 1991-2007 MoFNE classified social spending under Social Development and included central government contributions to the pension fund and to the social security fund. In addition, it includes social subsidies that directly benefit the poor, which are mainly directed to subsidizing electricity, free medication in emergencies, free medicines for kidney dialysis and heart disease, support to poor students in higher education and primary and secondary education teachers, medical staff for all health units, except specialized hospitals, and water supply employees [18].

5. Empirical Estimates

5.1 Social Spending and Growth

Table 1 and 2 present the regression results of different equations estimated to explain the effects of social spending on the growth during the period 1970-2007. In most cases the coefficients are statistically significant; all equations have tested of over-identifications using J-statistics test [19]; indicated all models have a good fit.

Table 1, Column [1] presents the estimated coefficients when the equation augmented by social spending, column [2] shows the results using the same measures, exclude social spending, column [3] exclude dummy variables for economic reforms, columns [4] and [5] are exclude health capital on the ground that its insignificant and may affect the growth equation, moreover, to see whether the effect of education capital is more or less than the effect of health capital on economic growth. The augmented model presents in table 2; here we introduced the working age population instead of population growth which it appears not statistically significant for all equations.

The results show that the levels of education capital and social spending have positive effects on the Sudan's economic growth. The impact of health capital on growth differ from that of education capital, health capital indicator negatively and insignificant affect to growth, this seems consistent with a high rate of under-five mortality in Sudan during the period under consideration. (Findings are same as in Emanuele [20]).

Table 1: The Effects of Social Expenditure on Growth
Dependent Variable: growth rate of real GDP per capita in 1990 PPP

| Variable | [1] | [2] | [3] | [4] | [5] |
|-------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Lagged GDP Per Capita | -0.290380 (-5.053802)** | -0.276770 (-4.332198)** | -0.184883 (-1.982567)** | -0.187704 (-2.879547)** | -0.418322 (-3.431797)** |
| Investment | -0.002054 (-0.682296) | -0.002869 (-0.893282) | 0.009245 (2.521448)** | 0.008676 (2.479784)** | 0.008850 (3.723609)** |
| Education Capital | 0.004027 (2.558181) ** | 0.003099 (2.007791)** | 0.001085 (0.459922) | 0.000468 (0.196028) | 0.003709 (1.393497) |
| Health Capital | -0.336575 (-1.176686) | -0.383966 (-1.364175) | 0.118659 (0.330546) | - | - |
| Social Spending | 0.003419 (2.145536)** | - | 0.005549 (2.787500)** | 0.005125 (2.371293)** | 0.004256 (2.409412)** |
| Population Growth | -5.442775 (-1.526941) | -3.599402 (-1.020186) | -7.459767 (-1.870419)** | -6.033767 (-1.494830) | -9.966561 (-3.108151)** |
| Dummy (Economic Reforms 1992) | 0.102681 (3.030098)** | 0.125028 (3.168131)** | - | - | 0.148581 (2.974894)** |
| Constant | 3.588282 (2.198831)** | 3.747094 (2.287674)** | 0.739649 (0.330950) | 1.338108 (3.162290)** | 2.822005 (3.708879)** |
| R-Squared | 0.377887 | 0.320100 | 0.459822 | 0.354196 | 0.218451 |
| J-Statistic | 0.000000 | 5.04E-23 | 0.007707 | 0.007598 | 0.066407 |

Notes: ** t-values significant at 1% and 5% level of significance

The results suggested that the Sudan's economic reforms adopted in 1992 have a positive effect on the growth; an economic reforms raises the growth rate by 6% in the health capital effects and about 14% for education capital effects.

The results show that the social spending in Sudan has positive affect on the economic growth, for all equations the coefficients of social spending are significance with positive sign, however, the contribution of it is very limit with small impact; an increase of social spending by 1 per cent GDP growth could increase by 0.3 per cent, to 0.5 per cent when working age population introduced into the growth equation.

the under-five mortality rate reduces growth, an increase in under five mortality rate by 1 precent is found to reduce growth by about 61 per cent, while education capital bolsters economic performance; an increase in the primary education enrolment by 1 percentage is found to increase the economic growth in Sudan by 0.8%; this result indicate that the Sudan education capital is still very weak in terms of contributions to the economic growth. The results indicate that the working age population and investment affects growth although education and health capital does not. An increase in working age population and investment by 1% is associated with an increase in the growth of 13% and 0.6% respectively.

Table 2 reports that the health capital is very weak with negative impacts on growth for the Sudan; results show that

Table 2: The Effects of Social Expenditure on Growth
Dependent Variable: growth rate of real GDP per capita in 1990 PPP

| Variable | Complete Model | | Effects of Health Capital | | Effects of Education Capital | |
|-------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| | | | | | | |
| Lagged GDP Per Capita | -0.598844 (-2.262230)** | -0.729944 (-2.407183)** | -0.168488 (-2.801483)** | -0.208506 (-3.001181)** | -0.097717 (-3.447801)** | -0.274264 (-3.473797)** |
| Investment | 0.006281 (2.560185)** | 0.006996 (2.976017)** | - | - | - | - |
| Education Capital | -0.002699 (-1.378605) | -0.003173 (-1.144877) | - | - | 0.005051 (1.932254)** | 0.008117 (2.265591)** |
| Health Capital | - | -0.192548 (-0.596555) | -0.613774 (-2.978608)** | -0.549722 (-2.097368)** | - | - |
| Social Spending | 0.004201 (2.109429)** | 0.004450 (2.518237)** | 0.003785 (2.046165)** | 0.003742 (2.409149)** | 0.004707 (3.049699)** | 0.003881 (2.764642)** |
| Working Age Population | 0.115073 (2.291202)** | 0.136258 (2.575649)** | - | - | - | - |
| Dummy (Economic Reforms 1992) | - | -0.009830 (-0.210402) | - | 0.062261 (2.032703)** | - | 0.144752 (2.762207)** |
| Constant | -1.959259 (-2.065226)** | -1.239232 (-0.670163) | 4.154585 (3.027195)** | 4.099107 (2.402082)** | 0.432948 (3.059997)** | 1.440413 (3.787025)** |
| R-Squared | 0.651419 | 0.677044 | 0.294425 | 0.313796 | 0.076158 | 0.159342 |
| J-Statistic | 0.062310 | 0.061607 | 0.0000000 | 0.038999 | 0.046945 | 0.039297 |

Source: Author's estimation

Notes: ** t-values significant at 1% and 5% level of significance

5.2 Growth, Human Capital and Social Spending Cointegration

In the first stage, the order of integration was tested using the ADF unit root test. Table 3 reports the results of the unit root tests. The ADF statistics for the GDP per capita growth, social spending and human capital do not exceed the critical values (in absolute terms). However, when we take the first difference of each of the variables, the ADF statistics are higher than their respective critical values (in absolute terms).

Therefore, we conclude that GDP per capita growth, social spending and human capital are each integrated of order one or I(1). The next step is to test whether the stationary variables are co integrated or not.

Table 3: ADF Unit Root Test of Stationarity

| Variable | Level | | First Difference | |
|----------|----------------|----------------|------------------|----------------|
| | Test Statistic | Critical Value | Test Statistic | Critical Value |
| Ln(Y) | -1.750779 | -1.9602 | -4.908774 | -1.9677 |
| Ln(Se) | -0.719753 | -1.9504 | -7.136805 | -1.9507 |
| Ln(Hc) | -1.911448 | -2.9446 | -7.075374 | -2.9472 |

All the variables are stationary at their first differences and 5% level of significance

Using Johansen co-integration to test the stationary variables are cointegrated in the short run, the Eigen value at 5% show that there is one cointegration for GDP per capita growth, social spending and Human capital in the short run. Result of cointegrating equation show that there is positive relationship social spending and human capital and GDP per capita growth this relationship.

Table 4: Johansen cointegration test

| Likelihood | | 5 Percent | | Hypothesized |
|-------------|----------|----------------|----------------|--------------|
| Eigen value | Ratio | Critical Value | Critical Value | No. of CE(s) |
| 0.772051 | 32.23888 | 29.68 | 35.65 | None * |
| 0.559594 | 11.53799 | 15.41 | 20.04 | At most 1 |
| 0.004076 | 0.057176 | 3.76 | 6.65 | At most 2 |

Table 6: Granger Causality Test

| Null Hypothesis: | F-Statistic | Probability | Result |
|--|-------------|-------------|--------------|
| Social Spending Does Not Granger Cause GDP per capita growth | 0.73487 | 0.40684 | No Causality |
| GDP per capita Growth Does Not Granger Cause Social Spending | 4.02301 | 0.05616** | Causality |
| Human Capital Does Not Granger Cause GDP per capita growth | 0.10119 | 0.75546 | No Causality |
| GDP per capita Growth Does Not Granger Cause Human Capital | 0.70467 | 0.41639 | No Causality |
| Human Capital Does Not Granger Cause Social Spending | 0.05708 | 0.81261 | No Causality |
| Social Spending Does Not Granger Cause Human Capital | 3.97196 | 0.05434** | Causality |

Notes: ** F-values significant at 5% and 10% level of significance

6. Conclusion

In this paper we have investigated the effects of social spending benefits on economic growth for the Sudan; covering the period (1970-2007).

*(**) denotes rejection of the hypothesis at 5%(1%) significance level L.R. test indicates 1 cointegrating equation(s) at 5% significance level Table 5 shows that the VEC model estimates and the results indicate that the error correction terms (ECM) in the long run of GDP per capita growth, social spending and human capital statistical significant. For the GDP per capita growth the ECM indicates 0.34 per cent speed of convergence towards equilibrium position in the case of any disequilibrium situation. The ECM shows that for social spending the convergence speed of 3.1 per cent towards equilibrium and for human capital convergence towards equilibrium point at the speed of 0.19 per cent.

Table 5: The VEC model basic results

| | D(Y) | D(SE) | D(HC) |
|---------|------------------|-----------------|------------------|
| ECM(-1) | 0.003385 | 0.030537 | -0.001907 |
| | (0.01918)** | (0.01009)** | (0.00116)** |
| | (0.17649) | (3.02590) | (-1.64809) |
| C | -0.364740 | 0.143425 | -0.009212 |
| | (0.34405) | (0.18105) | (0.02075)** |
| | (-1.06013) | (0.79220) | (-0.44388) |

Notes: ** t-values significant at 1% and 5% level of significance

Table 6 gives results on Granger causality tests. In carrying out the test of causality between GDP per capita growth, social spending and human capital the results indicate directional causality between the GDP per capita growth and social spending. This causality runs from GDP per capita growth to social spending and from social spending to human capital. We also see no causality from social spending to GDP per capita growth and from human capital to GDP per capita growth.

The results show that in the short run social spending lead to increase the GDP per capita output, and there is evidence of positive and significant effect of social spending on GDP per capita growth, this effect is very limited due to the different factors affecting that: the social spending received the lowest percentage ratio in relation to other items on average 2.8%

for health and 1.2% for education with low levels of education and health capital, social development ranked very low as government priorities. However, the results show that the effect of social spending on GDP per capita equal on average 0.5% and an increase in primary education enrolment by 1% is associated with an increase in the growth of 0.8%, in contrast the health capital have negative and insignificant impacts.

The limited effects of social spending mentioned in the previous section appeared in the long run causality test; the causality runs from GDP per capita growth to social spending. Therefore, GDP per capita growth provides statistically significant information about future values of social spending in Sudan. The main challenge for the Sudanese policy makers is to rethinking into social spending as not only protective factor but also as productive factors enhance economic growth.

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- [12] Granger causality is a technique for determining whether one time series is useful in forecasting another. Ordinarily, regressions reflect "mere" correlations. Granger (1969) defined causality as follows: A variable Y is causal for another variable X if knowledge of the past history of Y is useful for predicting the future state of X over and above knowledge of the past history of X itself. So if the prediction of X is improved by including Y as a predictor, then Y is said to be Granger causal for X. Granger Causality takes into account prediction rather than the name it suggests that is causation. This is because it creates the impression that while the past can cause or predict the future, the future cannot cause or predict the past. From what Granger deduced, 'X' causes 'Y' if the past values of 'X' can be used to predict 'Y' better than the past values of 'Y' itself.
- [13] Dickey, A. and W.A. Fuller (1979), 'Distribution of the Estimators for Autoregressive Time Series with a Unit Root', American Statistical Association Journal, 74, Website: <http://www.jstor.org/stable/2286348?seq=2>
- [14] VAR model describes the evolution of a set of k variables (called *endogenous variables*) over the same sample period ($t = 1, \dots, T$) as a linear function of only their past evolution. The variables are collected in a $k \times 1$ vector y_t , which has as the i^{th} element $y_{i,t}$ the time t observation of variable y_i . For example, if the i^{th} variable is GDP, then $y_{i,t}$ is the value of GDP at t .A (reduced) p -th order VAR, denoted VAR(p), is $y_t = c + A_1y_{t-1} + A_2y_{t-2} + \dots + A_py_{t-p} + e_t$, where c is a $k \times 1$ vector of constants (**intercept**), A_i is a $k \times k$ matrix (for every $i = 1, \dots, p$) and e_t is a $k \times 1$ vector of error terms satisfying $E(e_t) = 0$ every error term has mean zero, $E(e_t e_t') = \Omega$ the contemporaneous covariance matrix of error terms is Ω (a $n \times n$ positive definite matrix), and $E(e_t e_{t-k}') = 0$ for any non-zero k there is no correlation across time; in particular, no serialcorrelation in individual error terms. The l -periods back observation y_{t-l} is called the *l-thlag* of y . Thus, a p -th-order VAR is also called a **VAR with p lags**.
- [15] Sim, C.A. (1980). ' Macroeconomics and Reality', *Econometrica* 48: website: <http://www.jstor.org/>
- [16] Engle, R.F. and C.W.J. Granger (1987), 'Cointegration and Error-Correction: Representation, Estimation, and Testing', *Econometrica* 55. website: <http://www.jstor.org>
- [17] Unfortunately, data for 2008 and 2009 are not available for most of variables used.
- [18] Ibid
- [19] Specification Tests in Over-identified Models An advantage of the GMM estimation in over- identified models is the ability to test the specification of the model. The J -statistic, introduced in Hansen (1982), refers to the value of the GMM objective function evaluated using an efficient GMM estimator: $J = J(\hat{\delta}(\hat{S}-1), \hat{S}-1) = ngn(\hat{\delta}(\hat{S}-1))\hat{S}-1gn(\hat{\delta}(\hat{S}-1))\hat{\delta}(\hat{S}-1)$ = any efficient GMM estimator \hat{S} $p \rightarrow S$ Recall, If $K = L$, then $J = 0$; if $K > L$, then $J > 0$. Under regularity conditions (see Hayashi, 2000, Chap. 3) and if the moment conditions are valid, then as $n \rightarrow \infty$ $J \rightarrow \chi^2(K - L)$ Remarks: 1. In a well-specified over-identified model with valid moment conditions the J -statistic behaves like a chi-square random variable with degrees of freedom equal to the number of over-identifying restrictions. 2. If the model is misspecified and/or some of the moment conditions do not hold (e.g., $E[x_it] = E[x_it(yt - z0t\delta_0)] = 0$ for some i), then the J -statistic will be large relative to a chi-square random variable with $K - L$ degrees of freedom. 3. The J -statistic acts as an omnibus test statistic for model misspecification. A large J -statistic indicates a misspecified model. Unfortunately, the J -

statistic does not, by itself, give any information about how the model is misspecified

- [20] ibid
- [21] Sudan in Figures and Sudan Fifth Population Results, Central Bureau of Statistics, 2010
- [22] ibid
- [23] Medani, M. (2010), 'Global Financial Crises Discussion Series; Paper 19: Sudan Phase 2', ODI
- [24] Ahmed et al (1991), ' Social Security in Developing Countries' Oxford University Press; Oxford
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