Does Human Capital Matter for Economic Growth in Sri Lanka? An Analysis Using Employment-Based Human Capital Indicators[8]

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Introduction

'Human Capital'is considered a factor of production (e.g. Becker, 1964; Shultz, 1961; Romer, 1986; Lucas, 1988), with education, health, training and experience as key components (Becker, 1992). Its empirical contribution to economic growth, however, shows a large variation across the range of human capital indicators in use[9] (Flabbi and Gatti, 2018). At the macro level, physical indicators of human capital in terms of education and health tend to be based on the entire population. Examples are: literacy, numeracy and educational attainment (World Economic Forum, 2017)[10], and in Sri Lanka, (indices for) adult literacy and gross enrollment in constructing a proxy for education and (an index of) life expectancy for health (Vijesandiran and Vinayagathasan, 2015), and primary school enrollment (adjusted for health).

A recent approach targets the education and health status of the *employed* population in Sri Lanka (Sumaiya and Abayasekara, 2016) on the grounds that this group is directly involved with domestic production. All these models, however, yield ambiguous results for the relationship between human capital and economic growth for Sri Lanka. For instance, the education-economic growth nexus is negative (Vijesandiran and Vinayagathasan, 2015) or positive (Sumaiya and Abayasekara, 2016, Godagampala, 2018[11]). Also, real capital

[8] The authors gratefully acknowledge the invaluable assistance provided by S. Sivarajasingham in model estimation, and suggestions by anonymous referees.

[9] And on specific model used

[10]For a 'capacity' sub-index of human capital

[11] Using education 'adjusted for health'

and recurrent expenditure on human capital shows no significance for growth in one case (Vijesandiran and Vinayagathasan, 2015), but positive (for capital expenditure) and negative (for recurrent expenditure) relationships in another (Godagampala, 2018). The research gap is the lack of consistent empirical confirmation of the expected positive relationship between, on the one hand the education and health components of human capital, and on the other hand, economic growth for Sri Lanka. The research problem is therefore whether such positive relationships exist for Sri Lanka.

Objectives

The objectives of the study are to first construct employment-based Human Capital Indices for Sri Lanka and secondly, to investigate the existence of a dynamic relationship between the constructed indices and economic growth.

Methodology

To meet the first objective, annual employment is first broken down separately into four educational groups and five age-groups as defined by the Sri Lanka Quarterly Labor Force Survey[12]. Weights are then applied to these groups to obtain 'adjusted' (weighted) employment separately for education and health. An 'Education-Adjusted Employment Index' (EAEI) and 'Health-Adjusted Employment Index' (HAEI) are then constructed. Formulae and calculations areshown in Table 1.

A (composite) Human Capital Index (HCI) is also derived as $HCI = \sqrt{(EAEI * HAEI)}$. The indices differ from commonly used physical indicators of education and health which apply to the entire population irrespective of their labor force status. Human capital, H is conceptualized as entering the growth function through Y = f (K, H), where Y refers to an output measure and K is physical capital.

[12] Conducted by the Department of Census and Statistics

Table 1. Construction of Human Capital Sub-Indices

Item	Education	Health
No. of groups	Four[1]	Five[2]
Basis for weighting	Mean completed years of education, y_j for group j	Life Expectancy at Birth for mean age, y_j, group j
Maximum j	j = 4	'Max' (Highest Life Expectancy among age groups)
Minimum j	j = 1	'Min' (Lowest Life Expectancy among age groups)
Weight, w_j	y_j / y_4, where j=1-4	y_j / y_{max}, where j=1-5
Sub-Index	EAEI = $\frac{\sum_1^4 w_j E_j - w_1 E}{w_4 E - w_1 E}$	HAEI[3] = $\frac{\sum_1^5 w_j E_j - w_{min} E}{w_{max} E - w_{min} E}$

Notes: [1] Defined as 'Grade 5 & below', 'Grade 6-10', 'GCE O Level/NCGE', GCE A Level/HNCE & Above'[2] Defined as '15-19', '20-24', '25-29', '30-39', '40 & Above'[3]w_{max} and w_{min} refer to maximum and minimum weights, respectively, which are in turn derived from the respective maximum and minimum y values.[13]

To meet the second objective, viz. exploration of a dynamic relationship between economic growth and human capital, the following alternative models are constructed:

$$LnGDPPC_t = \beta_0 + \beta_1 LnGCF_t + \beta_2 HCI_t + u_{1t} \quad (1)$$

$$LnGDPPC_t = \delta_0 + \delta_1 LnGCF_t + \delta_2 EAEI_t + \delta_3 HAEI_t + u_{2t} \quad (2)$$

Ln GDPPC is the natural log of Gross Domestic Product per capita; Ln GCF is the natural Log of Gross Capital Formation (constant (2010) US$); HCI, EAEI and HAEI are the indices defined above; and u_{1t} and u_{2t} are the two error terms. The study period is 1990-2016, which is due to labor force data being available annually (quarterly) only from 1990 onwards. Employment data are obtained from the annual report of the Quarterly Labor Force Survey of the Department of Census & Statistics, Sri Lanka, and data for the remaining variables, from the online database of World Development Indicators (World Bank).

[13]Note that $w_{min}E < \sum_1^s w_j E_j < w_{max}E$, so that 0 <EAEI< 1,0 <HAEI< 1, where s=4 or 5 as the case is.

Stationarity of the variables was tested using Augmented Dickey Fuller and Philips Unit Root tests. Akaike Information Criterion was used as the model selection criterion. Given the relatively small number of observations, the long run equilibrium relationship between the variables was estimated through the Auto Regressive Distributed Lag (ARDL) Bounds Testing approach and the ARDL Error Correction Model was used to identify the short run relationship between variables. Diagnostic tests were conducted to check whether the results are robust. The tests conducted are, Jarque-Bera test to check whether the residuals are normally distributed, Lagrange Multiplier (LM) test to detect serial correlation among residuals, Breusch-Pagan-Godfrey test to detect heteroscedasticity in the model, Ramsey RESET test to check whether the model is specified correctly, and the Cumulative Sum (CUSUM) test and Cumulative Sum Squares (CUSUMSQ) test to check the stability of the model.

Results and Discussion

The behavior of the different indices over time is investigated and the EAEI shows a clear upward movement, representing a shift of the employed population towards higher education levels. The fall in the HAEI over some years has to be interpreted as the outcome of three reinforcing trends: the (natural) slowing down of the rate of increase in life expectancy, the reduction in differences in life expectancy across cohorts, and ageing of the working population[14]. The movements of these two indices in turn give the resulting trend for the HCI, which shows little increase by the end of the period.

The two models were estimated separately. After confirming that the variables are stationary at level or in the first difference, and that there is cointegration among variables in the model (through the ARDL bounds test), ARDL long run and short run estimations were derived firstly for Model 1 and secondly for Model 2. In Model 1, the HCI is not significant with GDP per capita both in the long and the short run. But there is a significant and positive relationship between Gross capital formation and GDP in both long run and short run.The long run relationship derived from ARDL model estimations for Model 1 is given below.

[14] Over 50% of the employed are in the highest defined age group of ’40 and above’

$$\widehat{Ln\,GDPPC_t} = \underset{(0.0000)}{-7.334465} - \underset{(0.2915)}{0.982607\,HCI_t} + \underset{(0.0000)}{0.671797\,LnGCF_t}$$

The Error Correction Term showed that the model is stable in the long run and there is long run adjustment. GDP growth moves back to equilibrium path and the disequilibrium error is corrected by 21.2 percent each year, following an exogenous shock. However in Model 2, findings indicated that both EAEI and HAEI have a significant and positive relationship with GDP in the long run. The long run relationship derived from ARDL model estimations for Model 2 is given below.

$$\widehat{Ln\,GDPPC_t} = \underset{(0.0000)}{7.1900\,EAEI_t} + \underset{(0.0215)}{1.1485 HAEI_t} + \underset{(0.0000)}{0.1666\,LnGCF_t}$$

It indicates that (better) health and education make a positive contribution to the country's economic growth in the long run. This is consistent with expectations and differs from results of some other models and indices referred to earlier. It also 'validates' the representation of human capital in terms of the education and health status of the working population. However, the lack of significance in the overall HCI needs to be investigated further[15], and is different from the findings of the 'health adjusted education index' in Godagampala (2018).

As per the Error Correction Model, in the short run, both EAEI and HAEI show a significant relationship with growth; but whereas the former shows a positive relationship (except for lagged values), the latter shows anegative relationship in its lags. This may reflect the decline in HAEI over short periods of time noted earlier. However gross capital formation in both long run and short sun impact on GDP significantly and positively.

The Error Correction Term showed that the model is stable in the long run and there is long run adjustment. GDP growth moves back to equilibrium path and the disequilibrium error is corrected by 33.1 percent each year, following an exogenous shock. All the diagnostic tests proved that there are no diagnostic errors in the two models and the results are robust.

[15] There is presumably an 'interaction' effect between education and health, apart from its separate effects.

Conclusion

Human capital is seen to unambiguously increase over time when represented by the educational status of Sri Lanka's employed population over time, but subject to short periods of decline in terms of its health status as measured by Life expectancy at Birth. Both indices however show a positive and significant relationship with economic growth over the period. This indicates that the index formulation in the current model performs better than some others. It also suggests that raising the educational and health status of the workforce is a worthwhile goal for sustained economic growth. However, their combined effect as measured by the geometric mean of the two indices is not significantly related to economic growth, and therefore needs further investigation.

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