Fiscal Stimulus and Human Capital in Nigeria: A Bayesian VAR Analysis

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Abstract

This study investigates the relationship between fiscal stimulus and human capital in Nigeria between 1981-2015 using Bayesian estimation (BVAR model) with a KoKo Minnesota/Litterman prior distribution. Fiscal stimulus is proxied by education expenditure and human capital by school enrolment rates. The findings show that higher fiscal stimulus is associated with higher levels of human capital in Nigeria. It is, however, interesting to note that fiscal stimulus is having an insignificant positive impact on human capital. Education expenditure in the country is not robust enough to support the necessary quanta of human capital with its puny investment in education. It is, therefore, imperative for Nigeria to adopt a strategy which promotes provision of adequate funds for human capital development.

Key words: Human capital, fiscal stimulus, Bayesian VAR

JEL classification: E62, H2, H5, H63

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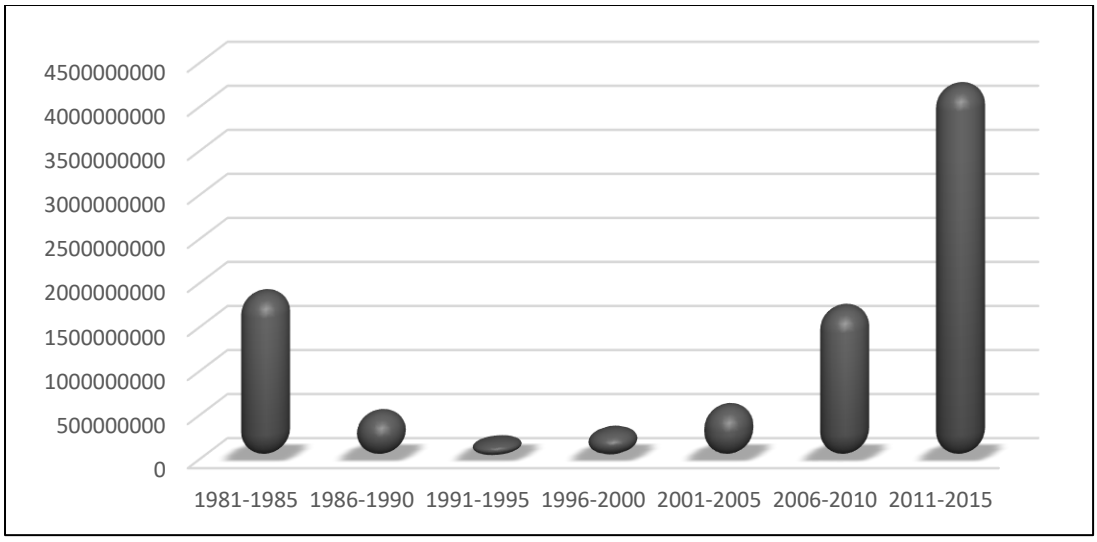
Introduction

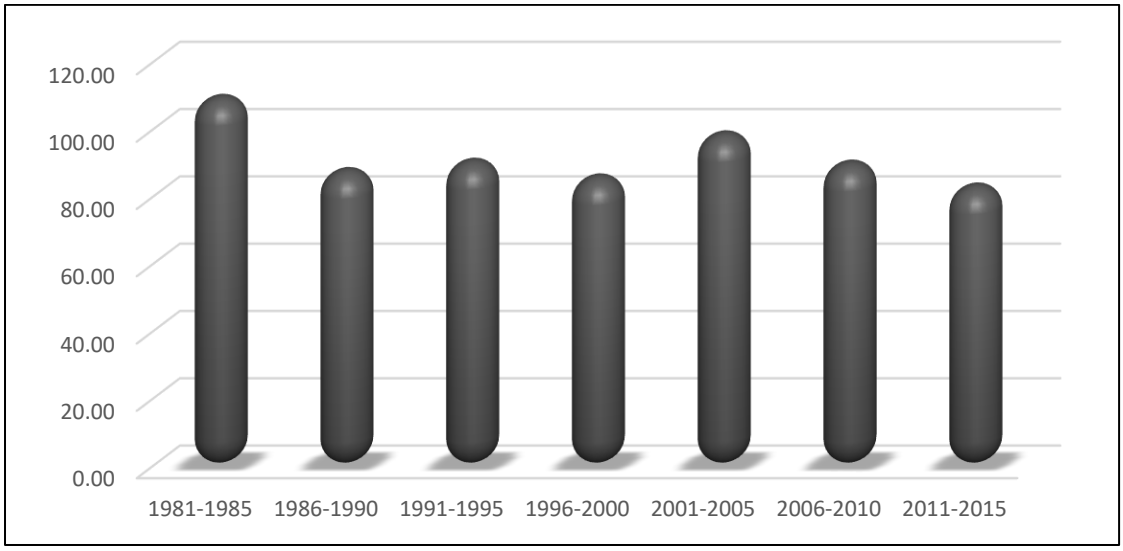
Human capital development has become a widely-recognized policy issue in Nigeria, transcending into a vital social agenda. This stems from the importance of human capital in achieving sustainable growth, equality, and poverty alleviation. As a result, the Nigerian government has spread its fiscal tentacles in order to meet up with the demands of ever-increasing education of its citizenries. However, while available statistics have shown that fiscal stimulus for education has increased astronomically in recent years (i.e. Figure 1), this has not translated into increase in human capital (i.e. school enrollment rates in Figure 2). In fact, the trend of school enrollment has been low, fluctuating and disappointing.

Figure 1. The Trend of Education Expenditure



Data Source: WDI (2016)

Figure 2. The trend of School enrollment Rates



Data Source: WDI (2016)

The beauty of fiscal stimulus, especially on education, is to promote positive externalities, associated with economic growth. Any increase in fiscal stimulus therefore should be felt in the development of human capital in all economic ramifications. If the effects are not felt, in the form of for example, increase in education, then the fiscal stimulus has insignificant impacts on human capital. For example, as shown in Figure 2, a marginal increase in education expenditure was experienced between 2006 and 2015, this increase is not reflected in the level of human capital, such as enrolment rates.

The key objective of this study is theretofore to determine the relationship between fiscal stimulus and human capital in Nigeria using a Bayesian VAR approach over the period from 1981 to 2015. It is therefore to investigate if the level of fiscal stimulus in Nigeria is appropriate for the needed human capital.

The paper is structured as follows. Section II reviews the literature on fiscal stimulus and human capital. Section III presents the econometric methodology and the data used. Section IV discusses the results of the empirical analysis. Section V concludes with summary and key findings.

Theory and Review of Literature

The new endogenous growth theories in economics have established the significance of human capital in the growth of every economy. In the endogenous growth literature, it is argued that higher education causes more economic growth (Mehrara and Musai, 2013). For example, Lucas (1988) argues the accumulation of human capital leads to sustained growth, and education is the main channel of human capital accumulation. Romer (1986, 1990) show that human capital, which generates innovations, leads to economic growth. As documented in the literature, education also has spillover effects, boosts research productivity and improves the adaptation speed of entrepreneurs to disequilibrium. Moreover, there is feedback effects from economic growth to human capital (Mehrara and Musai, 2013).

In the literature, human capital, popularized by Gary Becker and Jacob Mincer, refers to the stock of knowledge, social and personality attributes, including creativity, embodied in the ability to perform labor so as to produce economic value (Hewlett, 2002; Becker, 2009). Alternatively, human capital is a collection of traits — all the knowledge, skills, experience, intelligence, judgment, and wisdom possessed individually and collectively by individuals in a population (Schultz, 1961; Lepak, and Snell, 1999). These resources are the total capacity of the people; a form of wealth which can be directed to accomplish the goals of the nation or state (Ben-Porath, 1967; Anand and Sen, 2000). Human capital can therefore be described as education, health and other human capacities that can raise productivity when increased (Todaro and Smith, 2003).

A few studies have considered the issue of human capital, as related to fiscal stimulus in the literature. For example, Suescún (2007) developed a dynamic intertemporal general equilibrium model of a small open economy that incorporates and endogenizes human development and also various indicators of social progress. This was in order to study the effect of marginal increases in different types of useful and wasteful public expenditures under alternative financing schemes in 15 Latin American economies. The results showed that infrastructure spending dominates other forms of public expenditure (education, health, government consumption and transfers to poor households) in terms of sizable positive effects on growth performance, human development, welfare, and social progress.

In a three-sector model of endogenous growth with physical and human capital accumulation, Alonso-Carrera and Freire-Serén (2004) showed that taxation policy can generate indeterminacy under plausible parameterizations. They argued that the accumulation of human capital is a non-market activity in which individuals combine their non-working time with intermediate goods that are provided by the market. This assumption is in line with the microfoundations of human capital accumulation found by the literature on life-cycle earnings. To study the effects of labor and capital income taxation on the transitional dynamics to the balanced path, Ortigueira (1998) developed an endogenous growth model with physical and human capital accumulation. He showed that parameters on preferences, technologies and depreciation rates, as well as fiscal policy parameters, are significant in the determinination of the dynamic behavior of the economy.
In South Africa, Van and Bonga-Bonga (2009) econometrically modelled the relationship between national fiscal expenditure on human capital and the efficiency of the human resource base in stimulating economic growth. Using a the constant elasticity of substitution modelling, the study showed that fiscal stimulus of human capital does not translate into high technological change and higher economic growth rates.
In Nigeria, using the augmented Solow model, Oluwatobi and Ogunrinola (2011) investigated atgatethe impact of government recurrent and capital expenditures on education and health in Nigeria and their effect on economic growth between 1970 and 2008. The results showed a positive relationship between government recurrent expenditure on human capital and real output, while capital expenditure is negatively related to the level of real output. Using co-integration, error correction mechanism and Granger causality test, Simon-Oke (2012) investigated the relationship between human capital investment and industrial productivity in Nigeria. The results showed that government expenditure on education has a positive long run relationship with index of industrial production while government expenditure on health and gross capital formation has a long run negative relationship with of industrial production. Using ordinary least square methodology, Arden (2013) investigated the relationship between investment in human capital and economic growth in Nigeria between 1980 and 2010. The study showed that government expenditure on education is insignificant at 5 percent significant level.

The major gap in the literature therefore is to determine the significance of fiscal stimulus to human capital development. It is therefore to ask if fiscal stimulus in Nigeria is appropriate for the needed human capital.

Methodology and data

The VAR model, as introduced by Sims (1980), is a standard method of evaluating the properties of the macroeconomic data. The BVAR models, introduced by Litterman (1980), serves as an alternative for the VAR methodology. The BVAR models have some advantages over the VAR methodology. BVAR solves "the problem of the degrees of freedom common to VAR techniques, but they also offer more accurate forecast results. Also, they have some advantages in terms of objectivity and flexibility" (Spulbăr and Niţoi, 2013, p. 7). Félix and Nunes (2002) details the advantages of BVAR models over VAR models.

This study therefore investigates the relationship between fiscal stimulus and human capital in Nigeria using a BVAR model with a KoKo Minnesota/Litterman prior distribution. To demonstrate the BVAR methodology, consider the following VAR model:

$$y_t = a_0 + \sum_{l=1}^{p} A_l y_{t-l} + \varepsilon_t, \qquad \varepsilon_t \sim N(0, \Sigma) \tag{1}$$

where y_t is an $m \times 1$ vector of $t = 1, \dots, T$ observations on m variables; a_0 is an $m \times 1$ vector of intercepts, and A_l is an $m \times m$ matrix of regression coefficients for the lth lag with the p maximum number of lags.

According to Koop and Korobilis (2009), the VAR can be rewritten in following matrix form:

$$x_t = \begin{bmatrix} 1 & y_{t-1} \dots y_{t-p} \end{bmatrix}, \qquad X = \begin{bmatrix} x_1 \\ \vdots \\ x_T \end{bmatrix}, \quad B = \begin{bmatrix} a_0 \\ A_1 \\ \vdots \\ A_p \end{bmatrix} \tag{2}$$

and $\beta = vec(B)$; the model (1) can be written:

$$Y_{T \times m} = X_{T \times (mp+1)} B_{(mp+1) \times m} + E_{T \times m}, \qquad E \sim N(0, \Sigma) \tag{3}$$

The posterior distribution can be easily generated using this approach. The KoKo Minnesota prior distribution, as developed by Koop and Korobilis (2009), is used in this

study. The merit of the Minnesota prior is that Σ is assumed to be known (Spulbăr and Niţoi, 2013). The prior for β is:

$$\beta \sim N(\beta_0, \underline{V}) \tag{4}$$

with $\beta_0 = 0$ and $\underline{V} = 0$. Koop and Korobolis (2009) stated the prior covariance matrix $\underline{V}$ as a diagonal matrix with its elements $\upsilon_{ij,l}(l = 1, \ldots, p)$, where:

$$\upsilon_{ij,l} = \begin{cases} \frac{a_1}{p^2} & \text{for coefficients on own lags} \\ \frac{(a_2\sigma_i)}{(p^2\sigma_j)} & \text{for coefficients on lags of variable } i \neq j \\ a_3\sigma_i & \text{for coefficients on exogenous variables} \end{cases} \tag{5}$$

where σ_i^2 is the ith diagonal element of Σ. A detailed analysis of the derivation of the conditional posteriors can be found in Koop and Korobilis (2009).

In line with existing studies (i.e. Ortigueira, 1998; Alonso-Carrera and Freire-Serén, 2004; Suescún, 2007; Vincent, Nwosu, and Okonma, 2013), the econometric model for the study is given as:

$$Humancap_t = \tau_0 + \tau_1 Edu\exp_t + \tau_2 Gdpc_t + \tau_3 Interest_t + \xi_t \tag{6}$$

Where *Humancap* is school enrollment rates (proxy for human capital); *Eduexp* is education expenditure (proxy for fiscal stimulus); *Gdpc* is GDP per capita; and *Interest* is lending interest rate (proxy for monetary policy); ξ are the residuals, and the subscript *t is* the *t*-th year.

Table 1 Description of Variables

Variable	Indicator Name	Definition
Eduexp	Education expenditure	Education expenditure refers to the current operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment.
Humancap	School enrollment, primary (% gross)	Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Primary education provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music.
Gdpc	GDP per capita (constant 2010 US$)	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars.
Interest	Lending interest rate (%)	Lending rate is the bank rate that usually meets the short- and medium-term financing needs of the private sector. This rate is normally differentiated according to creditworthiness of borrowers and objectives of financing.

Data Source: WDI (2016)

Data for this analysis are collected from the World Development Indicators (WDI) on variables such as education expenditure, school enrollment, primary (% gross), GDP per capita (constant 2010 US$) and lending interest rate (%). WDI was an appropriate source because it offers a large range of information on the variables. The data span is limited to 1981-2015 because of data availability.

Empirical Results

While it is necessary to test for non-stationarity when dealing with time series data, non-stationarity is not an issue when using BVAR models because the presence of unit roots in the data does not affect the likelihood function (Sims et al., 1990).

Table 2 shows the BVAR estimates. The results suggest that fiscal stimulus has a positive but insignificant impact on human capital. Only GDP per capita has significant positive impacts on human capital. This outcome that fiscal stimulus has a positive but insignificant impact on human capital in Nigeria is very surprising. Nonetheless, it indicates that the fiscal stimulus is not significant enough to boost human capital in Nigeria.

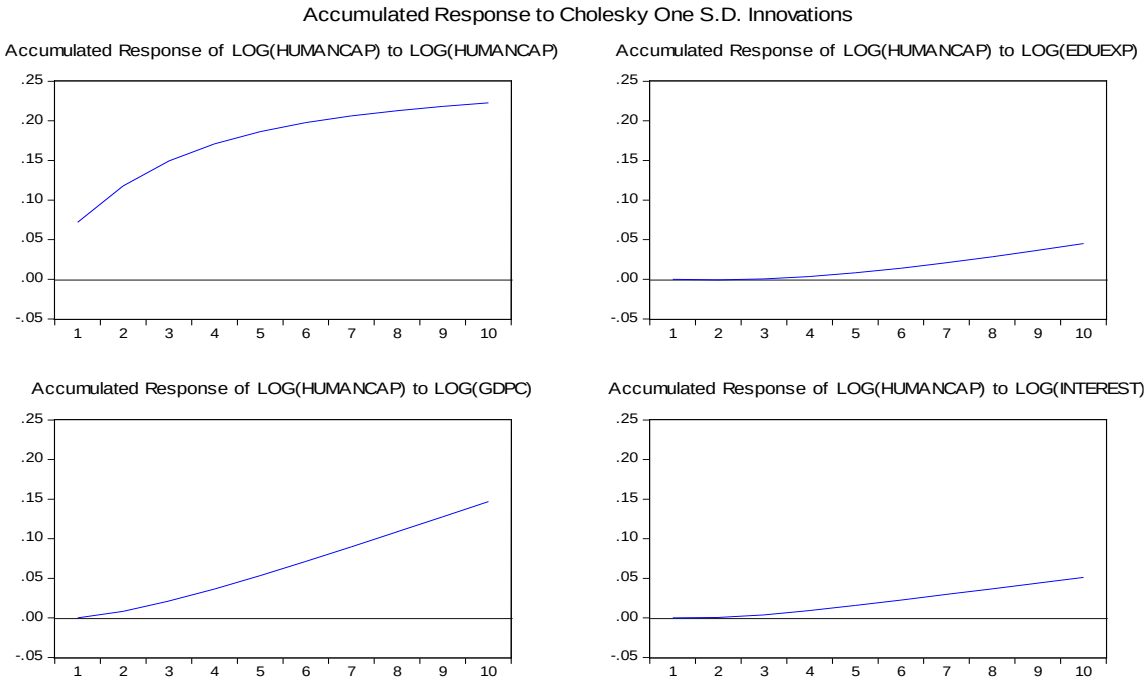
Table 2. Bayesian VAR Estimates

	Log(Humancap)	Log(Eduexp)	Log(Gdpc)	Log(Interest)
Log(Humancap(-1))	0.632118	0.689288	0.099785	-0.108516
	(0.05782)	(0.27208)	(0.05484)	(0.13477)
	[10.9318]	[2.53338]	[1.81947]	[-0.80518]
Log(Eduexp(-1))	0.013619	0.528530	0.044392	-0.118361
	(0.01366)	(0.06475)	(0.01300)	(0.03198)
	[0.99708]	[8.16245]	[3.41467]	[-3.70089]
Log(Gdpc(-1))	0.156447	1.117450	0.865253	0.372532
	(0.03652)	(0.17259)	(0.03472)	(0.08540)
	[4.28421]	[6.47476]	[24.9218]	[4.36230]
Log(Interest(-1))	0.000964	-0.377262	0.113605	0.406071
	(0.02997)	(0.14165)	(0.02852)	(0.07044)
	[0.03216]	[-2.66329]	[3.98366]	[5.76469]
R-squared	0.511863	0.910074	0.950522	0.714533
Adj. R-squared	0.463050	0.901082	0.945575	0.685986
Sum sq. resids	0.176188	3.425060	0.116137	0.792386
S.E. equation	0.076635	0.337889	0.062219	0.162520
F-statistic	10.48606	101.2031	192.1119	25.03026
Mean dependent	4.511245	20.40937	12.37857	2.855736
S.D. dependent	0.104583	1.074325	0.266701	0.290024

Notes: *Notes: t-statistics in [ ]. If the t-statistics is more than 1.8, the variable in question has a significant impact on the dependent variable. The prior type is Litterman/Minnesota. The initial residual covariance is diagonal AR. The hyper-parameters are Mu: 0, L1: 0.1, L2: 0.99, L3: 1. The VAR lag order is selected by AIC.*

Figure 3 shows the impulse response functions of human capital to fiscal stimulus and the other endogenous variables. While a unit shock to human capital and GDP per capital produces, to a great extent, a positive effect on human capital, the response of human capital to fiscal stimulus and interest rates is largely insignificant. In other words, fiscal stimulus has positive insignificant effects on human capital from the results of the IRFs.

Figure 1. Impulse Response Functions for Human Capital



This study further uses variance decomposition to separate the variation in the endogenous variables into the component shocks to the VAR. This is in order to provide information about the relative importance of each random innovation in influencing the variables in the VAR. Table 3 shows that the forecast error variance of human capital is better explained by GDP per capita. However, human capital is not significantly explained by fiscal stimulus.

Table 3 Variance Decomposition

Variance Decomposition of LOG(HUMANCAP):					
Period	S.E.	LOG(HUMANCAP)	LOG(EDUEXP)	LOG(GDPC)	LOG(INTEREST)
1	0.076635	100.0000	0.000000	0.000000	0.000000
2	0.090959	99.00980	0.012638	0.977312	0.000246

3	0.097468	97.04756	0.021496	2.820030	0.110915
4	0.101411	94.27950	0.105599	5.226617	0.388288
5	0.104425	91.01879	0.293968	7.919752	0.767491
6	0.107096	87.54056	0.583865	10.69061	1.184966
7	0.109636	84.03601	0.956662	13.40698	1.600349
8	0.112120	80.62101	1.388780	15.99720	1.993013
9	0.114573	77.35782	1.857872	18.42949	2.354821
10	0.116999	74.27463	2.345458	20.69550	2.684407

Variance Decomposition of LOG(EDUEXP):

Period	S.E.	LOG(HUMANCAP)	LOG(EDUEXP)	LOG(GDPC)	LOG(INTEREST)
1	0.337889	2.199244	97.80076	0.000000	0.000000
2	0.419078	6.376132	90.61234	1.236232	1.775299
3	0.464089	8.247628	86.82520	2.964722	1.962445
4	0.493114	9.019694	84.21388	4.960796	1.805627
5	0.514090	9.232169	82.00998	7.095732	1.662116
6	0.530716	9.153810	79.96643	9.275517	1.604245
7	0.544871	8.931830	78.00284	11.43559	1.629741
8	0.557555	8.647930	76.09759	13.53516	1.719317
9	0.569319	8.346035	74.24993	15.55089	1.853143
10	0.580473	8.048353	72.46519	17.47134	2.015120

Cholesky Ordering: LOG(HUMANCAP) LOG(EDUEXP) LOG(GDPC) LOG(INTEREST)

The results of the BVAR estimates, the impulse response functions and the variance decomposition have all shown that fiscal stimulus has insignificant positive impact on human capital in Nigeria. This means that while the impact of fiscal stimulus on human capital is positive, the impact is not significant. This finding is in line with Arin and Li (2005) who, using macroeconomic panel data from 21 OECD countries, found that fiscal policy stimulates human capital accumulation. This study has therefore established that higher fiscal stimulus is associated with higher levels of human capital, but the impact is not significant. This means there is need to stimulate fiscal spending towards education in Nigeria

Conclusions

This study has provided new empirical evidence on Bayesian estimation of the relationship between fiscal stimulus and human capital in Nigeria using a BVAR model with a KoKo Minnesota/Litterman prior distribution. The findings show that higher fiscal stimulus is associated with higher levels of human capital in Nigeria. It is, however, interesting to note that fiscal stimulus is having an insignificant positive impact on human capital. The evidence also suggests that only GDP per capita has positive and significant impacts on human capital.

Recommendations

The finding that fiscal stimulus has positive but insignificant impact on human capita in Nigeria is very interesting for policy implications. While the new endogenous growth theories in economics have established significance of human capital in the growth of every economy, the education expenditure in Nigeria is not robust enough to support higher quanta of human capital with its puny investment in education. It is, therefore, imperative for Nigeria to adopt a strategy which promotes provision of adequate funds for human capital.

Limitations

There are of course limitations to the analysis undertaken in this study. Using proxies such as school enrollment rate as a measure of human capital may not be adequate. It would therefore be worthwhile to examine other alternative measures which could enhance human capital, such as literacy rates and years of schooling. Further research may thus be necessary using specific types of human capita proxies.

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