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Economic impact of the demand for human capital in Ghana: An input-output multiplier analysis

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Abstract

Numerous studies have dealt with the issue of the relationship between human capital and economic growth. There is however, a paucity of literature or information as regards the examination of the economic impact of the demand for education and health on the Ghanaian economy based on multipliers derived from Input-Output (IO) analysis. This study attempts to quantify the economic impact of the demand for education and health in Ghana using the Input-Output (IO) approach. The input-output table of Ghana for 2011 sourced from Eora MRIO database, has been used to estimate the impact multipliers of the demand for human capital and also carried out simulation exercises to forecast the impact on the Ghanaian economy of a future increases in the demand for human capital using three different scenarios. The results revealed that the human capital sector is among the top five sectors as far as income generation is concerned. The impact on labour incomes far outweighs that of non-labour incomes. This buttresses the point that human capital sector is very important as far as income generation and poverty reduction are concerned. It is also evident that out of the 26 sectors, it is only in the human capital sector that expenditure on subsidies outweighs tax revenues. Given the potential gains from human capital, in terms of output and incomes among others, there is scope for a government investment policy that enhances the linkage effects. Policy objectives should therefore, aim at increasing the human capital sector's linkage with other sectors. With the much-needed investment into the human capital sector, the sector's expansion offers the potential to contribute significantly to economic growth in Ghana.

Keywords: Human Capital; Economic Growth; Input-Output Approach; Impact Multipliers; Linkage Effects

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1. Introduction

It is a common saying that the most important resource of any nation is the human resource or human capital. There exists ample evidence that human capital is a key determinant of economic growth and it is also believed to be associated with a wide range of non-economic benefits such as better health and well-being. Human capital is generally considered a key ingredient for improving countries' economic well-being, via higher productivity and more innovation. This has motivated nations to invest more into the development of their human resource. Investment in human capital has now assumed centre stage in economic development strategies. As a result, an investment in human capital is considered an investment in the collective future of societies and nations, rather than simply in the future success of individuals.

Education and health are directly linked to the development of the human resource. Economic performance of developing countries could conceivably be enhanced by improving the educational levels and health of the citizens. In an attempt to build and improve upon the human capital base of the country the Government of Ghana introduced the free compulsory universal basic education policy as well as the national health insurance scheme as a financing scheme in 2003. Subsequently, other new policies in education such as school feeding programme, free exercise books and uniforms were also introduced even though in some selected schools in the country. These major social policies have led to a significant increase in basic school enrolment and hospital attendance and have also resulted in increases in total expenditures on these social services. It is noted that all exogenous injections of expenditure into an economy have a multiplier effect, and human capital sector is only one of them.

It is also a well-known fact that the provision of critical social services such as education and health plays an important role in economic development in general and in improving the welfare of the poor in particular. The benefits for economic development arise because better education and health raise the human capital of the population, ensuring greater productivity and hence higher output and economic growth. In fact, the link between human capital and economic growth is one of the best-documented relationships in economics. There is a plethora of empirical literature on the effect of education and health on economic growth. Studies such as Lucas (1988) and Mankiw et al. (1992), Bloom et al. (2004) among others, have long established that human capital in the form of education and health have positive and statistically significant effects on aggregate output. Lucas (1988) and Mankiw et al. (1992) for instance, observed that the accumulation of human capital could increase the productivity of other factors and thereby raise growth. There is however, to the best of our knowledge, a paucity of literature or information as regards the examination of the economic impact of the demand for education and health on the economy especially, the Ghanaian economy based on multipliers derived from Input-Output (IO) analysis. As noted by Archer and Fletcher (1990) input-output models are more appropriate because of their flexible nature and the ability to take a comprehensive view of the economy and more importantly pay attention to intersectoral linkages.

The question that this study seeks to address is: What is the economic impact of the demand for human capital on the Ghanaian economy? The study therefore, aims at finding out the impact of human capital on output, incomes, government tax revenue, cost of government subsidy, trade balance and on energy demand. Despite the importance of human capital to the economy of Ghana, there is lack of appropriate empirical

studies that tries to quantify the effect of human capital on economic growth thus contributing to the inadequate policy guidance to the sector. It is against this background that this study intends to contribute to the expansion of the frontier of knowledge by quantifying the impact of the demand for human capital on the Ghanaian economy in order to inform policy.

2. Overview of expenditures on human capital in Ghana

The Government of Ghana's Coordinated Programme of Economic and Social Development Policies (CPESDP) 2014 – 2020, gave birth to the Ghana Shared Growth and Development Agenda (GSGDA) II, 2014 – 2017 (a successor to the (GSGDA) I, 2010 – 2013). The GSGDA II, contains the specific strategies to be implemented to systematically position the country towards the attainment of the President's Vision and Goal under the CPESDP.

Out of the estimated US$23,891.459 million (GH¢34,642.62 million) earmarked for the implementation of the GSGDA, 25.2% was expected to go to "Human development, employment and productivity" thematic area. In the medium term, this thematic area aims at implementing policies and programmes that will bring about the development of the human resource capable of driving and sustaining the socio-economic transformation of the country over the long-term. The total resource requirements for the thematic area over the plan period is estimated at US$3,644.431 million (GH¢14,577.72 million). Out of this amount about 47.1% is expected to be expended on activities related to the provision of quality health care, nearly 41.6% is expected to be expended on activities related to the provision of quality education, while the remaining 11.3% goes into programmes aimed at improving human capital development, employment, and productivity, promoting nutrition, prevention of HIV and AIDS among others. It is the expectation that the resource requirement in this thematic area will be evenly distributed over the plan period, with about 24.4% required in 2014 and increasing gradually to 26.0% in 2017 (Government of Ghana, 2015).

2.1. Health expenditure in Ghana

Ghana's expenditure on health for years 2000 to 2014 has been reported in Table 1. Except for 2002, 2009 and 2014 where there were drops, health expenditure per capita witnessed upward trend from US$12.72 in 2000 to as high as US$84.53 in 2013. It is noted that the periods that witnessed high rate of growth in the expenditures were the periods after the introduction of the health insurance scheme. Private health expenditure as a percentage of GDP has remained at approximately 2% over the years under consideration whereas public health expenditure as a percentage of GDP has seen some fluctuations over the period. In terms of the total health expenditure as a percentage of GDP, the highest percentage of 5.33% occurred in 2010. This is followed by 5.30% in 2007, 5.17% in 2009 and 4.85% in 2008. As already stated these are the years which saw health insurance in operation and that might have accounted for the increases.

Table 1. Health Expenditure in Ghana, 2000 – 2014

	Health expenditure per capita (current US$)	Health expenditure, private (% of GDP)	Health expenditure, public (% of GDP)	Health expenditure, public (% of government expenditure)	Health expenditure, total (% of GDP)
2000	12.27	1.50	1.50	7.85	3.00
2001	15.25	1.51	2.05	9.34	3.56
2002	14.98	1.56	1.51	8.45	3.07
2003	18.48	1.54	1.58	8.33	3.12
2004	26.70	1.56	2.40	12.58	3.96
2005	36.03	1.58	2.92	15.08	4.51
2006	43.11	1.59	3.04	13.98	4.64
2007	58.25	1.57	3.73	16.16	5.30
2008	59.86	1.63	3.22	13.153	4.85
2009	56.67	1.50	3.67	16.45	5.17
2010	70.58	1.51	3.83	14.93	5.33
2011	76.30	1.23	3.58	14.03	4.81
2012	78.64	1.65	3.14	9.32	4.79
2013	84.53	1.38	3.24	10.58	4.63
2014	57.89	1.43	2.13	6.82	3.56

Source: WDI (2017)

With the signing of the Abuja Declaration in 2001, the Government of Ghana committed itself to spending at least 15% of the total national budget on health (15% Benchmark). According to the World Health Organisation (WHO) Ghana, since 2001, has hit 15% Benchmark of general expenditure on health three times (2005, 2007 and 2009). In 2010, the WHO recommended that, in order to achieve universal access to healthcare by 2015, Ghana's total health spending – including both government and private spending – should amount to a minimum of US$54 per person. According to the Communiqué issued by the Ghana's Civil Society Organisations in Health (the CSOs) in 2013, this target cannot be met if the Government does not meet the 15% Benchmark. The CSOs believe that the Government of Ghana can achieve the 15% benchmark and honour its Abuja Declaration pledge if some steps including facilitating the actual release and disbursement of allocated funds and managing identified funding leakages are taken.

2.2. Education expenditure in Ghana

According to UNESCO standards, government's expenditure on education should be at least 10% of its GDP in order for the sector to achieve its targets and the desired results. Table 2 presents Government of Ghana's expenditure on education from 2005 to 2013. It shows government expenditure as a percentage of GDP, as a percentage of total government expenditure, and government expenditure per student in three categories of education, primary, secondary and tertiary all expressed in purchasing power parity dollars. Government expenditure as a percentage of GDP has ranged between 5% and 9% which does not meet the UNESCO standards. The highest percentage of 8.14% was registered in 2011 which is followed by 7.92% in 2012 and 7.42% in 2005.

Table 2. Government Expenditure on Education, 2005 – 2013

	Government Expenditure		Government Expenditure per student (in PPP$)		
	% of GDP	% of Total Government Expenditure	Primary Education	Secondary Education	Tertiary Education
2005	7.42	23.43	486.86	857.84	6673.97
2006	5.26	24.16	331.14	719.83	5176.85
2007	5.52	24.12	327.57	693.65	5987.92
2008	5.76	23.61	354.44	732.22	5049.57
2009	5.32	22.68	323.94	740.61	4199.22
2010	5.54	21.24	-	-	-
2011	8.14	30.77	820.43	886.6	3197.12
2012	7.92	37.69	630.57	1430.48	4881.93
2013	5.93	21.7	375.6	1265.12	3440.06

Source: UNESCO Institute of Statistics

3. Literature review

Majority of the studies on the effects of human capital on economic growth have measured the quality of human capital using proxies related to education (e.g. school-enrolment rates, tests of mathematics and scientific skills, etc.) and health. Many studies such as Barro, 1991; Mankiw et al., 1992; Barro and Sala-i-Marin, 1995; Brunetti et al., 1998, Hanushek and Kimko, 2000 among others, have found evidence suggesting that educated population is key determinant of economic growth.

Barro (1991), studied 98 countries in the period 1960-1985 and concluded that the growth rate of real per capita GDP is positively related to initial human capital. In 1995, he further concluded that for a country to grow adequately, human capital in the form of education and health is an important element. Sach and Warner (1997), in their study of African economies, also noted that a rapid increase in human capital development would result in rapid transitional growth. Furthermore, Gallup et al. (1998) note that a well-developed labour force, in terms of better education and health, is likely to be able to produce more from a given resource base, than less-skilled workers.

Levine and Zervos (1993) conclude that countries that have more students enrolled in secondary schools grow faster than countries with lower secondary school enrollment rates. According to Brunetti et al. (1998) education, measured by secondary school enrollment, is positively related to growth. Sala-i-Martin (1997) also support the view that various measures of education are positively related to growth. Levine and Renelt (1992) concur.

Becker et al. (1990) state that higher rates of investment in human and physical capital lead to higher per capita growth. This is because well-developed human capital will lead to an improvement in productivity, and an increase in the growth rate and investment ratio.

In their study of developing countries, Bloom and Canning (2000) identified four different channels through which health influences productivity: (i) Individuals with greater health not only have less sick days, but are also more mentally and physically prepared for work. (ii) Individuals who live longer have a greater

incentive to invest in education and acquire higher return on such investments. (iii) The level of savings increases as the individual's life expectancy rises, hence stimulating investment. (iv) Better health in the form of higher life expectancy and improved child health may lead to a decrease in the impregnation rate, hence adults participate more extensively in the labour market, allowing them to obtain higher income per capita.

Using the generalized Solow growth model, inter-country approach and panel data model of thirty-three developing countries between 1990- 1998, Mojtahed and Javadipour (2004) found a positive and significant impact of health expenditure as a variable of health capital on economic growth.

More recent studies on the impact of human capital on economic growth include Cadil, Petkovová and Blatná (2014), Pelinescu, (2015), Chang and Shi (2016). Using a panel of 28 EU countries, Pelinescu, (2015), examines the role of human capital as a factor of growth. Consistent with economic theory, the study reveals a significant positive relationship between GDP per capita and innovative capacity of human capital (evidenced by the number of patents) and qualification of employees (secondary education).

Chang and Shi (2016) discusses mechanism and classification of heterogeneous effects of human capital on economic growth using demographic data from China's 30 provinces and autonomous regions. They revealed among others, that when human capital is measured by years of education, primary and advanced human capital can promote economic growth, but work in a different way. Primary human capital directly contributes to the final output of increase whereas advanced human capital stimulates economic growth via technological innovation.

These empirical studies reviewed only established relationships between various forms of human capital and economic growth. None of them, however, employed the input-output multiplier approach to quantitatively find out the impact of human capital (education and health) on the economy. Analysis of economic impact of the demand for any product or service using multipliers derived from Input-Output (IO) analysis has been considered by a number of studies especially in the tourism sector (see Archer and Fletcher, 1990, Wagner, 1997, Fletcher, 1989, 1994, Kweka et al., 2003, Bentum-Ennin, 2016). These multipliers measure the effect of a unit increase in expenditure (demand) on economic activity in a country, usually concentrating on output, incomes and employment. Using multipliers derived from Input-Output (IO) analysis to analyse the impact of the demand for human capital on the Ghanaian economy is nonexistent to the best of our knowledge hence the need for this study.

4. Methodology

4.1. Theoretical framework of the input-output analysis

4.1.1. Input-Output multipliers and linkage measures

There is an inter-sectorial linkages among the various sectors of the Ghanaian economy. The human capital sector demands inputs from other sectors while other sectors also demand inputs from the human capital

sector. In examining the impact of changes in one or more sectors of the economy on the total economy, the input-output analysis has been used. The basic structure of the input-output model used is explained below.

For the general case of *n* sectors, we write x_i and d_i for the total output and final demand for the ith sector. Of the x_i units of output of sector i that are produced,

$a_{i1}x_1$ is used as input for sector 1

$a_{i2}x_2$ is used as input for sector 2

… … … … … …

$a_{in}x_n$ is used as input for sector n

and

d_i is used for external demand

Hence

$x_i = a_{i1}x_1 + a_{i2}x_2 + \ldots + a_{in}x_n + d_i$

in matrix form, the totality of equations obtained by setting i = 1, 2, …, n, in turn, can be written as

$$\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} + \begin{bmatrix} d_1 \\ d_2 \\ \vdots \\ d_n \end{bmatrix}$$

that is, as

$$x = Ax + d \qquad (1)$$

where A is the n x n matrix of technical coefficients, x is the n x 1 total output vector and d is the n x 1 final demand vector.

This technical or input-output coefficient (a_{ij}), which represents the share of inputs from sector *i* in total output of sector *j*, is defined as:

$$a_{ij} = \frac{z_{ij}}{x_j}$$

where z_{ij} is the output of each sector *i* sold to sector *j* which is termed the inter-sector transaction and is also the (intermediate) inputs to sector *j* purchased from sector *i*; x_j is the total value of inputs (primary and intermediate) purchased by sector *j* which is equal to the total value of output (final demand and intermediate) of that sector.

The matrix equation in (1) rearranges to give

$$(I - A)\, x = d \qquad (2)$$

Equation (2) can be solved by multiplying the inverse of the coefficient matrix by the right-hand-side vector to get

$$x = (I - A)^{-1} d \qquad (3)$$

In the context of input-output analysis the matrix $(I - A)^{-1}$ is called the Leontief inverse. Suppose our *n* sector model gives us the Leontief inverse, $B = (I - A)^{-1}$, given by

$$B = \begin{bmatrix} b_{11} & b_{12} & \cdots & b_{1n} \\ b_{21} & b_{22} & \cdots & b_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ b_{n1} & b_{n2} & \cdots & b_{nn} \end{bmatrix}$$

Each element of B (b_{ij}), the inter-dependence coefficient, measures the total stimulus (direct and indirect) to the gross output of sector *i* when sector *j*'s final demand changes by one unit (i.e. $b_{ij} = \delta x_i / \delta d_j$). The output multiplier for sector *j* is defined as the total change in the output of all sectors given a unit change in the demand for output of sector j, and is given by the column sum of b_{ij} (denoted by Q_j):

$$Q_j = \sum_i b_{ij}$$

Q_j can be decomposed into the effects occurring within the sector (*intra*-sector effects) and those that spread to all other sectors (*inter*-sector effects). We can express intra-sector and inter-sector effects respectively as g_j and k_j, where:

$g_j = b_{ij}$ for $i = j$

$k_j = Q_j - g_j$

The above analysis can be extended to estimate different primary input multipliers as well as different primary income multipliers such as labour, non-labour, taxes and import multipliers. For instance, the income multiplier can be calculated by multiplying the value-added vector by the Leontief inverse, B. These static multipliers will indicate the effects of a unit increase in demand for the output of a human capital sector on total output, incomes, tax revenue, cost of government subsidy, imports and exports and on energy. To evaluate the significance of the demand for inputs from other sectors resulting from human capital we use linkage measures. Linkage analysis is carried out by examining the strengths of the inter-sectoral forward (FL) and backward (BL) relationships between the human capital sector and the non-human capital industries in the rest of the economy. The FL measures the relative importance of the human capital sector as supplier to the other (non-human capital) industries in the economy whereas the BL measures its relative importance as demander. According to Jones (1976), sectors with relatively high linkage effects offer the greatest potential to stimulate the economic activity of other sectors and therefore have a greater effect on growth (p. 324).

The forward and backward linkages can be estimated in various ways. According to Rasmussen (1956), the forward and backward linkages can be calculated based on the row and column sum of the Leontief inverse respectively. Backward linkage is thus given as

$$BL_j = \sum_i b_{ij}$$

where ij is the ij'th element of Leontief inverse matrix that is denoted by $B = (I - A)^{-1}$. BLj is backward linkage for sector j which reflects the effects of an increase in final demand.

Forward linkage which is defined as the row sums of the Leontief inverse matrix is given as

$$FL_i = \sum_j b_{ij}$$

FL_i is forward linkage for sector i. It measures the magnitude of output increase in sector i, if the final demand in each sector were to increase by one unit. It measures the extent to which a unit change in the primary input of sector i causes production increases in all sectors.

4.2. Application to Ghana

The Input-Output multiplier analysis has been used to assess the relative significance of human capital in terms of their impact on output, incomes, government tax revenue, cost of subsidy, trade balance as well as energy expenditure, distinguishing the impact occurring within the sector and that spreading to other sectors.

A simulation exercise has also been done (by multiplying the Leontief inverse by the vector of final demand, with all sectors other than social services sector entered as zero) to find out the levels/amounts of economic activities that are supported by three different scenarios: (i) expenditure projections in GSGDA II are implemented that is if US$900.833 million and US$948.810 million are injected in the human capital sector for the years 2016 and 2017 respectively and a cumulative amount of US$3,644.431 million is injected for the period 2014 – 2017 which is the period for the implementation of GSGDA II. (ii) WHO and UNESCO expenditure targets for health and education are achieved and (iii) a 10% annual increase in the final demand for human capital. Simulation has also been done to find out the impact on labour and non-labour incomes, government tax revenue, expenditure on subsidies, trade balance as well as on energy expenditures. In this study, human capital sector refers to education and health sectors.

4.3. Data description and sources

Two sets of data are required for estimating the multipliers. The first is the inter-industry flow of transactions among the sectors of the economy, for which we use the twenty-six sector Input-Output table for 2011. The second is the value of human capital expenditures**.** Input-Output table for 2011 has been sourced from Eora multi-region IO database and has been used to estimate the multipliers since that is the most recent one for Ghana. Bulmer-Thomas, (1982:156) notes that, in practice, IO tables take a number of years to be published and construct, especially in developing countries where delays of five to seven years are common. Using Input-Output table 2011 will be reasonable in the sense that from 2011 to date there has not been any significant changes in the structure of the Ghanaian economy and as noted by Leontief (1986:165), structural coefficients change slowly in developing countries.

5. Analysis of results

5.1. Estimated output multipliers

The estimated sector multipliers were based on a twenty-six sector model but for expositional convenience we report results for the top 5 sectors. Table 3 shows the total, intra and inter-sector output multipliers and

their rankings. Both backward linkage effects and forward linkage effects are reported. In terms of backward linkage effects, the output multiplier for human capital is 1.221, ranking 23rd in the 26 sector model. This implies, for example, that an increase in demand for human capital by US$1 million will generate or induce about US$1.22 million worth of total output in the economy. The total output in the economy will have to increase by approximately US$1.22 million in order to meet US$1 million worth of human capital demand. The intra-sector effect is 1.001 accounting for about 82% whereas the inter-sector effect is 0.220 which accounts for 18%.

In terms of forward linkages, the human capital sector has an impact of 1.180 and is ranked 12th. This implies that that a US$1 million increase in human capital output (increase in supply of education and health), for example, will increase human capital sector's earnings by US$1.18 million. This forward linkage effects suggest that as the sector develops it provides services that can be utilized by other sectors. The inter-sector effect is 0.179 constituting 15% of the total forward linkage effect. Since the multipliers (both backward and forward linkages) are greater than one the human capital sector is confirmed as one of the key sectors in Ghana.

Table 3. Total, Intra and Inter-Sector Effects due to Backward and Forward Linkages

Human Capital	Total		Intra-sector		Inter-sector	
	Multiplier Qj	Rank	Multiplier gj	Percentage (gj/Qj) %	Multiplier kj	Percentage (kj/Qj) %
Backward Linkages	1.221	23	1.001	82	0.220	18
Forward Linkages	1.180	12	1.001	85	0.179	15

Source: Author's calculations based on Eora MRIO data

Table 4 decomposes the total backward and forward linkage effects into direct and indirect effects. In terms of backward linkage effects, the direct effect is 0.167 accounting for about 14% whereas the indirect effect is 1.054 constituting about 86%. The direct and indirect effects, in terms of forward linkage effects, are 0.123 and 1.057 representing about 10% and 90% respectively. In both cases, the indirect effects outweigh the direct effects.

Table 4. Total, Direct, and Indirect Effects due to Backward and Forward Linkages

	Total	Direct	Percentage	Indirect	Percentage
Backward Linkages	1.221	0.167	13.69	1.054	86.31
Forward Linkages	1.180	0.123	10.46	1.057	89.54

Source: Author's calculations based on Eora MRIO data

Table 5 shows the distribution of human capital output effects by sector. In other words, it shows the top five suppliers and demanders of human capital output. The greatest impact is seen in the human capital sector itself. Apart from the human capital sector itself, financial intermediation and business activities sector, Petroleum, Chemical and Non-Metallic Mineral Products sector, Wholesale Trade sector, Electricity, Gas and Water sector are among the top five suppliers to the human capital sector. Private Households, Public Administration, Hotels and Restaurants are among the top five demanders of human capital output.

As the supply of education and health increases, by say US$1 million, other sectors make increasing use of these services. Some US$0.02 million of this amount will come from the Private Households, US$0.019 million will come from others, US$0.017 million each will come from Public Administration and Hotels and Restaurants, US$0.012 million will come from Post and Telecommunications among others. According to Yotopoulos and Nugent (1976) however, linkages provide a stimulus to growth only if the interdependence among sectors is causal and Jones (1976) identified backward linkages as being the more causal.

Human capital has a significant potential to stimulate the economy of Ghana given its high multipliers. If this stimulus is to be fully realised, the sectors that benefit from induced demand must be able to respond otherwise, the growth of human capital and impact on the economy will be constrained. It is therefore, very pertinent to identify those sectors in order to inform policy. We identify them by examining elements of the Leontief inverse where the share of each sector in Q_j is computed. Table 5 shows a summary of the output effects of human capital due to backward linkages and it indicates that the greatest impact is felt within human capital sector (intra-sector effect). As indicated in Table 4 above, a US$1 million increase in human capital output, for example, requires output in the economy to increase by US$1.22 million. Table 5 shows the distribution of this output. Approximately, US$1.00 million of this output will come from the human capital sector itself whereas about US$0.22 million will come from the other sectors (inter-sector effects) such as financial intermediation and business activities (about US$ 0.11 million), petroleum, chemical and non-metallic mineral products (about US$0.02 million), wholesale trade (about US$0.02 million), electricity, gas and water (about US$0.02 million) among others.

Table 5. Distribution of Human Capital Output Effects by Sector (Total Effects)

Backward Linkages			Forward Linkages		
Sector	Multiplier	Rank	Sector	Multiplier	Rank
Human Capital	1.001	1	**Human Capital**	1.001	1
Financial Intermediation and Business Activities	0.108	2	Private Households	0.020	2
Petroleum, Chemical and Non-Metallic Mineral Products	0.019	3	Others	0.019	3
Wholesale Trade	0.019	4	Public Administration	0.017	4
Electricity, Gas and Water	0.015	5	Hotels and Restaurants	0.017	5

Source: Author's calculations based on Eora MRIO data

5.2. Estimated income multipliers

The income multipliers have been estimated by multiplying the value-added vector derived from the input-output table by the Leontief inverse, B and selecting the value related to the human capital sector. The estimated income multipliers for human capital are presented in Table 6. Human capital sector has an estimated total multiplier of approximately 0.80 ranking 5th. This result means that an increase in human capital demand by US$1 million will generate approximately US$ 0.80 million of incomes to factors of production, with labour receiving about US$ 0.45 million, ranking 2nd and others (non-labour) about US$ 0.35 million. The impact on labour incomes is higher. This shows that the human capital sector is very important as far as income generation is concerned. The result is not surprising given the fact that the human capital sector enhances labour productivity and therefore enhances labour earnings.

Table 7 shows the direct and indirect effects. Indirect income multipliers outweigh that of the direct income multipliers. Total indirect effects account for about 87% whereas that of the direct effects account for 13%.

Table 6. Income Multipliers

Sector	Labour	Rank	Non-Labour	Rank	Total	Rank
Wholesale Trade	0.490	1	0.526	3	1.017	1
Human Capital	0.449	2	0.347	15	0.795	5
Retail Trade	0.376	3	0.431	6	0.807	4
Construction	0.366	4	0.354	14	0.720	10
Public Administration	0.357	5	0.365	11	0.722	9

Source: Author's calculations based on Eora MRIO data

Table 7. Income Multipliers- Direct and Indirect

	Total	Direct	Percentage	Indirect	Percentage
Labour	0.449	0.033	7.28	0.416	92.72
Non-Lab	0.347	0.072	20.82	0.274	79.18
Total	0.795	0.105	13.18	0.691	86.82

Source: Author's calculations based on Eora MRIO data

5.3. Estimated subsidy and tax multipliers

The estimated subsidy multiplier for the human capital sector is 0.01 and ranking 6th after wholesale trade, electricity, water and gas, retail trade, food and beverages and financial intermediation and business activities as depicted in Table 8. The result means that Government expenditure on subsidies will increase by about US$ 0.01 million if the demand for human capital increases by US$1 million.

In the case of tax revenue multiplier, human capital sector has an estimated multiplier of approximately 0.006 ranking 20th. The result implies that an increase in human capital demand by US$1 million will

generate approximately US$ 0.006 million in tax revenues. It is also evident that out of the 26 sectors, it is only in the human capital sector that expenditure on subsidies outweighs tax revenues. Education and health being considered as important sectors increasing taxes or removing subsidies may increase their prices thereby excluding many people from access to such important and essential social services. This will negatively affect the human capital development of the country and therefore negatively affect productivity and economic growth.

The estimates for direct and indirect effects have been reported in Table 9. In the case of the subsidies, the indirect effects account for about 88% whereas the direct effects account for about 22%. The indirect effects of tax account for approximately 75% while that of the direct effects constitute about 25%.

Table 8. Subsidy and Tax Multipliers

Sector	Subsidies on production	Rank	Taxes on Production	Rank	Net
Wholesale Trade	-0.018	1	0.030	1	0.011
Electricity, Gas and Water	-0.016	2	0.025	2	0.009
Retail Trade	-0.012	3	0.024	3	0.013
Food & Beverages	-0.011	4	0.018	5	0.007
Financial Intermediation and Business Activities	-0.010	5	0.011	9	0.001
Human Capital	-0.010	6	0.006	20	-0.004

Source: Author's calculations based on Eora MRIO data

Table 9. Subsidy and Tax Multipliers – Direct and Indirect

	Total	Direct	Percentage	Indirect	Percentage
Subsidy	-0.0097	-0.0012	12.18	-0.0085	87.82
Tax	0.0064	0.0016	24.54	0.0048	75.46
Net	-0.0034	0.0004	11.24	-0.0037	88.76

Source: Author's calculations based on Eora MRIO data

5.4. Estimated import and export multipliers

To determine the impact of the demand for human capital on foreign trade, import and export multipliers have been estimated. Import and export multipliers have been calculated by multiplying the vectors of import output ratios and export output ratios respectively by the Leontief inverse. Table 10 presents the estimated multipliers. Out of the 26 sectors considered in the analysis, the estimated multipliers for exports and imports are 0.027 and 0.047 ranking 25th and 23rd respectively. The results show a net deficit of about 0.020 indicating that an increase in the demand for human capital by US$1million will worsen the balance of trade by about US$0.20 million.

Table 11 reports the direct and indirect effects as far as exports and imports of human capital are concerned. The indirect effects outweighs the direct effects. In the case of export multiplier, the indirect

effect is about 0.022 representing about 80% whereas direct effect is about 0.006 representing about 20% of the total effects. In the case of import multiplier, the indirect effect is about 0.039 representing about 83% whereas direct effect is about 0.008 representing about 17% of the total effects. In terms of the net deficit, the indirect effect accounts for about 87% whereas the direct effect account for approximately 13%.

Table 10. Export and Import Multipliers

Sector	Export	Rank	Import	Rank	Net Export	Rank
Agriculture	0.730	1	0.053	21	0.678	1
Wood and Paper	0.678	2	0.111	10	0.567	2
Food & Beverages	0.458	3	0.105	11	0.353	3
Mining and Quarrying	0.267	4	0.050	22	0.217	4
Recycling	0.200	5	0.130	7	0.069	5
Human Capital	0.027	25	0.047	23	-0.020	16

Source: Author's calculations based on Eora MRIO data

Table 11. Export and Import Multipliers – Direct and Indirect

	Total	Direct	Percentage	Indirect	Percentage
Export	0.027	0.006	20.20	0.022	79.80
Import	0.047	0.008	16.97	0.039	83.03
Net	-0.020	-0.003	12.53	-0.017	87.47

Source: Author's calculations based on Eora MRIO data

5.5. Estimated energy multipliers

Table 12 presents total energy multipliers, petroleum and non-petroleum which were calculated by multiplying the vector of energy output ratios by the Leontief inverse. The human capital sector has an estimated multiplier of 0.002, ranking 22nd out of the 26 sectors. This is almost equally shared between petroleum multiplier (about 0.001) and non-petroleum multiplier (about 0.001). In terms of direct and indirect effects, the direct effects outweigh that of the indirect effects. The direct effects constitute about 64% whereas the indirect effects represent approximately 36% of the total effects as shown in Table 13.

Table 12. Energy Multipliers

Sector	Total Energy	Rank	Petroleum	Rank	Non-Petroleum	Rank
Electricity, Gas and Water	0.063	1	0.009	3	0.054	1
Petroleum,	0.039	2	0.008	4	0.031	2

Chemical and Non-Metallic Mineral Products						
Recycling	0.029	3	0.011	2	0.018	3
Transport	0.027	4	0.025	1	0.002	21
Other Manufacturing	0.015	5	0.005	5	0.010	4
Human Capital	0.002	22	0.001	22	0.001	22

Source: Author's calculations based on Eora MRIO data

Table 13. Energy Multipliers – Direct and Indirect

	Total	Direct	Percentage	Indirect	Percentage
Petroleum	0.0005	0.0003	62.36	0.0002	37.64
Non-Petroleum	0.0012	0.0008	64.71	0.0004	35.29
Total	0.0018	0.0011	64.01	0.0006	35.99

Source: Author's calculations based on Eora MRIO data

The low energy multipliers of the human capital sector mean that the sector is not heavily dependent on energy and therefore challenges in the energy sector may not significantly affect the human capital sector. It may not lead to total collapse of the sector as compared to some other sectors.

5.6. Simulation analysis

An increase in final demand for human capital and /or an injection of some more funds into the human capital sector will represent some injections of funds into the economy and therefore, it is appropriate to examine the impact of human capital on the Ghanaian economy by finding out the values of output in the economy which is supported by human capital expenditures. We simulate (by multiplying the Leontief inverse by the vector of final demand, with all sectors other than human capital entered as zero) the levels of output, incomes, expenditure on government subsidies, government tax revenue, balance of trade as well as on energy expenditures supported by the following scenarios:

(i) Expenditure projections in GSGDA II are implemented that is if US$900.833 and US$94.810 are injected in the human capital sector for the years 2016 and 2017 respectively and a cumulative amount of US$3,644.431 is injected for the period 2014 – 2017 which is the period for the implementation of GSGDA II.

(ii) WHO and UNESCO expenditure targets are implemented

(iii) A 10% annual increase in the final demand for human capital.

Scenario 1: Expenditure projections in GSGDA II are implemented.

Tables 14, 15, 16 and 17 show the results of the simulation exercises based on the first scenario. As depicted in Table 14, if the government is able to implement the expenditure projections it will have a positive impact on output of all the sectors of the economy. Consistent with the earlier results, the human capital sector will

witness the greatest impact increasing from about US$901.75 million by the close of 2016 to about US$949.78 million by the close of 2017. This is followed by financial intermediation and business activities sector increasing from US$97.36 million to US$102.54 million; Petroleum, Chemical and Non-Metallic Mineral Products from US$17.22 million to US$18.13 million, wholesale trade from US$17.13 million to US$18.05 million; electricity, gas and water from US$13.86 million to US$14.59 million etc. The total effect on the entire economy will increase from US$1100.15 million by the close of 2016 to US$1158.74 million by the close of 2017. In terms of percentage of projected GDP, it represents about 2%. The cumulative effects over the plan period, 2014 – 2017, will amount to US$4450.79 million representing approximately 8% of the projected GDP in 2017. Inter-sector effects will amount to US$802.64 million representing about 1.5% of the projected GDP in 2017 whereas the intra-sector effects will amount to US$3648.16 million representing approximately 6.7% of GDP by the close of 2017.

Table 14. Impact of Human Capital on Outputs in million US dollars

	2016	2017	Cumulative Effects over the Plan Period 2014-2017	Rank
Human Capital	901.754	949.780	3648.155	1
Financial Intermediation and Business Activities	97.357	102.542	393.870	2
Petroleum, Chemical and Non-Metallic Mineral Products	17.215	18.132	69.645	3
Wholesale Trade	17.134	18.046	69.317	4
Electricity, Gas and Water	13.855	14.593	56.053	5
Total	1100.150	1158.742	4450.793	-
%Proj.GDP	2.168	2.114	8.121	-
Intra	901.754	949.780	3648.155	-
%Proj.GDP	1.777	1.733	6.656	-
Inter	198.397	208.963	802.638	-
%Proj.GDP	0.391	0.381	1.464	-

Source: Author's calculations based on Eora MRIO data

Table 15 presents the impact of human capital on incomes, tax revenues and expenditure on subsidies. The impact on labour incomes outweighs that of non-labour incomes. This buttresses the point made earlier that human capital sector is very important as far as income generation is concerned. The total incomes are expected to increase from about US$716.48 million representing 1.4% of the projected GDP in 2016 to approximately US$754.64 million representing 1.4% of projected GDP in 2017. The cumulative effects over the plan period will amount to US$2898.61 representing about 5.3% of 2017 projected GDP. In terms of tax revenue, it will increase from about US$5.7 million in 2016 to about US$6.00 million in 2017. The cumulative effects over the plan period US$23.17 million. As already noted, the expenditure on subsidies will outweigh that of tax revenues. Expenditure on subsidies will increase from US$8.75 million in 2016 to US$9.22 million

in 2017. The cost of government subsidy over the plan period will amount to about US$35.40 million. Comparing this value to that of the tax revenue, it creates a funding gap of about US$12.23 million.

Table 15. Impact of Human Capital on Incomes, Subsidies and Tax Revenue in million US dollars

	2016	2017	Cumulative Effects over the Plan Period, 2014 – 2017
Labour	404.323	425.857	1635.740
Non Lab	312.156	328.781	1262.865
Total	716.479	754.638	2898.605
%Proj.GDP	1.412	1.377	5.289
	2016	2017	Cumulative Effects over the Plan Period, 2014 – 2017
Taxes on Production	5.727	6.032	23.169
%Proj.GDP	0.011	0.011	0.042
Subsidies on production	8.749	9.215	35.395
%Proj.GDP	0.017	0.017	0.065
Net	-3.022	-3.183	-12.226
%Proj.GDP	0.006	0.006	0.022

Source: Author's calculations based on Eora MRIO data

The impact on the trade balance is reported in Table 16. Expenditure on imports will increase from US$42.15 million in 2016 to US$44.40 billion in 2017 whereas export receipts will increase from US$24.39 million in 2016 to US$25.68 million in 2017 resulting in deficits for the years under consideration. The cumulative effects over the Plan period will cause a deterioration of the balance of trade by US$71.87 representing about 0.13% of the projected GDP for 2017.

Table 16. Impact of Human Capital on Trade Balance in million US dollars

	2016	2017	Cumulative Effects over the Plan Period, 2014 – 2017
Imports(I)	42.151	44.396	170.528
Exports(X)	24.385	25.684	98.654
Net (X-I)	-17.766	-18.712	-71.874
%Proj.GDP	0.035	0.034	0.131

Source: Author's calculations based on Eora MRIO data

If expenditure projections in GSGDA II are implemented it will result in increases in the demand for energy and therefore increased expenditure on energy as shown in Table 17. The total expenditure on energy will increase from US$1.59 million in 2016 to US$1.68 million in 2017. Expenditure on non-petroleum sources of energy will outweigh that of petroleum sources. Expenditure on non-petroleum sources will increase from US$1.12 million in 2016 to US1.18 million in 2017 whereas that of petroleum sources will increases from US$0.47 million in 2016 to US$0.50 million in 2017. The cumulative demand for energy over

the Plan period, 2014 – 2017 will amount to US$6.45 million representing about 0.01% of the projected GDP for 2017.

Table 17. Impact of Human Capital on Energy Demand in million US dollars

	2016	2017	Cumulative Effects over the Plan Period, 2014 – 2017
Petroleum	0.471	0.496	1.904
Non-Petro	1.122	1.182	4.541
Total Energy	1.593	1.678	6.445
%Proj.GDP	0.003	0.003	0.012

Source: Author's calculations based on Eora MRIO data

Scenario 2: WHO and UNESCO expenditure targets are achieved

Tables 18, 19, 20 and 21 show the results of the simulation exercises based on the WHO and UNESCO expenditure standards for the period 2016 – 2020, earmarked by the government for the implementation of the agenda for transformation captured in CPESDP. As depicted in Table 18, if the government is able to implement the WHO's recommendation that at least US$54 per person is spent on health and the UNESCO's recommendation that at least 10% of GDP is spent on education are adhered to, they will have positive impact on all the sectors of the economy. The greatest impact will be felt within the human capital itself consistent with the earlier results.

The total effect on the entire economy will increase from US$8026.63 million in 2016 to US$10434.99 million by the close of 2020. In terms of percentage of projected GDP, it represents about 15%. At the end of GSGDA II in 2017, the cumulative effect will amount to US$31,178.72 million representing approximately 57% of the projected GDP in 2017. Inter-sector effects will amount to US$5622.64 million representing about 10% of the projected GDP in 2017 whereas the intra-sector effects will amount to US$25,556.08 million representing approximately 57% of GDP by the close of 2017.

Table 19 presents the impact of human capital on incomes, tax revenues and expenditure on subsidies. The total incomes are expected to increase from about US$5,227.39 million representing about 10% of the projected GDP in 2016 to approximately US$6795.85 million representing about 10% of projected GDP in 2020. At the end of GSGDA II in 2017, the cumulative effect will amount to US$20305.33 million representing approximately 37% of the projected GDP in 2017. In terms of tax revenue, it will increase from US$41.78 million in 2016 to US$54.32 million in 2020. The cumulative effects will be US$162.30 million. Expenditure on subsidies will increase from US$63.83 million in 2016 to US$82.98 million in 2020. The total cost of government subsidy at the end of GSGDA II will amount to US$247.95. Comparing this value to that of the tax revenue, it creates a funding gap of US$85.54 million.

The impact on the trade balance is reported in Table 20**.** Expenditure on imports will outweigh export receipts. Deficit in trade balance will increase from US$129.62 million in 2016 to US$168.51 million in 2020. At the end of GSGDA II in 2017, it will worsen the trade balance by US$503.49 representing about 1% of the projected GDP for 2017.

If government is able to implement the recommendations of WHO and UNESCO it will result in increased expenditure on energy as shown in Table 21. The total expenditure on energy will increase from US$11.62 million in 2016 to US$15.11 million in 2020. The cumulative effects on energy demand will amount to US$45.15 million representing about 0.08% of the projected GDP for 2017.

Table 18. Impact of Human Capital on Outputs in million US dollars

	2016	2017	Cumulative Effects over Plan period 2014-2017	2018	2019	2020	Rank
Human Capital	6579.14	7020.03	25556.08	7494.21	8004.32	8553.19	1
Financial Intermediation and Business Activities	710.31	757.91	2759.14	809.11	864.18	923.44	2
Petroleum, Chemical and Non-Metallic Mineral Products	125.60	134.02	487.88	143.07	152.81	163.29	3
Wholesale Trade	125.01	133.38	485.58	142.39	152.09	162.52	4
Electricity, Gas and Water	101.09	107.86	392.66	115.15	122.98	131.42	5
Total	8026.63	8564.52	31178.72	9143.03	9765.37	10434.99	-
%Proj.GDP	15.82	15.63	56.89	15.45	15.28	15.11	-
Intra-sector	6579.14	7020.03	25556.08	7494.21	8004.32	8553.19	-
%Proj.GDP	12.96	12.81	46.63	12.66	12.52	12.39	-
Inter-sector	1447.49	1544.49	5622.64	1648.82	1761.05	1881.80	-
%Proj.GDP	2.85	2.82	10.26	2.79	2.75	2.73	-

Source: Author's calculations based on Eora MRIO data

Table 19. Impact of Human Capital on Incomes, Subsidies and Tax Revenue in million US dollars

	2016	2017	Cumulative Effects over Plan period 2014-2017	2018	2019	2020
Labour	2949.92	3147.60	11458.70	3360.21	3588.93	3835.03
Non-Lab	2277.47	2430.09	8846.63	2594.24	2770.82	2960.82
Total	5227.39	5577.69	20305.33	5954.45	6359.75	6795.85
%Proj.GDP	10.30	10.18	37.05	10.06	9.95	9.84
Taxes on Production	41.78	44.58	162.30	47.59	50.83	54.32
%Proj.GDP	0.08	0.08	0.30	0.08	0.08	0.08
Subsidies on production	-63.83	-68.11	-247.95	-72.71	-77.66	-82.98
%Proj.GDP	-0.13	-0.12	-0.45	-0.12	-0.12	-0.12
Net	-22.05	-23.53	-85.64	-25.11	-26.82	-28.66
%Proj.GDP	0.04	0.04	0.16	0.04	0.04	0.04

Source: Author's calculations based on Eora MRIO data

Table 20. Impact of Human Capital on Trade Balance in million US dollars

	2016	2017	Cumulative Effects over Plan period 2014-2017	2018	2019	2020
Imports (I)	307.53	328.14	1194.58	350.31	374.15	399.81
Exports(X)	177.91	189.84	691.09	202.66	216.45	231.30
Net	-129.62	-138.30	-503.49	-147.65	-157.70	-168.51
%Proj.GDP	0.26	0.25	0.92	0.25	0.25	0.24

Source: Author's calculations based on Eora MRIO data

Table 21. Impact of Human Capital on Energy Demand in million US dollars

	2016	2017	Cumulative Effects over Plan period 2014-2017	2018	2019	2020
Petroleum	3.43	3.66	13.34	3.91	4.18	4.47
Non-Petroleum	8.19	8.74	31.81	9.33	9.96	10.65
Total	11.62	12.40	45.15	13.24	14.14	15.11
%Proj.GDP	0.02	0.02	0.08	0.02	0.02	0.02

Source: Author's calculations based on Eora MRIO data

Scenario 3: A 10% annual increase in final demand

As depicted in Table 22, from 2016 to 2027, increases in final demand for human capital will have positive impact on all the sectors of the economy. Consistent with the earlier results, the human capital sector will witness the greatest impact increasing from about US$9.35 billion by the close of 2016 to about US$26.67 billion by the close of 2027 representing about 185.24 percent increase. This is followed by financial intermediation and business activities sector increasing from US$1.0 billion to US$2.88 billion; Petroleum, Chemical and Non-Metallic Mineral Products from US$0.18 billion to US$0.51 billion, wholesale trade from US$0.18 billion to US$0.51 billion; electricity, gas and water from US$0.14 billion to US$0.41 billion etc. The total effect on the entire economy will increase from US$11.40 billion by the close of 2016 to US$32.54 billion by the close of 2027. In terms of percentage of projected GDP, it will increase from 22% by the close of 2016 to about 24% in 2020 and then decline to about 22% by the close of 2027. Inter-sector effects will increase from about 4.05% of GDP in 2016 to about 4.36% in 2020 before declining to about 3.99% in 2027 whereas the intra-sector effects will increase from 18.42% of GDP in 2016 to 19.82% by the close of 2020 before declining to 18.14% in 2027.

Table 23 presents the impact of human capital on incomes, tax revenues and expenditure on subsidies for the period 2016 to 2027. The impact on labour incomes far outweighs that of non-labour incomes. The total incomes are expected to increase from about US$7.43 billion representing 14.64% of GDP to approximately US$10.87 billion representing 15.75% of GDP in 2020 and increasing further to about US$21.19 representing 14.41% by the close of 2027. As already noted, the expenditure on subsidies will outweigh that of tax revenues. The funding gap will increase from US$31.33 million in 2016 to US$89.38 million in 2027 averaging about 0.06% per annum.

As depicted in Table 24, 10% per annum increases in final demand for human capital from 2016 to 2027, will cause a deterioration of the balance of trade. Expenditure on imports will increase from US$436.95 million in 2016 to US$1.25 billion in 2027 whereas export receipts will increase from US$252.79 million in 2016 to US$721.23 million in 2027 resulting in deficits for the years under consideration. The deficit in the trade balance will average about 0.37% of the projected GDP for the years under consideration.

Table 22. Impact of Human Capital on Outputs, 2016 – 2027 in million US dollars

	2016	2017	2018	2019	2020	2022	2027	Rank
Human Capital	9347.84	10282.62	11310.89	12441.97	13686.17	16560.27	26670.48	1
Financial Intermediation and Business Activities	1009.23	1110.15	1221.17	1343.29	1477.61	1787.91	2879.45	2
Petroleum, Chemical and Non-Metallic Mineral Products	178.46	196.30	215.93	237.52	261.28	316.15	509.16	3
Wholesale Trade	177.61	195.38	214.91	236.40	260.05	314.65	506.76	4
Electricity, Gas and Water	143.63	157.99	173.79	191.17	210.28	254.44	409.78	5
Total	11404.48	12544.92	13799.42	15179.36	16697.29	20203.72	32538.30	-
%Proj. GDP	22.47	22.89	23.31	23.74	24.18	22.55	22.13	-
Intra-Sector	9347.84	10282.62	11310.89	12441.97	13686.17	16560.27	26670.48	-
%Proj. GDP	18.42	18.76	19.11	19.46	19.82	18.48	18.14	-
Inter-Sector	2056.64	2262.30	2488.53	2737.38	3011.12	3643.46	5867.82	-
%Proj. GDP	4.05	4.13	4.20	4.28	4.36	4.07	3.99	-

Source: Author's calculations based on Eora MRIO data

Increases in final demand for human capital by 10% per annum from 2016 to 2027 will result in increases in the demand for energy and therefore increased expenditure on energy as shown in Table 25. The total expenditure on energy will increase from US$16.51 million in 2016 to US$47.12 million in 2027. Expenditure on non-petroleum sources of energy will outweigh that of petroleum sources. Expenditure on non-petroleum sources will increase from US$11.63 million in 2016 to US$33.19 million in 2027 whereas that of petroleum sources will increases from US$4.88 million in 2016 to US$13.92 million in 2027.

Table 23. Impact of Human Capital on Incomes, Subsidies and Tax Revenue, 2016 – 2027 in million US dollars

	2016	2017	2018	2019	2020	2022	2027
Labour	4191.33	4610.47	5071.51	5578.67	6136.53	7425.20	11958.36
Non-Labour	3235.90	3559.49	3915.44	4306.98	4737.68	5732.59	9232.39
Total	7427.23	8169.95	8986.95	9885.65	10874.21	13157.79	21190.76

%Proj.GDP	14.64	14.91	15.18	15.46	15.75	14.69	14.41
	2016	2017	2018	2019	2020	2022	2027
Taxes on production	59.37	65.30	71.83	79.02	86.92	105.17	169.38
%Proj.GDP	0.12	0.12	0.12	0.12	0.13	0.12	0.12
Subsidies on Production	-90.69	-99.76	-109.74	-120.71	-132.79	-160.67	-258.76
%Proj.GDP	0.18	0.18	0.19	0.19	0.19	0.18	0.18
Net	-31.33	-34.46	-37.91	-41.70	-45.87	-55.50	-89.38
%Proj.GDP	0.06	0.06	0.06	0.07	0.07	0.06	0.06

Source: Author's calculations based on Eora MRIO data

Table 24. Impact of Human Capital on Trade Balance, 2016 – 2027 in million US dollars

	2016	2017	2018	2019	2020	2022	2027
Imports (I)	436.95	480.65	528.71	581.58	639.74	774.09	1246.67
Exports (X)	252.79	278.06	305.87	336.46	370.10	447.82	721.23
Net (X-I)	-184.17	-202.58	-222.84	-245.13	-269.64	-326.26	-525.45
%Proj.GDP	0.36	0.37	0.38	0.38	0.39	0.36	0.36

Source: Author's calculations based on Eora MRIO data

Table 25. Impact of Human Capital on Energy Demand, 2016 – 2027 in million US dollars

	2016	2017	2018	2019	2020	2022	2027
Petroleum	4.88	5.37	5.90	6.50	7.14	8.6	13.92
Non-Petroleum	11.63	12.80	14.08	15.49	17.03	20.61	33.19
Total Energy	16.51	18.17	19.98	21.98	24.18	29.26	47.12
%Proj.GDP	0.03	0.03	0.03	0.03	0.04	0.03	0.03

Source: Author's calculations based on Eora MRIO data

6. Summary, conclusions and policy implications

There is a plethora of empirical literature on the effect of education and health on economic growth. These studies have only established relationships. There is however, to the best of our knowledge, a paucity of literature or information as regards the examination of the economic impact of the demand for education and health on the economy especially, the Ghanaian economy based on multipliers derived from Input-Output (IO) analysis. This study has attempted to quantify the economic impact of the demand for education and health in Ghana using the Input-Output (IO) analysis. The input-output table of Ghana for 2011 which has been sourced from Eora MRIO database has been used to estimate the impact multipliers of the demand for human capital and also carried out simulation exercises to forecast the impact on the Ghanaian economy of a future increases in the demand for human capital under three different scenarios namely (i) Expenditure

projections in GSGDA II are implemented, (ii) WHO and UNESCO expenditure targets are achieved and (iii) a 10% annual increase in the final demand for human capital.

The importance of the human capital sector can be seen in terms of generating demand for the output of other sectors and also supplying inputs to the other sectors. This is shown by the significant stimuli human capital offers many other sectors in the economy. The results have shown that human capital has a significant impact on output and this importance lies mainly in its inter-sector effects. This is enhanced by its significant backward and forward linkage effects. The sectors most important for human capital demand impacts are financial intermediation and business activities sector; Petroleum, Chemical and Non-Metallic Mineral Products, wholesale trade; electricity, gas and water among others**.** Apart from the impact on energy demands, the indirect effects are greater than the direct effects in all the cases.

The human capital sector is among the top five sectors as far as income generation is concerned. The result is not surprising given the fact that the human capital sector enhances labour productivity and therefore enhances labour earnings. The human capital sector has a significant impact on labour incomes. The impact on labour incomes far outweighs that of non-labour incomes. This buttresses the point that human capital sector is very important as far as income generation and poverty reduction are concerned. Increased investments in human capital sector to create more access as a way of alleviating poverty and enhancing the well-being of the people is highly recommended. Ministry of Finance should prioritize government expenditure in favour of the human capital sector. Government should work towards the implementation of WHO and UNESCO recommendations on education and health expenditures or at least stick to its expenditure plans for the human capital sector captured in GSGDA II.

It is also evident that out of the 26 sectors, it is only in the human capital sector that expenditure on subsidies outweighs tax revenues. Given Government's budget constraints, there is the need to find additional resources to fill this gap. The private sector should be incentivized to provide/establish more scholarships and insurance schemes and also contribute financially towards the establishment of National Education and Health Funds to help fund education and health in Ghana.

Our analysis identifies the other sectors that should be included in any integrated development strategy. One of the human capital policy objectives should be to increase the industry's linkage with other sectors. This calls for an inclusion and highlighting of the sectors most important for human capital demand and supply impacts such as financial intermediation and business activities sector; Petroleum, Chemical and Non-Metallic Mineral Products, wholesale trade; electricity, gas and water in any National Development Plan for education and health. This has the potential to attract the much needed investment into those sectors.

Given the potential gains from human capital, in terms of output and incomes among others, there is scope for a government investment policy that enhances the linkage effects. Policy objectives should therefore, aim at increasing the human capital sector's linkage with other sectors such as the financial intermediation and business activities sector; Petroleum, Chemical and Non-Metallic Mineral Products, wholesale trade; electricity, gas and water**.** Expanding the sector offers a potential stimulus to the entire economy, but other sectors need to be enabled to respond to the stimulus. With the much needed investment into the human

capital sector, the sector's expansion will enable Ghana to realize the sector's full potentials in terms of output growth, increased incomes and poverty alleviation.

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