STUDIA UNIVERSITATIS
BABEŞ-BOLYAI

OECONOMICA

1/2022

STUDIA
UNIVERSITATIS BABEŞ-BOLYAI
OECONOMICA

1/2022

April

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YEAR **(Volume 67) 2022**
MONTH **April**
ISSUE **1**

Studia Universitatis Babeş-Bolyai Oeconomica

1

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SUMAR – SOMMAIRE – CONTENTS – INHALT

Y. JUSAJ, B. FETAI
DOES FEMALE EDUCATION GENERATE ECONOMIC GROWTH? AN EMPIRICAL ANALYSIS OF WESTERN BALKAN COUNTRIES 1

Y. TANAKA
INVOLUNTARY UNEMPLOYMENT UNDER ONGOING NOMINAL WAGE RATE DECLINE IN OVERLAPPING GENERATIONS MODEL 11

Z. BOUZIDA, N. MALEK, S. GHOMARI
CAPITALIZATION OF HUMAN SKILLS AND COMPETENCIES – AN EXPLORATORY MODEL 27

M. OBERHOLZER, M. O. OMOTOSO, D. SCHUTTE, P. BUYS
THE RELATIVE SUCCESS OF IFRS ADOPTED AFRICAN COUNTRIES TO ATTRACT FOREIGN INVESTMENT..... 44

J. K. OLOWOOKERE, W. D. OLANIPEKUN, G. M. SOKUNBI, T. A. ADEREMI
HUMAN CAPITAL DEVELOPMENT AND SUSTAINABLE DEVELOPMENT: EVIDENCE FROM NIGERIA 63

STUDIA UNIVERSITATIS BABEȘ-BOLYAI OECONOMICA
VOLUME 67, ISSUE 1, 2022, pp. 1-10
DOI: 10.2478/subboec-2022-0001

DOES FEMALE EDUCATION GENERATE ECONOMIC GROWTH? AN EMPIRICAL ANALYSIS OF WESTERN BALKAN COUNTRIES

Yvesa JUSAJ*
South East European University, Republic of North Macedonia

Besnik FETAI
South East European University, Republic of North Macedonia

Abstract: This paper investigates the relationship between female education and economic growth in Western Balkan countries during the period 2000-2019. The motive behind choosing Western Balkan countries was because there is insufficient research that has been made in this field of study; hence, this research assists to expand the issue of this topic. By using GDP as dependent variable, the paper addresses the question whether female education generates or not economic growth. The techniques applied for this study are OLS, fixed and random effects, and Hausman-Taylor model IVs. The findings show a positive relationship between GDP per capita, female labor participation, school enrollment primary, and literacy rate. On the other hand, there exists a negative relationship with fertility rate, while the school enrollment tertiary is statistically insignificant. This paper brings evidence that female education generates more economic growth in Western Balkan countries. Therefore, the Government of the Western Balkans should take into consideration to invest more on education of the woman in those countries. These in turn will lead to higher economic growth.

JEL Classification: I24, J16, J21, O1, O57;
Keywords: education; female; labor force; economic growth; western Balkan

1. Introduction

The relationship between female's education and economic growth has been intensely investigated. Yet, the findings are still open to discussion. Most of the studies have concluded that female's education generates economic growth (Hassan and Rafaz, 2017; Sheehan et al., 2017; Tansel and Gungor, 2016;

*Corresponding author. Address: Department of Economics and Management, South East European University, Ilindenska 335, Tetovo 1200, North Macedonia, E-mail: yj27457@seeu.edu.mk

Sehrawat and Giri, 2017; Ince, 2011; Khan, 2016). What is surprising is the fact that there exist insufficient studies that investigate such relationship in Western Balkans countries, particularly in Kosovo, North Macedonia, Bosnia, and Herzegovina, Montenegro, Serbia, and Albania (Atoyan and Rahman, 2017; Eric, 2018; Lilyanova, 2018; Browne, 2017; Lazarević and Tadić, 2018).

Regarding the relationship between economic growth and human capital, there exist a lot of studies that support the claim that human capital is the key to economic growth of a country. With other words, it reduces poverty, migration and it improves the quality of institutions and citizens' society. According to Barro (2013), individual health, social capital and education (the main components of human capital) refer to the knowledge and skills embodied in human beings that contribute to achieve the advancement of production and social and economic growth. But the suspicion is how does a government which is so far away from being an ideal state of development to move forward? The answer lays in its education. When it comes to the future of the region, education is the key – especially female education. In such a way, the region through education will be able to let go of the past and focus on the joint future. Therefore, the primary research question is whether women's education is associated with economic growth?

The first contribution of this research study is to bring new evidences toward the relationship between females' education and economic growth, since there exist a gap of such investigation made on Western Balkans countries. The second contribution is to realize where does Western Balkans countries stand in the context of female's education and economic growth when comparing with other regions and further. The third contribution is to pronounce a critical argument of evidence not only by presenting a general frame of all previous research paper on this topic, but by developing the conceptual outline. Most of the studies made on this topic have been heavily criticized because of the usage of only one econometric technique such as OLS. OLS, Fixed and Random-effects model, and the Haussmann–Taylor model are very appropriate techniques to be implemented for such topics but they were ignored by previous researchers (El Alaoui, 2015; Kaur & Letic, 2012; Hong, Kim, Park, & Sim, 2019).

The results of the research show that various factors have effects on the economic growth of the Western Balkans countries, namely FLFP (female labor force participation) and other factors such as SEPF (school enrolment primary female) and FLR (literacy rate female) which present significant effects on GDP.

The research paper is organized in five sections as: Section 2 reviews the literature; Section 3 discusses the research methodology and data; Section 4 provides the results; Section 5 provides the conclusion.

2. Literature review

This section presents the empirical evidence whether female's education generate economic growth or not. Hassan and Rafaz (2017) investigated the "Role of Female Education in Economic Growth of Pakistan". According to their results, fertility rate must be as low as possible in order to boost the economic development. Their study indicates that females' education will reduce fertility rate, which in turn it may have a positive effect on economic growth. Moreover, Hassan and Rafaz

concluded that many opportunities are being created for female employment which has led to a higher rate of female labor force participation and such achievement is contributing impressively to the economic growth of Pakistan.

Sehrawat and Giri (2017) investigated whether female human capital generates economic growth or not. They found out that female education is significant and positively related with economic growth. The same conclusions were reached even by Tansel and Gungor (2016). Based on their study results, they found out that education is considered to be the primary essential sector leading to female empowerment, especially in developing countries. According to them, females' education has many benefits because it reduces fertility and infant mortality, while it increases life expectancy and quantity and quality of children's education. Moreover, their study infers that a country grows faster when having higher levels of education attainment. They came to such conclusion because recently the number of females graduating from high school has increased and in this way their participation in the labor force has also increased. This means that female labor force participation rate increases by an additional year of female schooling. This in turn leads to a raise to GDP.

Oztunc, Chi Oo and Serin (2015) made a study on the contribution of female education to economic growth (long-term). This study included 11 countries of the Asia Pacific by using the random effects model. The results of their investigation show that female labor force participation rate and female primary school enrolment have positive effect on GDP, while female literacy rate does not have any significant effect at all. However, the most significant factor affecting GDP per capita growth is considered to be fertility rate factor.

Another contribution on this research filed was made even by the author Khan (2016). He investigated the role of human capital on the economic growth. This investigation took place at Pakistan by using economic growth as dependent variable, while female human capital, male human capital, physical capital and labor force were used as independent variables. Based on study results, female human capital is positively related to economic growth and is significant only in the long run, while male human capital is positively related to economic growth but is insignificant.

Forbes (2000) explored the relationship between inequality and growth for 45 countries. Growth was used as dependent variable, while income, female education, male education, inequality and PPP (price level of investments) were used as independent variables. Based on study results, Forbes came to conclusion that female education generates economic growth. With such conclusion agree even other authors (Knowles, Lorgelly and Owen, 2002), which tried to figure out whether gender inequality in education causes or not a break on economic development. Their findings show that female education has a positive effect on the real output of a country.

Even though many authors have concluded a positive relationship between female education and economic growth in different regions of Western Balkan countries, yet, the findings are still open to discussion. Not only that, but findings do not even ensure any relationship between female education and economic growth at all (Heath and Jayachandran, 2017; Kim, 2016; and Hong, Kim, Park, and Sim, 2019). Based on their results, GDP growth is not improved by female's education. Actually, what they concluded is that education not anyway leads in a higher probability of working, but it may improve health and environmental conditions.

This research study will be an attempt to figure out whether female education generates economic growth or simply it follows economic growth. In order to overcome the lack of robustness of the result, this research study applies three econometric models: OLS, fixed and random effects models, and Haussmann–Taylor model (IV).

3. Methodology

This section presents the empirical econometric model to assess the relationship and the causal link between female education and economic growth in the Western Balkans Countries during the period 2000-2019. For such purpose, there are applied three econometric models: pooled OLS, fixed and random effects and the Hausman–Taylor IV. Besides, there is also applied the Hausman test in order to differentiate between fixed effects, random effects and the Hausman–Taylor model. As shown in table two, the Hausman–Taylor (IV) method is reflected to be a better choice than Fe and Re model.

3.1 Panel data model

The reason why the Hausman–Taylor model is applied to examine the relationship and the causal link between female education and economic growth in the Western Balkans is because this model is considered to be more consistent and efficient than the fixed and random effects.

Furthermore, the Hausman–Taylor model helps in finding solutions if endogeneity problem appears. This model is very practical to be applied because it identifies endogenous variables if they are present in the regression model. The main cases when endogenous variables perform in the model are measurement error, omitted variable bias and simultaneity causality. One of the main assumptions of Ordinary Leas Square is that there should be no correlations between error term and predictor variables, but if this happens, then it should be reviewed if endogenous variables are present in the model. Thus, Hausman–Taylor model is a solution to figure out whether statistical model corresponds to the data or not. For comparison purpose, there are shown even the results from pooled OLS, fixed effects and random effects for the comparison purpose.

The specification of the Hausman–Taylor empirical model is as follows:

$$\begin{aligned} \mathrm{y_{it}} = \mathrm{c} + \beta_1(\mathrm{Y_{it}} - 1) + \beta_2(\mathrm{FLFP_{it}}) + \beta_3(\mathrm{SEPF_{it}}) + \beta_4(\mathrm{SETF_{it}}) + \\ + \beta_5(\mathrm{FLR_{it}}) + \beta_6(\mathrm{FR_{it}}) + \mu_{\mathrm{it}} \end{aligned} \quad (1)$$

Where y_{it} is the dependent variable which represents the GDP growth rate for each country while t represents years and c is the term of constant. The explanatory variables include y_{it-1} which is the first lag of the dependent variable, $FLFP_{it}$ represents labor force female participation (% of female's population – aged 15-64), $\mathrm{SEPF_{it}}$ characterizes school enrolment primary female, $SETF_{it}$ symbolizes

school enrolment tertiary female, FLR_{it} stands for literacy rate adult female (% of literacy rate of females aged 15 and over), FR_{it} symbolizes fertility rate and u_{it} is an exogenous disturbance (table one).

The data have been downloaded by the World Bank and have been administered and analyzed through the statistical program Stata 13. The most amount of information is contained in nominal and interval scale data.

Table 1: Description of variables

Serial no	Variables	Definitions of Variables	Code	Source
1	GDP	Economic growth GDP growth rate (annual %)	GDP Growth	WBI, IM
2	Female's labor force participation	Female's labor force participation % of female's population – aged 15-64	FLFP	WBI
3	School enrolment primary female	% of female enrollment in primary school	SEPF	WBI, IM
4	School enrolment tertiary female	% of female enrollment in tertiary school	SETF	WBI, IM
5	Female literacy rate	% of literacy rate of females aged 15 and over	FLR	WBI, IM
6	Fertility rate	Fertility rate, total (births per person)	FR	WBI

Notes: WBI means World Bank Indicators (IMB Indicators) and IM means Index Mundi

4. Results

This section highlights the final results gathered from the econometric techniques applied in this research study. Since the coefficient from pooled OLS estimator is biased because of the presence of the heterogeneity of unobservable individual-specific effect, then, the fixed and random effects models have been calculated. In order to choose between Fe model and Re model, the Hausman test is run.

It should be mentioned that if the null hypothesis is not rejected, then, the preferred model is random effect model. In the other hand, if null hypothesis is rejected and alternative hypothesis stands, then, the preferred model is fixed effect

model. The Hausman test tries to detect if there exist a correlation between error term and the explanatory variables. If there is no correlation between the two, then the null hypothesis stands in the model.

Special attention should be paid to the trade-of between bias and variance in the two estimators. The fixed effect model doesn't introduce bias but it may have a very high degree of variance, while the random effect model doesn't remain unbiased but it may reduce the variance of estimates of coefficients. In this case, if the null hypothesis is rejected in the model, this means that probably the error term is correlated with one or more regressors under the random effect model.

As shown in table two, the Hausman test is calculated with the aim to choose between Fe model and Re model. As it can be seen, the Hausman test p value is 7.99, which means that the null hypothesis stands in the model in favor of Hausman–Taylor IV.

Table 2: Fixed Effect, Random Effect and Hausman – Taylor IVs

Test	Chi^2	$Prob>chi^2$	Result
Fixed Effects vs Random Effects vs Hausman – Taylor IVs	8.99 0.17	0.1094 7.99	Reject H_0 Does not reject H_0

Source: Authors' calculations

Based on these results, it is understandable that the Hausman–Taylor (IV) method with IVs eradicates the correlation between error term and explanatory variables. Moreover, the problem of endogeneity is eliminated as well. To conclude it all, the better choice than Fe and Re model is considered to be the Hausman–Taylor (IV) method.

In our model the variables such as female labor force participation, school enrollment primary female and ferility rate are considered to be exogenous variables and are used as their own instruments. While the variables such as school enrollment tertiary female and femaile literacy rate are instruments by the deviation of the individual mean and endogenous. Table three presents the regression results.

Table 3: Regression results

Variables	OLS	FIXED EFFECTS	RANDOM EFFECTS	HAUSMAN TYLOR IV
First lag GDP-per capita				-.061
s.e.				(0.795)
FLFP	.288**	.913*	.287*	.706*
s.e.	(0.125)	(0.254)	(0.125)	(0.223)
SEPF	.181**	.102	.181*	.127**

Variables	OLS	FIXED EFFECTS	RANDOM EFFECTS	HAUSMAN TYLOR IV
s.e.	(0.072)	(0.071)	(0.071)	(0.069)
SETF	.000	.001	.000	-.003
s.e.	(0.028)	(0.032)	(0.028)	(0.031)
FLR	.050	.121*	.050	.099*
s.e.	(0.106)	(0.053)	(0.029)	(0.048)
FR	5.894*	-5.054*	5.893*	-2.600
s.e.	(3.275)	(5.66)	(3.278)	(5.301)
CONS	-6.144	-29.097*	-6.144*	-19.911**
s.e.	(4.819)	(0.028)	(4.819)	(11.589)
R-square	0.387	*0.431*		
F	4.93	5.32		
Chi^2			24.67	24.47

*Notes: *Statistically significant at 5% level; **statistically significant at 10%*
Source: Authors' calculations

As shown in the table three, the female labor force participation (FLFP) has positive coefficient 0.706 (s.e.0.223) and is statistically significant which means that the female labor force participation has a positive effect in country's GDP per capita growth. According to this, female labor force participation stimulates economy growth even that the gap in labor forces participation rates of men and women's remains high. Only in the second quarter of 2019, the percentage of female inactivity in Western Balkans scored very high, at 46.3 percent while the percentage of male inactivity was lower, at 27.1% (WBG, 2019). The main factor leading to such high level of female inactivity are low levels of education attainments, family responsibilities, cultural and religious reasons and lack of affordable or available child care (especially in rural areas). Moreover, the positive relationship between female labor force participation and GDP growth are same as the most of previous studies (Ince, 2011; Oztunc, Chi Oo and Serin, 2015; Khan, 2016).

The results in table three shows that school enrolment primary female (SEPF) with coefficient 0.127 (s.e.0.069) affect GDP per capita growth positively while school enrolment tertiary female (SETF) with coefficient -0.003 (s.e.0.031) has a negative impact on GDP. In the other side, school enrolment primary female it is statistically significant in contrast to school enrolment tertiary, which is statistically insignificant. This is consistent with studies by Oztunc et al., (2015) which found that school enrolment primary female has positive impact in GDP growth.

While female literacy rate (FLR) has a positive coefficient of 0.099(s.e.0.048) and is statistically significant which means that female literacy rate has positive impact on GDP growth. In order to increase their position in labor force, females need to increase their literacy rate by increasing their education which in return leads to an increase in GDP per capita. Such result is controversial to the findings of other researches such as Heath and Jayachandran (2017); Kim (2016); and Hong, et al. (2019) whom did not find (statistically) significant evidence that GDP growth is

improved by female's education. Meanwhile, fertility rate (FR) has a negative coefficient -2.600(s.e.5.301) and is statistically significant, which means that fertility rate has a negative effect on GDP growth.

5. Conclusion and discussion

The research has shown interesting impacts on GDP per capita and this impact is evident for the period 2000-2019, since it includes two decades of a region that has gone through more economic crisis than economic stability. The effects of FLFP (female labor force participation) are a positive and important element for the development and emancipation of women and their position in the workplace. On the other hand, there is an effect from SEPF (school enrolment primary female) and FLR (literacy rate female) which present significant effects on GDP. In general, the effect of the female labor force, school enrolment primary, and literacy rate have a meaning for all stakeholders, both for the states and for the society itself, as this represents a new social structure, where women have an impact on the economic situation of their states.

The work and results may be appropriate for the development of economic development strategies and the field of education. The recommendation for all participating states is to have a clearer development policy, where the influence of women is more productive and with positive effects for the state and society in general.

In this context, this paper has a scientific contribution since it brings these new evidences toward the relationship between females' education and economic growth in Western Balkans countries. Additionally, it reveals where Western Balkans countries stand in the context of female's education and economic growth when comparing with other regions and further. And last but not least, it pronounces a critical argument of evidence not only by presenting a general frame of all previous research paper on this topic, but by developing the conceptual outline.

Despite the insights gained from the current study, this research faced some limitations as well. The lack of data in some of the countries was a major limitation. Additionally, there were no sufficient research studies toward this topic, especially in Western Balkan countries. These limitations affected the collection of the data in a way; however, they didn't create huge difficulties on exploring the topic.

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STUDIA UNIVERSITATIS BABEȘ-BOLYAI OECONOMICA
VOLUME 67, ISSUE 1, 2022, pp. 11-26
DOI: 10.2478/subboec-2022-0002

INVOLUNTARY UNEMPLOYMENT UNDER ONGOING NOMINAL WAGE RATE DECLINE IN OVERLAPPING GENERATIONS MODEL

Yasuhito TANAKA*
Doshisha University, Japan

Abstract: We analyze involuntary unemployment based on consumers' utility maximization and firms' profit maximization behavior with ongoing nominal wage rate decline. We consider a three-periods overlapping generations (OLG) model with a childhood period as well as younger and older periods under monopolistic competition with increasing, decreasing or constant returns to scale technology. When there exists involuntary unemploymnet, the nominal wage rate may decline. We examine the existenbce of involuntary unemployment in that model with ongoing mominal wage rate decline (or deflation). Even if the nominal wage rate declines, we have a steady state with involuntary unemployment and constant output and employment. We need budget deficit or budget surplus to maintain the steady state depending on whether real balance effect is positive or negative. Also we examine the possibility to achieve full-employment by fiscal policy.

JEL classifications: E12, E24, E31
Keywords: involuntary unemployment, monopolistic competition, wage rate decline, real balance effect.

1. Introduction

In this paper we examine the existence of involuntary unemployment with ongoing nominal wage rate decline under monopolistic competiton. Involuntary unemployment is a phenomenon that workers are willing to work at the market wage or just below but are prevented by factors beyond their control, mainly, deficiency of aggregate demand. Umada (1997) derived an upward-sloping labor demand curve from the mark-up principle for firms, and argued that such an upward-sloping labor demand curve leads to the existence of involuntary unemployment without wage rigidity (Lavoie (2001) presented a similar analysis based on Kalecki (1944)). But his model of firm behavior is ad-hoc. Otaki (2009) says that there exists involuntary unemployment for two reasons: (i) the nominal wage rate is set above the reservation

* Corresponding author. Address: Doshisha University, Faculty of Economics, Kamigyo-ku, Kyoto, 602-8580, Japan, Tel: +81-75-251-3648, E-mail: yatanaka@mail.doshisha.ac.jp

nominal wage rate; and (ii) the employment level and economic welfare never improve by lowering the nominal wage rate. He assume indivisibility (or inelasticity) of individual labor supply, and has shown the existence of involuntary unemployment using efficient wage bargaining according to McDonald and Solow (1981). The arguments of this paper, however, do not depend on bargaining. If labor supply is indivisible, it may be 1 or 0. On the other hand, if it is divisible, it takes a real value between 0 and 1. Tanaka (2020a) and (2020b) analyzed the existence of involuntary unemployment under perfect competiton or monopolistic competition with indivisible labor supply. As discussed by Otaki (2015) (Theorem 2.3) and Otaki (2012), if the labor supply is divisible and very small, no unemployment exists (About indivisible labor supply also please see Hansen (1985)). However, we show that even if labor supply is divisible, unless it is so small, there may exist involuntary unemployment. We consider consumers' utility maximization and firms' profit maximization in an overlapping generations (OLG) model under monopolistic competition according to Otaki (2007, 2009, 2011, 2015, 2016), and demonstrate the existence of involuntary unemployment without the assumption of wage rigidity.

In the next section we show the existence of involuntary unemployment under monopolistic competition with increasing or decreasing or constant returns to scale technology using a three-periods OLG model with a childhood period as well as younger (working) and older (retired) periods. Also we consider pay-as-you go pension system for the older generation. In a simple two-periods OLG model declines in the nominal wage rate and the price of goods may increase consumption and employment by the real balance effect. In such a model consumers have savings for future consumption, but no debt. In a three-periods model with childhood period they consume goods in their childhood period by borrowing money from (employed) consumers of the previous generation and scholarships, and must repay their debts in the next period. Real value of the debt is increased by declines in the nominal wage rate and the price. In addition to this configuration we consider a pay-as-you go pension system for the older generation which may reduce the savings of consumers. Then, consumptions and employment may be decreased by falling of the nominal wage rate. We think that our model is more general and realistic than a simple two-periods OLG model.

When there exists involuntary unemploymnet, the nominal wage rate may decline. In Section 3 we examine the effects of ongoing decline in the nominal wage rate and the price. In our three-periods OLG model with pay-as-you-go pension increases in consumption and employment due to declines in the nominal wage rate and the price of goods might be negative, that is, there may be negative real balance effect. The positive real balance effect is the fact that a decline in the nominal wage rate increases consumption, and the negative real balance effect means that a decline in the nominal wage rate decreases consumption. The real balance effect is positive (or negative) when the difference between the savings of the older generation consumers net of the pay-as-you-go pensions and the debt of the younger generation consumers is positive (or negative). Whether a budget deficit or a budget surplus is needed to maintain a steady state with constant income and employment and ongoing nominal wage rate decline depends on whether the real balance effect is positive or negative. Also we examine the possibility to achieve and maintain full-employment by fiscal policy.

As we will state in the concluding remarks, the main limitation of this paper is that the goods are produced by only labor and there exists no capital and investment of firms. A study of the problem of involuntary unemployment in such a situation is the theme of future research.

Schultz (1992) showed that there does not exist involuntary unemployment in an overlapping generations model. His arguments depends on positive real balance effect on consumption of the older generation consumers. We consider a three-periods overlapping generations model with pay-as-you go pension to explore the possibility of negative real balance effect.

2. Existence of involuntary unemployment

2.1 Consumers

We consider a three-periods (0: childhood, 1: younger or working, and 2: older or retired) OLG model under monopolistic competition. It is a re-arrangement and an extension of the model put forth by Otaki (2007), (2009), (2012). The structure of our model is as follows.

1. There is one factor of production, labor, and there is a continuum of perishable goods indexed by $z \in [0,1]$. Good z is monopolistically produced by firm z with increasing or decreasing or constant returns to scale technology.

2. Consumers consume the goods during the childhood period (Period 0). This consumption is covered by borrowing money from (employed) consumers of the younger generation and/or scholarships. They must repay these debts in their Period 1. However, unemployed consumers cannot repay their own debts. Therefore, we assume that unemployed consumers receive unemployment benefits from the government, which are covered by taxes on employed consumers of the younger generation.

3. During Period 1, consumers supply l units of labor, repay the debts and save money for their consumption in Period 2. They also pay taxes for the pay-as-you go pension system for the older generation.

4. During Period 2, consumers consume the goods using their savings carried over from their Period 1 earnings and the pay-as-you go pension, which is a lump-sum payment. It is covered by taxes on employed consumers of the younger generation.

5. Consumers determine their consumptions in Periods 1 and 2 and the labor supply at the beginning of Period 1. We assume that their consumption during the childhood period is constant.

We use the following notation.

C_i^e: consumption basket of an employed consumer in Period $i,\ i = 1,2$.
C_i^u: consumption basket of an unemployed consumer in Period $i,\ i = 1,2$.
$c_i^e(z)$: consumption of good z of an employed consumer in Period $i,\ i = 1,2$.
$c_i^u(z)$: consumption of good z of an unemployed consumer in Period $i,\ i = 1,2$.
D: consumption basket of an individual in the childhood period, which is constant.
P_i: the price of consumption basket in Period $i,\ i = 1,2$.
$p_i(z)$: the price of good z in Period $i,\ i = 1,2$.

$\rho = \frac{P_2}{P_1}$: (expected) inflation rate (plus one).
W: nominal wage rate.
R: unemployment benefit for an unemployed consumer. $R = D$.
$\widehat{D}$: consumption basket in the childhood period of a next generation consumer.
Q: pay-as-you-go pension for a consumer of the older generation.
Θ: tax payment by an employed consumer for the unemployment benefit.
$\widehat{Q}$: pay-as-you-go pension for a consumer of the younger generation when he retires.
Ψ: tax payment by an employed consumer for the pay-as-you-go pension.
Π: profits of firms which are equally distributed to each consumer.
l: labor supply of an individual.
$\Gamma(l)$: disutility function of labor, which is increasing and convex.
L: total employment.
L_f: population of labor or employment in the full-employment state.
$y(Ll)$: labor productivity, which is increasing or decreasing or constant with respect to "employment $\times$ labor supply" (Ll).

We assume that the population L_f is constant. In our model there is no capital, and the interest rate is zero.

We consider a two-step method to solve utility maximization of consumers such that:

1. Employed and unemployed consumers maximize their utility by determining consumption baskets in Periods 1 and 2 given their income over two periods:

2. Then, they maximize their consumption baskets given the expenditure in each period.

We define the elasticity of the labor productivity with respect to "employment $\times$ labor supply" as follows,

$$\zeta = \frac{y'}{\frac{y(Ll)}{Ll}}.$$

We assume that $-1 < \zeta < 1$, and ζ is constant. Increasing (decreasing or constant) returns to scale means $\zeta > 0$ ($\zeta < 0$ or $\zeta = 0$).

Since the taxes for unemployed consumers' debts are paid by employed consumers of the same generation, D and Θ satisfy the following relationship.

$$D(L_f - L) = L\Theta.$$

This means

$$L(D + \Theta) = L_f D.$$

The price of the consumption basket in Period 0 is assumed to be 1. Thus, D is the real value of the consumption in the childhood period of consumers.

Since the taxes for the pay-as-you-go pension system are paid by employed consumers of younger generation, Q and Ψ satisfy the following relationship:

$$L\Psi = L_f Q.$$

The utility function of employed consumers of one generation over three periods is written as

$$u(C_1^e, C_2^e, D) - \Gamma(l).$$

We assume that $u(\cdot)$ is a homothetic utility function. The utility function of unemployed consumers is

$$u(C_1^u, C_2^u, D).$$

The consumption baskets of employed and unemployed consumers in Period i are

$$C_i^e = \left(\int_0^1 c_i^e(z)^{\frac{\sigma-1}{\sigma}} dz\right)^{\frac{\sigma}{\sigma-1}}, \qquad i = 1,2,$$

and

$$C_i^u = \left(\int_0^1 c_i^u(z)^{\frac{\sigma-1}{\sigma}} dz\right)^{\frac{\sigma}{\sigma-1}}, \qquad i = 1,2.$$

σ is the elasticity of substitution among the goods, and $\sigma > 1$.

The price of consumption basket in Period i is

$$P_i = \left(\int_0^1 p_i(z)^{1-\sigma} dz\right)^{\frac{1}{1-\sigma}}, \qquad i = 1,2.$$

The budget constraint for en employed consumer is

$$P_1 C_1^e + P_2 C_2^e = Wl + \Pi - D - \Theta + \hat{Q} - \Psi.$$

Employed consumers of the younger generation lend money to consumers in the childhood period of the next generation. It is repaid in the next period. The budget constraint for en unemployed consumer is

$$P_1 C_1^u + P_2 C_2^u = \Pi - D + R + \hat{Q}$$

Since $R = D$,

$$P_1 C_1^u + P_2 C_2^u = \Pi + \hat{Q}.$$

Let

$$\alpha = \frac{P_1 C_1^e}{P_1 C_1^e + P_2 C_2^e}, \ 1 - \alpha = \frac{P_2 C_2^e}{P_1 C_1^e + P_2 C_2^e}. \tag{1}$$

Since the utility functions $u(C_1^e, C_2^e, D)$ and $u(C_1^u, C_2^u, D)$ are homothetic, α is determined by the relative price $\frac{P_2}{P_1}$, and do not depend on the income of the consumers. Therefore, we have

$$\alpha = \frac{P_1 C_1^e}{P_1 C_1^e + P_2 C_2^e} = \frac{P_1 C_1^u}{P_1 C_1^u + P_2 C_2^u},$$

$$1-\alpha=\frac{P_2C_2^e}{P_1C_1^e+P_2C_2^e}=\frac{P_2C_2^u}{P_1C_1^u+P_2C_2^u},$$

From the budget constraints for employed and unemployed consumers we obtain the following demand functions for consumption baskets.

$$C_1^e=\alpha\frac{Wl+\Pi-D-\Theta+\hat{Q}-\Psi}{P_1},\ C_2^e=(1-\alpha)\frac{Wl+\Pi-D-\Theta+\hat{Q}-\Psi}{P_2},$$

and

$$C_1^u=\alpha\frac{\Pi+\hat{Q}}{P_1},\ C_2^u=(1-\alpha)\frac{\Pi+\hat{Q}}{P_2}.$$

Lagrange functions in the second step for employed and unemployed consumers are

$$\mathcal{L}_1^e=\left(\int_0^1 c_1^e(z)^{\frac{\sigma-1}{\sigma}}dz\right)^{\frac{\sigma}{\sigma-1}} \tag{2}$$

$$-\lambda_1^e\left[\int_0^1 p_1(z)c_1^e(z)dz-\alpha(Wl+\Pi-D-\Theta+\hat{Q}-\Psi)\right],$$

$$\mathcal{L}_2^e=\left(\int_0^1 c_2^e(z)^{\frac{\sigma-1}{\sigma}}dz\right)^{\frac{\sigma}{\sigma-1}},$$

$$-\lambda_2^e\left[\int_0^1 p_2(z)c_2^e(z)dz-(1-\alpha)(Wl+\Pi-D-\Theta+\hat{Q}-\Psi)\right],$$

$$\mathcal{L}_1^u=\left(\int_0^1 c_1^u(z)^{\frac{\sigma-1}{\sigma}}dz\right)^{\frac{\sigma}{\sigma-1}}-\lambda_1^u\left[\int_0^1 p_1(z)c_1^u(z)dz-\alpha(\Pi+\hat{Q})\right],$$

and

$$\mathcal{L}_2^u=\left(\int_0^1 c_2^u(z)^{\frac{\sigma-1}{\sigma}}dz\right)^{\frac{\sigma}{\sigma-1}}-\lambda_2^u\left[\int_0^1 p_2(z)c_2^u(z)dz-\alpha(\Pi+\hat{Q})\right].$$

λ_1^e, λ_2^e, λ_1^u and λ_2^u are Lagrange multipliers. Solving these maximization problems, the following demand functions of employed and unemployed consumers are derived.

$$c_1^e(z)=\left(\frac{p_1(z)}{P_1}\right)^{-\sigma}\frac{\alpha(Wl+\Pi-D-\Theta+\hat{Q}-\Psi)}{P_1},$$

$$c_2^e(z)=\left(\frac{p_2(z)}{P_2}\right)^{-\sigma}\frac{(1-\alpha)(Wl+\Pi-D-\Theta+\hat{Q}-\Psi)}{P_2},$$

$$c_1^u(z)=\left(\frac{p_1(z)}{P_1}\right)^{-\sigma}\frac{\alpha(\Pi+\hat{Q})}{P_1},$$

and

$$c_2^u(z)=\left(\frac{p_2(z)}{P_2}\right)^{-\sigma}\frac{(1-\alpha)(\Pi+\hat{Q})}{P_2}.$$

About some calculations of these maximization problems please see Appendix. From these analyses we obtain the indirect utility functions of employed and unemployed consumers as follows:

$$V^e = u\left(\alpha\frac{Wl + \Pi - D - \Theta + \hat{Q} - \Psi}{P_1}, (1-\alpha)\frac{Wl + \Pi - D - \Theta + \hat{Q} - \Psi}{P_2}, D\right) - \Gamma(l),$$

and

$$V^u = u\left(\alpha\frac{\Pi + \hat{Q}}{P_1}, (1-\alpha)\frac{\Pi + \hat{Q}}{P_2}, D\right).$$

Let

$$\omega = \frac{W}{P_1}, \qquad \rho = \frac{P_2}{P_1}.$$

Then, since D is constant, we can write

$$V^e = \varphi\left(\omega l + \frac{\Pi - D - \Theta + \hat{Q} - \Psi}{P_1}, \rho\right) - \Gamma(l),$$

$$V^u = \varphi\left(\frac{\Pi + \hat{Q}}{P_1}, \rho\right),$$

ω is the real wage rate. Denote

$$I = \omega l + \frac{\Pi - D - \Theta + \hat{Q} - \Psi}{P_1}. \tag{3}$$

The condition for maximization of V^e with respect to l given ρ is

$$\frac{\partial\varphi}{\partial I}\omega - \Gamma'(l) = 0, \tag{4}$$

where

$$\frac{\partial\varphi}{\partial I} = \alpha\frac{\partial u}{\partial C_1^e} + (1-\alpha)\frac{\partial u}{\partial C_2^e}.$$

Given P_1 and ρ the labor supply is a function of ω. From (4) we get

$$\frac{dl}{d\omega} = \frac{\frac{\partial\varphi}{\partial I} + \frac{\partial^2\varphi}{\partial I^2}\omega l}{\Gamma''(l) - \frac{\partial^2\varphi}{\partial I^2}\omega^2}. \tag{5}$$

If $\frac{dl}{d\omega} > 0$, the labor supply is increasing with respect to the real wage rate ω.

2.2 Firms

Let $d_1(z)$ be the total demand for good z by younger generation consumers in Period 1. Then,

$$d_1(z) = \left(\frac{p_1(z)}{P_1}\right)^{-\sigma} \frac{\alpha(WLl + L_f\Pi - LD - L\Theta + L_f\hat{Q} - L\Psi)}{P_1}$$
$$= \left(\frac{p_1(z)}{P_1}\right)^{-\sigma} \frac{\alpha\left(WLl + L_f\Pi - L_fD + L_f\hat{Q} - L_fQ\right)}{P_1}.$$

This is the sum of the demand of employed and unemployed consumers. Note that $\hat{Q}$ is the pay-as-you-go pension for younger generation consumers in their Period 2. Similarly, their total demand for good z in Period 2 is written as

$$d_2(z) = \left(\frac{p_2(z)}{P_2}\right)^{-\sigma} \frac{(1-\alpha)\left(WLl + L_f\Pi - L_fD + L_f\hat{Q} - L_fQ\right)}{P_2}.$$

Let $\overline{d_2(z)}$ be the demand for good z by the older generation. Then,

$$\overline{d_2(z)} = \left(\frac{p_1(z)}{P_1}\right)^{-\sigma} \frac{(1-\bar{\alpha})\left(\bar{W}\bar{L}\bar{l} + L_f\bar{\Pi} - L_f\bar{D} + L_fQ - L_f\bar{Q}\right)}{P_1},$$

where $\bar{W}$, $\bar{\Pi}$, $\bar{L}$, $\bar{l}$, $\bar{D}$ and $\bar{Q}$ are the nominal wage rate, the profits of firms, the employment, the individual labor supply, the debt of an individual, and the pay-as-you-go pension, respectively, during the previous period. $\bar{\alpha}$ is the value of α for the older generation. Q is the pay-as-you-go pension for consumers of the older generation themselves. Let

$$M = (1-\bar{\alpha})\left(\bar{W}\bar{L}\bar{l} + L_f\bar{\Pi} - L_f\bar{D} + L_fQ - L_f\bar{Q}\right).$$

This is the total savings or the total consumption of the older generation consumers including the pay-as-you-go pensions that they receive in their Period 2. It is the planned consumption that is determined in Period 1 of the older generation consumers. Net savings is the difference between M and the pay-as-you-go pensions in their Period 2, as follows:

$$M - L_fQ.$$

Their demand for good z is written as $\left(\frac{p_1(z)}{P_1}\right)^{-\sigma}\frac{M}{P_1}$. Government expenditure constitutes the national income as well as the consumptions of the younger and older generations. Then, the total demand for good z is written as

$$d(z) = \left(\frac{p_1(z)}{P_1}\right)^{-\sigma}\frac{Y}{P_1}, \tag{6}$$

where Y is the effective demand defined by

$$Y = \alpha\left(WLl + L_f\Pi - L_fD + L_f\hat{Q} - L_fQ\right) + G + L_f\hat{D} + M.$$

Note that $\hat{D}$ is consumption in the childhood period of a next generation consumer. G is the government expenditure, except for the pay-as-you-go pensions, scholarships and unemployment benefits (see Otaki (2007), (2015) about this demand function). Now, we assume that G is financed by seigniorage similarly to Otaki (2007), (2009). In a later section, we will consider the government's budget constraint with respect to taxes.

Let L and Ll be employment and the "employment $\times$ labor supply" of firm z. The total employment and the total "employment $\times$ labor supply" are also

$$\int_0^1 Ldz = L, \qquad \int_0^1 Lldz = Ll.$$

The output of firm z is $Lly(Ll)$. At the equilibrium $Lly(Ll) = d(z)$. Then, we have

$$\frac{\partial d(z)}{\partial (Ll)} = y(Ll) + Lly'.$$

From (6)

$$\frac{\partial p_1(z)}{\partial d(z)} = -\frac{p_1(z)}{\sigma d(z)}.$$

Thus

$$\frac{\partial p_1(z)}{\partial (Ll)} = -\frac{p_1(z)(y(Ll) + Lly')}{\sigma d(z)} = -\frac{p_1(z)(y(Ll) + Lly')}{\sigma Lly(Ll)}.$$

The profit of firm z is

$$\pi(z) = p_1(z)Lly(Ll) - LlW.$$

The condition for profit maximization is

$$\begin{aligned}\frac{\partial \pi(z)}{\partial (Ll)} &= p_1(z)(y(Ll) + Lly') - Lly(Ll)\frac{p_1(z)(y(Ll) + Lly')}{\sigma Lly(Ll)} - W \\ &= p_1(z)(y(Ll) + Lly') - \frac{p_1(z)(y(Ll) + Lly')}{\sigma} - W = 0.\end{aligned}$$

Therefore, we obtain

$$p_1(z) = \frac{1}{(1 - \frac{1}{\sigma})(1 + \zeta)y(Ll)}W.$$

Let $\mu = \frac{1}{\sigma}$. Then,

$$p_1(z) = \frac{1}{(1 - \mu)(1 + \zeta)y(Ll)}W.$$

This means that the real wage rate is

$$\omega = (1 - \mu)(1 + \zeta)y(Ll). \tag{7}$$

With increasing (decreasing or constant) returns to scale, ω is increasing (decreasing or constant) with respect to "employment $\times$ labor supply" Ll.

From (3), (4) and (7), we have

$$\frac{\partial \varphi}{\partial I}(1 - \mu)(1 + \zeta)y(Ll) - \Gamma'(l) = 0,$$

with

$$I = (1-\mu)(1+\zeta)y(Ll)l + \frac{\Pi - D - \Theta + \hat{Q} - \Psi}{P_1}.$$

Then, from (5)

$$\frac{dl}{d(Ll)} = \frac{dl}{d\omega}\frac{d\omega}{d(Ll)} = \frac{\left[\frac{\partial\varphi}{\partial I} + \frac{\partial^2\varphi}{\partial I^2}(1-\mu)(1+\zeta)y(Ll)l\right](1-\mu)(1+\zeta)y'}{\Gamma''(l) - \frac{\partial^2\varphi}{\partial I^2}[(1-\mu)(1+\zeta)y']^2}.$$

Assuming $\frac{dl}{d\omega} > 0$, with increasing (decreasing) returns to scale $y' > 0$ $(y < 0)$, this is positive (negative). Since

$$\frac{d(Ll)}{dL} = l + L\frac{dl}{dL}, \tag{8}$$

we have

$$\frac{dl}{dL} = \frac{dl}{d(Ll)}\frac{d(Ll)}{dL} = \left(l + L\frac{dl}{dL}\right)\frac{dl}{d(Ll)}.$$

Thus,

$$\frac{dl}{dL} = \frac{l}{1 - L\frac{dl}{d(Ll)}}\frac{dl}{d(Ll)}.$$

Usually $\frac{dl}{dL}$ and $\frac{dl}{d(Ll)}$ have the same sign, and we assume $\frac{d(Ll)}{dL} > 0$ in (8). Also, since $-1 < \zeta < 1$, we have

$$\frac{d(Lly(Ll))}{Ll} = y(Ll) + Lly' = y(Ll)(1+\zeta) > 0.$$

Then, the output $Lly(Ll)$ increases by an increase in L.
Since all firms are symmetric,

$$P_1 = p_1(z) = \frac{1}{(1-\mu)(1+\zeta)y(Ll)}W. \tag{9}$$

2.3 Involuntary unemployment

The (nominal) aggregate supply of the goods is equal to

$$WL + L_f\Pi = P_1 Lly(Ll).$$

The (nominal) aggregate demand is

$$\begin{aligned}&\alpha\left(WL + L_f\Pi - L_f D + L_f\hat{Q} - L_f Q\right) + G + L_f\widehat{D} + M\\ &= \alpha\left[P_1 Lly(Ll) - L_f D + L_f\hat{Q} - L_f Q\right] + G + L_f\widehat{D} + M.\end{aligned}$$

Since they are equal,

$$P_1 Lly(Ll) = \alpha\left[P_1 Lly(Ll) - L_f D + L_f\hat{Q} - L_f Q\right] + G + L_f\widehat{D} + M,$$

or

$$P_1 Lly(Ll) = \frac{\alpha\left(-L_f D + L_f \hat{Q} - L_f Q\right) + G + L_f \hat{D} + M}{1-\alpha}.$$

In real terms

$$Lly(Ll) = \frac{\alpha\left(-L_f D + L_f \hat{Q} - L_f Q\right) + G + L_f \hat{D} + M}{(1-\alpha)P_1}, \tag{10}$$

or

$$Ll = \frac{\alpha\left(-L_f D + L_f \hat{Q} - L_f Q\right) + G + L_f \hat{D} + M}{(1-\alpha)P_1 y(Ll)}.$$

$\frac{1}{1-\alpha}$ is a multiplier. From (4) and (5) the individual labor supply l is a (usually increasing) function of ω. From (7) ω is a function of Ll. With increasing (decreasing or constant) returns to scale technology it is increasing (decreasing or constant) with respect to Ll or with respect to L given l. The individual labor supply l may be increasing or decreasing in L or Ll. However, we assume that Ll is increasing in L. This requires

$$\frac{dLl}{dL} = l + \frac{dl}{dL} > 0.$$

It means $Ll < L_f l$ for $L < L_f$. The equilibrium value of Ll cannot be larger than $L_f l$. However, it may be strictly smaller than $L_f l$. Then, we have $L < L_f$ and involuntary umemployment exists.

If the government collects a lump-sum tax T from the younger generation consumers, the aggregate supply and demand satisfy

$$P_1 Lly(Ll) = \alpha\left[P_1 Lly(Ll) - T - L_f D + L_f \hat{Q} - L_f Q\right] + G + L_f \hat{D} + M. \tag{11}$$

2.4 Discussion summary

The real wage rate depends on the elasticity of the labor productivity with respect to “employment × labor supply” and the employment level. But the employment level does not depend on the real wage rate. The real aggregate demand and the employment level are determined by the value of

$$\frac{\alpha\left(-L_f D + L_f \hat{Q} - L_f Q\right) + G + L_f \hat{D} + M}{P_1}. \tag{12}$$

If the employment is smaller than the labor population, then involuntary unemployment exists.

2.5 Positive and negative real balance effects

The net savings of the older generation consumers is the difference between their savings and the pay-as-you-go pensions. It is written as

$$M - L_f Q.$$

On the other hand, the debts of the younger generation consumers is $L_f D$. There are two cases about the relation between $M - L_f Q$ and $L_f D$ as follows:

1. Case 1: $M - L_f Q > L_f D$, that is, $M > L_f Q + L_f D$. Then, the net savings of the older generation consumers is larger than the debts of consumers in the childhood period. In this case the real balance effect due to a decline in the price of the goods is positive.

2.Case 2: $M - L_f Q < L_f D$, that is, $M < L_f Q + L_f D$. Then, the net savings of the older generation consumers is smaller than the debts of consumers in the childhood period. In this case the real balance effect due to a decline in the price of the goods is negative.

2.6 The case of full-employment

If $Ll = L_f l$, full-employment is achieved. Then, (10) is re-written as

$$L_f ly(L_f l) = \frac{\alpha\left(-L_f D + L_f \hat{Q} - L_f Q\right) + G + L_f \widehat{D} + M}{(1-\alpha)P_1}. \tag{13}$$

Since L_f and $L_f l$ are constant (if $L = L_f$, ω is constant), this is an identity not an equation. On the other hand, (10) is an equation not an identity. (13) should be written as

$$\frac{\alpha\left(-L_f D + L_f \hat{Q} - L_f Q\right) + G + L_f \widehat{D} + M}{(1-\alpha)P_1} \equiv L_f ly(L_f l).$$

This yields:

$$P_1 = \frac{1}{(1-\alpha)L_f ly(L_f l)}\left[\alpha\left(-L_f D + L_f \hat{Q} - L_f Q\right) + G + L_f \widehat{D} + M\right].$$

Then, the nominal wage rate is determined by:

$$W = (1-\mu)(1+\zeta)y(L_f l)P_1.$$

3. Steady state with ongoing nominal wage rate decline and achievement of full-employment

3.1 Steady state with ongoing nominal wage rate decline

If there exists involuntary unemployment, the nominal wage rate may decline. By (9) a decline in the nominal wage rate induces a decline in the price of the goods. We assume that consumers correctly predict a decline in the price. Suppose that the output and the employment are constant, and the price of the goods declines at the rate $\rho - 1 < 0$ from a period to the next period. Let T be the tax revenue. We can assume that $\widehat{D} = \rho D$ and $\hat{Q} = \rho Q$. Thus, (11) is written as

$$P_1 Lly(Ll) = \alpha\left[P_1 Lly(Ll) - T - L_f D + (\rho - 1)L_f Q\right] + G + \rho L_f D + M. \tag{14}$$

In order to maintain the steady state, the total savings of the younger generation consumers including the pay-as-you-go pension that they will receive must be equal to ρM. Therefore,

$$(1-\alpha)\left[P_1 Lly(Ll) - T - L_f D + (\rho - 1)L_f Q\right] = \\ = G - T + (\rho - 1)L_f(D + Q) + M = \rho M. \quad (15)$$

This means

$$G - T = (\rho - 1)(M - L_f D - L_f Q). \quad (16)$$

We obtain the following prosposition.

Proposition 1

There are two cases.

1. If $M > L_f D + L_f Q$, that is, in the positive real balance effect case, in order to maintain the steady state where the output and the employment are constant with falling prices ($\rho < 1$), a budget surplus $G - T < 0$ is required.

2. If $M < L_f D + L_f Q$, that is, in the negative real balance effect case, in order to maintain the steady state where the output and the employment are constant with falling prices ($\rho < 1$), a budget deficit $G - T > 0$ is required.

3.2 Fiscal policy to achieve full-employment

Let G' and T' be the government expenditure and the tax to achieve full-employment. Then, (14) is written as

$$P_1 L_f ly(L_f l) = \alpha\left[P_1 L_f ly(L_f l) - T' - L_f D + (\rho - 1)L_f Q\right] + G' + \rho L_f D + M.$$

From this

$$(1-\alpha)\left[P_1 L_f ly\left(L_f l\right) - T' - L_f D + (\rho - 1)L_f Q\right] = \\ = G' - T' + (\rho - 1)L_f(D + Q) + M. \quad (17)$$

Suppose $P_1 L_f ly(L_f l) - T' > P_1 Lly(Ll) - T$ or $T = T'$, that is, the realization of full employment will increase consumers' disposable income or the tax is not changed. Then, from (15) and (17) we get

$$G' - T' > (\rho - 1)(M - L_f D - L_f Q).$$

Therefore, we have the following result.

Proposition 2

In order to achieve full-employment with ongoing nominal wage rate decline the budget surplus must be smaller, or the budget deficit must be larger than the steady state case in (16).

Let G'', T'', M' and $P_1{}'$ be the government expenditure, the tax revenue, the total savings of the younger generation consumers and the price of the consumption basket in the next period after realization of full-employment. (14) is written as

$$P_{1'}L_f ly(L_f l) = \alpha\left[P_{1'}L_f ly(L_f l) - T'' - L_f D + (\rho - 1)L_f Q\right] + G'' + \rho L_f D + M'.$$

To maintain full-employment, the total savings of the younger generation including the pay-as-you-go pension must be equal to $\rho M'$. Then, we have

$$\begin{aligned}(1-\alpha)\left[P_{1'}L_f ly\left(L_f l\right) - T'' - L_f D + (\rho - 1)L_f Q\right] = \\ = G'' - T'' + (\rho - 1)L_f(D + Q) + M' = \rho M',\end{aligned}$$

and,

$$G'' - T'' = (\rho - 1)(M' - L_f D - L_f Q).$$

If the nominal wage rate and the price are constant after realization of full-employment, $\rho = 1$. Then,

$$G'' - T'' = 0.$$

Therefore, we have the following result.

Proposition 3

If the nominal wage rate is constant after full-employment has been realized, the balanced budget is required to maintain the steady state with full-employment.

4. Concluding Remarks

We have examined the existence of involuntary umemployment and the effects of fiscal policy using a three-periods OLG model under monopolistic competition with ongoing nominal wage rate decline. We considered the case of a divisible labor supply, and we assumed that the goods are produced only by labor.

In the future research, we want to analyze involuntary unemployment and fiscal policy in a situation where goods are produced by capital and labor, and there exist investments of firms.

Appendix: Some calculations

The first order condition for (2) is

$$\left(\int_0^1 c_1^e(z)^{\frac{\sigma-1}{\sigma}} dz\right)^{\frac{1}{\sigma-1}} c_1^e(z)^{-\frac{1}{\sigma}} - \lambda_1^e p_1(z) = 0. \tag{A-1}$$

From this

$$\left(\int_0^1 c_1^e(z)^{\frac{\sigma-1}{\sigma}} dz\right)^{-1} c_1^e(z)^{\frac{\sigma-1}{\sigma}} = (\lambda_1^e)^{1-\sigma} p_1(z)^{1-\sigma}.$$

Then,

$$\left(\int_0^1 c_1^e(z)^{\frac{\sigma-1}{\sigma}}dz\right)^{-1}\int_0^1 c_1^e(z)^{\frac{\sigma-1}{\sigma}}dz = (\lambda_1^e)^{1-\sigma}\int_0^1 p_1(z)^{1-\sigma}dz = 1,$$

It means

$$\lambda_1^e\left(\int_0^1 p_1(z)^{1-\sigma}dz\right)^{\frac{1}{1-\sigma}} = 1,$$

and so

$$P_1 = \frac{1}{\lambda_1^e}.$$

From (A-1)

$$\left(\int_0^1 c_1^e(z)^{\frac{\sigma-1}{\sigma}}dz\right)^{\frac{1}{\sigma-1}} c_1^e(z)^{\frac{\sigma-1}{\sigma}} = \lambda_1^e p_1(z)c_1^e(z).$$

Then,

$$\left(\int_0^1 c_1^e(z)^{\frac{\sigma-1}{\sigma}}dz\right)^{\frac{1}{\sigma-1}}\int_0^1 c_1^e(z)^{\frac{\sigma-1}{\sigma}}dz = \left(\int_0^1 c_1^e(z)^{\frac{\sigma-1}{\sigma}}dz\right)^{\frac{\sigma}{\sigma-1}}$$
$$= C_1^e = \lambda_1^e\int_0^1 p_1(z)c_1^e(z)dz = \frac{1}{P_1}\int_0^1 p_1(z)c_1^e(z)dz.$$

Therefore,

$$\int_0^1 p_1(z)c_1^e(z)dz = P_1C_1^e.$$

Similarly,

$$\int_0^1 p_2(z)c_2^e(z)dz = P_2C_2^e.$$

Thus,

$$\int_0^1 p_1(z)c_1^e(z)dz + \int_0^1 p_2(z)c_2^e(z)dz = P_1C_1^e + P_2C_2^e =$$
$$= Wl + \Pi - D - \Theta + \hat{Q} - \Psi.$$

From (A-1)

$$P_1C_1^e = \alpha(Wl + \Pi - D - \Theta + \hat{Q} - \Psi).$$

Also by (A-1)

$$\left(\int_0^1 c_1^e(z)^{\frac{\sigma-1}{\sigma}}dz\right)^{\frac{\sigma}{\sigma-1}} c_1^e(z)^{-1} = C_1^e c_1^e(z)^{-1} = (\lambda_1^e)^\sigma p_1(z)^\sigma = \left(\frac{p_1(z)}{P_1}\right)^\sigma.$$

From this we get

$$c_1^e(z) = \left(\frac{p_1(z)}{P_1}\right)^{-\sigma}\frac{\alpha(Wl + \Pi - D - \Theta + \hat{Q} - \Psi)}{P_1}.$$

$c_2^e(z)$, $c_1^u(z)$ and $c_2^u(z)$ are similarly obtained.

Acknowledgment

This work was supported by the Japan Society for the Promotion of Science KAKENHI (Grant Number 18K01594).

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STUDIA UNIVERSITATIS BABEȘ-BOLYAI OECONOMICA
VOLUME 67, ISSUE 1, 2022, pp. 27-43
DOI: 10.2478/subboec-2022-0003

CAPITALIZATION OF HUMAN SKILLS AND COMPETENCIES – AN EXPLORATORY MODEL

Zahia BOUZIDA
University of Tizi-Ouzou, Algeria

Nadir MALEK
University of Tizi-Ouzou, Algeria

Souhila GHOMARI*
University of Tlemcen, Algeria

Abstract: The paper aims to synthesize the lessons learned from the analysis of the ISO 9001 quality management system standard. The objective is twofold: first, to understand the role of human capital in the conduct and success of an innovation project within a company, and secondly, to explain the simultaneous effect of this dynamic on the emergence of innovative behaviors. An exploratory study is established with the personnel of the first ISO certified company in Algeria and the proposed hypotheses are tested by the partial least squares structural equation modeling (PLS-sem) method. Analysis of the results show that by acting on certain mechanisms, these standards can be assimilated to a catalog of data that can be utilized to encourage and promote the construction and development of skills and competencies. The findings allow us to better understand the nature of the relationship that may exist between skills management and the quality approach.

JEL classification: L15, M59, P23
Keywords: ISO 9000; Human capital; Managerial innovation; PLS approach.

1. Introduction

In today's competitive world where economic actors are more and more interdependent and their relationships are increasingly complex and evolving, companies need to rely on an optimized organization and a strong commitment of their personnel to perform, offer and guarantee quality services to their clients. Competitiveness in companies is now based on three elements: first, the company's ability to bring together human skills, secondly, the administration of the company

*Corresponding author. Address: Bp 226, Faculty of Economics, Management & Commercial Sciences, Tlemcen University, Algeria, Phone: +213 771 757 902,
E-mail: souhila.ghomari@univ-tlemcen.dz

and its mode of operation must derive the highest performance from its personnel and third, the company must involve and motivate all its personnel (Diridollou and Vincent, 2001).

It is widely acknowledged that business innovation relies much more on know-how than on material aspects, hence the importance of good management (Sabrina Loufrani-Fedida, 2006). In this case, skills development becomes essential and indispensable. This makes it possible to identify one of the results of the skill-based theory.

Over the past few years, skills management has become one of the most important research axes as it aims to develop a systematic and organized approach, intended to improve a company's ability to mobilize its skills in order to ensure the implementation of its strategy in terms of performance.

In this context, the dissemination of operational excellence initiatives, and in particular the quality approach, within the company, undoubtedly constitutes a means of responding to these major challenges.

However, the implementation of such an approach is henceforth based on a simplified reference system, which in this case is the ISO 9000 system that is oriented towards the added value brought to the organization in general. This system appears to be an alternative that is adopted by a growing number of companies and a response to the issue related to their ability to manage this uncertainty and to control their organization in order to generate competitive advantages and conquer new markets (Khetib and Ghomari, 2010).

This paper constitutes a contribution at several levels in the field of HRM and quality management. In our opinion, this research could be considered as a clarification and an extension of previous work carried out in this direction and will allow us to better understand the nature of the relationship that may exist between human skills and performance.

Our contribution lies in the development of a conceptual model linking some practices of the quality approach and the pillars of competence. This modeling can also constitute an extension of previous work insofar as we have gone beyond the classic view given to the performance, which is no longer financial, but organizational. Indeed, the companies that have implemented this approach bear witness to the benefits obtained in terms of improving their relations, both external (customers) and internal (employees), as well as in terms of efficiently managing their activities. This may be achieved as a result of the new generated skills (Flynn, M. et al, 2003).

From that perspective, the objective assigned to this article is twofold: on the one hand, it is a matter of understanding the role of human capital in the management and success of the innovation project within the company and hence, of improving its performance, and on the other hand, elucidating the simultaneous effect of this dynamic on the emergence of innovative behaviors. For this purpose, it was considered more appropriate to adopt a methodology that consists, first of all, in carrying out a review of the literature on the different elements of our problematic, and, secondly, in considering the possibility of viewing the ISO 9000 standards as the essence of the creation of skills within the company. To this end, a questionnaire survey was carried out with the human component of the first ISO certified company in Algeria, i.e. the National Company of Household Appliance Manufacturing Industries (ENIEM), based on the perception of ISO 9000 standards, and their implications in strengthening human skills within the company, and relying on three essential elements of competence, namely training, communication, and motivation.

2. Literature review

2.1 Skills integration challenges

As in many situations, companies are forced to evolve under the pressure of their environment. Indeed, the company operates in a selective environment that characterized by some factors that are external to the industry or sector in question, and by internal factors that are more or less restrictive and demanding.

It is widely admitted that strategic management considers the company as a series of functions or a set of activities connected to each other (Boubaker, 2012). From this perspective, the company can be seen as the central point of a supply system and a set of services that are based on a combination of skills (de La Ville and Grimand, 2001).

To cope with a versatile environment, which depends on responsiveness requirements, companies are constantly looking for new solutions to keep their market share, and to meet the demands of their customers who are becoming more and more demanding. Faced with this situation, companies have to develop new innovative products not only of good quality but also with low costs.

Indeed, the search for performance requires companies to seek more flexibility at the organizational level, a better mastery of technology, but above all, a better appreciation of human skills (Prusak, 2001). Today, it is more and more recognized that the company cannot be financially sustainable if it is not humanly efficient (Collomb et al., 2011). The issue of human capital in general, and skills in particular, then becomes a factor of strategic performance. It should be noted that the question related to human skills is indeed at the center of the problematic of creating some added value in order to develop goods or services that meet the needs of the customer.

Furthermore, in order to be competitive, the company needs first to define the customer orientation as a strategic axis, and then to make this strategy last by acting on the next two essential elements:

- Improvement of structures through process control,
- Development of men's skills (Diridollou and Vincent, 2001).

As previously mentioned, the gradual expansion of the concept of competence and its growing importance as a factor of business performance are closely linked to new competitiveness challenges and current developments in the organization of work.

At first glance, the position of individuals in the company may be viewed as a resource whose quality criterion is competence[1]. It is worth indicating that competence is at the heart of multiple theoretical approaches. Indeed, the purpose is to address the issue related to the role of skills in implementing the adopted strategy and to develop competitive advantages for the company. In other words, the emphasis will be on the competency-based approach, which constitutes the main theoretical referent of our research work.

2.2 The competence-based approach

Competency-based theory seems to be a new avenue of research which assesses the company through its capacity of creating knowledge and skills. Indeed, the firm operates in a competitive environment, and its situation depends on its competencies and resources and not only on its position in the market (Chaudey, 2014).

Based on such reasoning, it may be asserted that the main question that comes to our mind is to find the way the company can build competitive advantages that are useful for its performance based on the information, resources and data it possesses.

Therefore, with this approach, the role of the human factor becomes strategic. This factor no longer has the simple function of organizing workstations in a coherent manner with regard to the company's objectives, but also of mobilizing skills in order to execute strategic decisions.

In this context, for Le Boterf Guy, competence is the ability to act through:

• Mobilization and combination of a set of appropriate personal resources, such as knowledge, know-how, behavior, etc., with their environment, like the databases, colleagues, experts, and other professions;

• Management of a set of professional situations;

• Obtaining results (products, services) that satisfy certain performance criteria for a given recipient who can be a customer, patient, user, etc. (Diez and Sarton, 2012).

These same authors have reported that competence lies in the arrangement of resources, as well as in the sequence, combination and completion of an action.

However, this definition specifies that we can only talk about competence in a professional situation and exclude any other life situation outside of this work context.

On the other hand, Plane (2008) proposed a concept of competence that is similar to that of Le Boterf Guy. For Plane J.M., competence is a body of knowledge, and a set of skills and attitudes, theoretical and practical, held by an actor, and implemented while accomplishing his professional activity, in one or more specialties.

For some authors, there is no fundamental difference between this notion and those of aptitude, know-how, skill, expertise or capacity. For others, competence cannot be reduced to knowledge or know-how. To be competent is to be able to mobilize the available resources in carrying out a task.

These two definitions, which are presented here for information only, allow deducing that competence is an arrangement resulting from the combination and activation of a body of knowledge that is acquired over time and implemented in professional situations. This can be the basis for its validation.

Therefore, one may assert that competence represents a link between knowledge, practice (know-how) and behavior (interpersonal skills).

As previously stated, the strategy is thought out and implemented for the sole purpose of guarantying the performance of the company. For Darbelet et al. (2007), the strategy is a process involving reflection (strategic analysis) and action (strategic choices) through which the company makes the necessary changes that allow

maintaining its competitive position. Indeed, the adopted strategy aims to significantly and sustainably consolidate the company's position in its environment and to enable it to develop competitive advantages over its rivals, by providing answers to the following questions: 1) How to be successful in the face of competition? 2) How to flourish? 3) What element (s) should the company rely on in order to develop its activities?

- **Strategic competencies in a company**

A recent analysis of the importance of competitiveness in companies has highlighted the role of competencies in making strategic decisions and choices. In this context, it was revealed that to be successful, a business must clearly define its mission and strategy; its success should also depend on the compatibility of this strategy with the actions it undertakes, the requirements of the environment, as well as on the level of interaction between the actions it undertakes and the portfolio of its competences (Beirendonck and Leroy, 2001).

It should be noted that the competency-based approach gives a new concept of the company by considering it, not through its activities, products and markets, but mainly through the skills of its personnel. Thus, the strategy no longer appears as a rational exercise of adaptation, but should rather be seen as an architecture that helps to develop skills within the company. From this perspective, it is first and foremost up to the company to identify its resources and skills. Once this has been done, they should then be assessed in the context of their competitive environment.

Finally, the company must create a stimulating and encouraging work climateas often as possible. In this context, Le Boterf Guy (2015) argued that developing a business strategy is one thing, and implementing it is another. It is not enough to have a strategic project; it is also required to have the capacity to implement it.

Experience has shown that taking action depends to a large extent on the skills and motivation of staff. (Malek, N. et al., 2019)

It should be noted that the difficulty may be even more immediate when moving from the strategy itself to more significant action plans, like successfully launching a new innovative product, or even making a successful organizational change. This wouldrequire employees to have a great capacity to perform new things using different approaches. It would therefore be tempting to say that most strategies fail due to a lack of sufficiently competent collaborators to implement them effectively.

- **Human skills as a source of competitive advantage**

A business can only survive if it knows how to define and defend its uniqueness in a market subject to extreme competitive pressures. This should distinguish it from its competitors. It is worth recalling that it is vital for a company to be able to secure a sustainable competitive advantage. Furthermore, the competitive advantage translates into a strategic desire to accomplish collective, permanent and transversal work. It refers to the value that the company is able to create and deliver

to its customers. In business, this advantage lies much more in the enhancement of human skills. On the other hand, the company cannot then be considered as a simple portfolio of activities determined by a technology, such as a product, a price or a market. It is interesting to take the example of Japanese companies which support the idea that successful companies are those that think in terms of skills portfolios and not in terms of business portfolios. Likewise, in a climate of competitiveness, it is essential for a company to have a sustainable competitive advantage over other firms. According to the theory of strategic resources, in order to have a competitive advantage, a resource must have the particularity of being precious, difficult to imitate and not substitutable. It is widely acknowledged that human resources are the real wealth that any company ought to have so the conditions mentioned above can be satisfied. These resources can certainly create a lot of value. Therefore, competence and real team work within a company can certainly help the company to acquire a sustainable competitive advantage. In this context, it is worth citing one of the results of the theory based on the core competency concept, developed by Prahalad and Hamel (1996), which indicates that the detection and arrangement of human resources skills do indeed allow companies to build their business innovation and guarantee their sustainable development.

Nowadays, competence has become one of the pillars of success within any company. Therefore, today's companies are urged to consider competence as a strategic variable, as it is certainly the level and nature of competence that will increasingly highlight the differences between competitive companies et al.

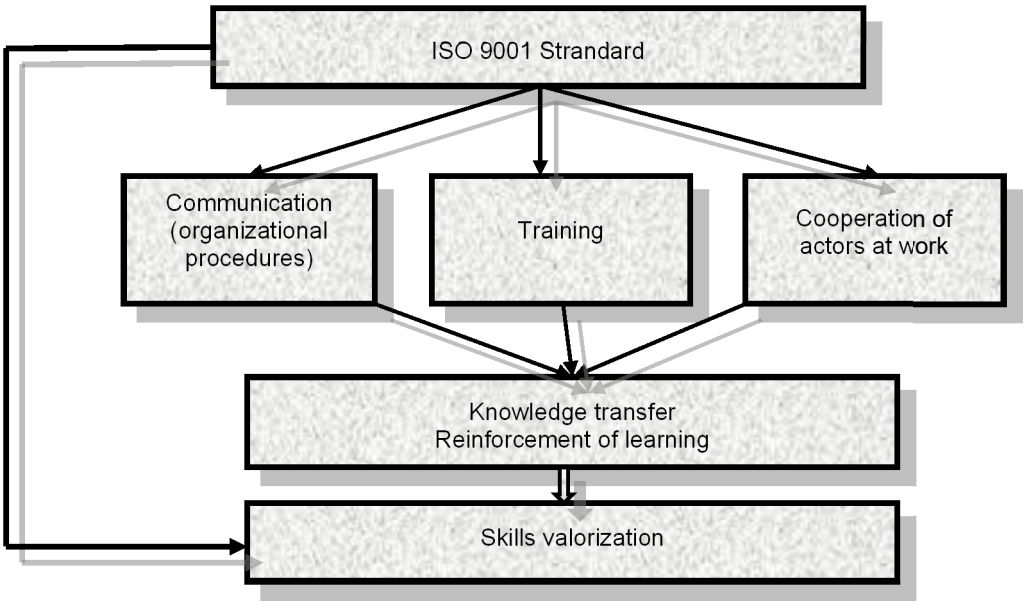
In the skills-based approach, building a competitive advantage must be founded on a higher valorization of the competent personnel of the company. To contribute to the development of a sustainable competitive advantage, skills must be valued, rare, inimitable and non-substitutable (Brulhartet et al., 2015).

The identification of these determinants aims in fact to push the reasoning further to see that the combination and mobilization of skills may create new horizons of value development that the company is supposed to follow in order to outclass its competitors and develop a sustainable competitive advantage.

2.3 ISO 9000 quality management standards and skills development

The ISO 9000 series standards, more particularly ISO 9001, represent a reference framework, a common basis for quality management for any company wishing to set up a quality approach (Ghomari, 2003). This approach is reflected in a management method whose success depends, among other things, on the commitment of human resources. It challenges the mode of organization advocated by Taylor based on the division of tasks, control, etc. In addition, this approach offers a mode of organization where the wealth of the company and the performance of everyone are, to a large extent, founded on the dynamism and competence of its human component. It is widely acknowledged that one of the originalities of the quality management system (QMS) is about respectingpeople and enhancing human potential and skills. This valorization is particularly felt in terms of training, communication and staff involvement.

Fig. 1: What are the means and requirements conveyed by this standard in terms of competence?



Source: Diagram developed based on our own research

According to Loukil (2005), the ISO 9001 standard should contribute to building and strengthening skills by favoring the creation and transfer of knowledge.

- **The role of communication in skills development**

At a time when human resources are recognized as one of the decisive factors for the success of the company, communication becomes a strategic asset for the development of the skills of its personnel. Indeed, communication promotes interactions and enhances the sharing of knowledge and know-how through the organization of meetings or workshops or even through organizational procedures.

Furthermore, communication should be viewed as a means of developing skills. Also, communication directly contributes to improving the productivity of individuals in an overall working environment, facilitates functional relationships, and opens up horizons to enrich and bring new ideas.

Indeed, an objective look at the texts of the ISO 9001: 2008 standard makes it possible to find communication requirements in several paragraphs, in particular in article 5.5 that is about *Responsibility, authority and communication*.

- **Quality, practice of training and skills development**

The implementation of a quality approach undoubtedly requires competent staff. Indeed, the ISO 9001 standard requires companies to adopt effective training programs, when the need arises.

Furthermore, training constitutes an asset within the company insofar as investing in the training of human resources would certainly help to build a range of skills required to meet new requirements and respond to changes in the world of business.

In addition, it should be noted that training enables companies to create and enhance the skills and productivity of their workforce while improving the quality of their products and services. It is the essential ingredient for improving the quality of work as it helps to develop the skills of employees and also to guarantee competitiveness. In short, it is the key to better develop, improve and use the capacities of their human resources.

- **Employee involvement and competence development**

The quality approach is a management method that is based on the sustained attention paid to quality by all stakeholders, at all stages of production. It is for this reason that it needs to be accompanied by a participatory approach.

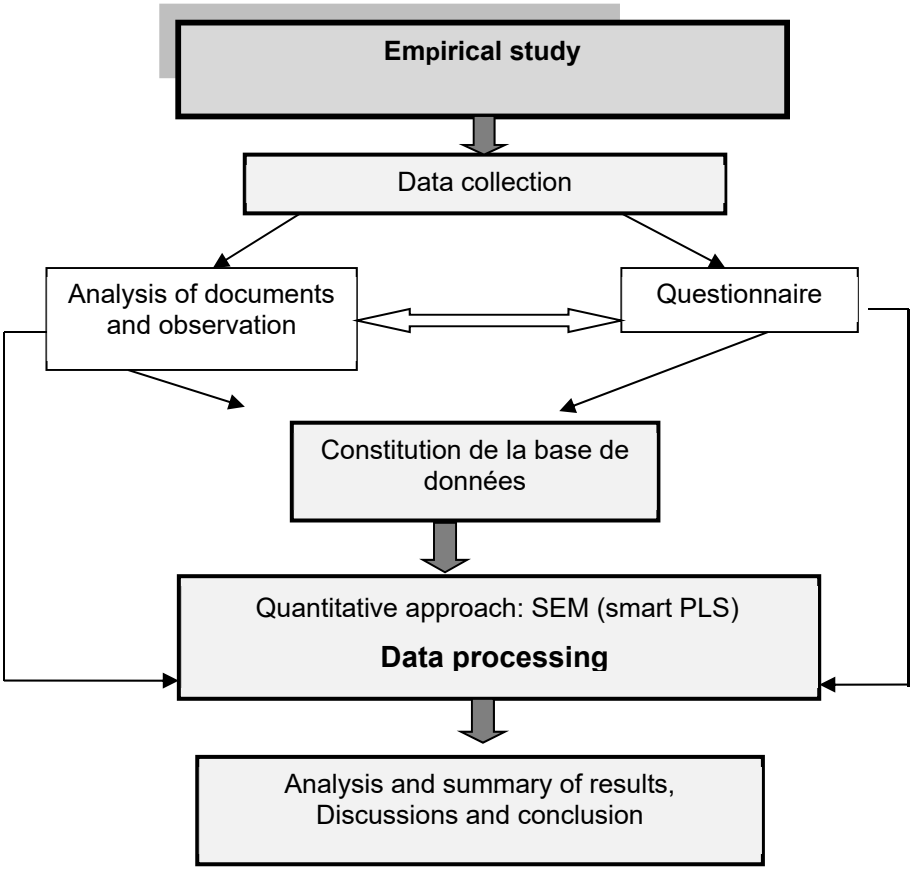
Furthermore, it should be mentioned that this injunction is not without influence on the development of skills within the company Dupuich (2011) and Pigeyre et al. (2002). Indeed, by adopting such a vision, each actor within the company, whatever his function, is called upon to develop his responsiveness and to use his knowledge wisely in complex tasks and situations. Therefore, this type of reasoning promotes and reinforces organizational learning as it allows everyone at the company level to share with others what they are expected to do. Consequently, each individual error becomes an opportunity to progress together, each suggestion becomes a collective wealth, and each piece of information shared allows everyone to do even better than the previous time.

3. Research methodology

This work was built in a way based on assumptions, we adopted a hypothetical-deductive approach which consists in making hypothesis, collecting data, then testing the results obtained to refute or support the assumptions. We made a projection on the first ISO certified company in Algeria, in this case ENIEM.

The figure below, we present the methodology we adopted for the development of our field study.

Fig. 2: General architecture of the case study



Source: Diagram developed based on our own research

3.1 Sample

Thus, in the context of this research, the study population refers to the personnel who make up the different production and management units in the ENIEM Company. The sample included 1656 employees at the end of 2016.

The method of Krejcie and Morgan (1970) was used to determine the sample to be studied.

$$S = X^2NP(1 - P) \div d^2(N - 1) + X^2P(1 - P)$$

S = required sample size.
X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).
N = the population size.

P = the population proportion (assumed to be 0.50 since this would provide the maximum sample size).
d = the degree of accuracy expressed as a proportion (0.05).

On this basis, this sample involved 312 individuals distributed according to the stratified sampling method by considering the socio-professional categories approved by the ENIEM Company. The following table summarizes all of these results.

Table 1: Sample distribution according to socio-professional categories

Socio-professional categories (SPC)	HR/ SPC		Sample HR/ SPC	
	Number	**%**	**Number**	**%**
Executives	280	17%	53	17%
Foremen	452	27%	85	27%
Subordinates	924	56%	174	56%
Total	**1656**	**100%**	**312**	**100%**

Source: From our own work

3.2 Measures

This survey was conducted on the basis of a questionnaire. A pre-test was carried out with the managers surveyed within the company in order to verify that the items are well understood, and to check the relevance in choosing these items

The “skills improvement” measurement model has several dimensions. These are represented by a set of exogenous variables which are 2 in number (reserved for the practices of the quality approach) as well as an endogenous variable which concerns the improvement of skills.

The variables of the model are measured and operationalized using the different items (manifest variables) which are formulated in the form of questions. The items were developed from the literature on the QMS, human skills and business performance. Thus these items were measured through a Likert scale of 5 levels. For each statement, the interviewee is asked to position themselves on a scale ranging from “Totally disagree” to “Totally agree”.

The exogenous variables of the research model are 2 in number relating to the quality approach, of which one variable measures the practice of the quality approach via training with 5 items and the other variable relates to the practices of the quality approach via internal communication (4 items) and involvement (4 items). The endogenous variable concerning the improvement and retention of skills was measured by 7 items.

4. Data processing

4.1 Descriptive analysis

The results of the descriptive analysis of the characteristics of the sample elements suggest that the respondents are male and female. The majority of employees surveyed are executives (48%); the rest belong to the other two categories.

Furthermore, 26% of the respondents have more than 10 years of experience. The rest, i.e. 52% of employees, have a seniority ranging from 5 to 10 years. In addition, 20% of ENIEM employees have been within the company for at least one year. Finally, 3% have less than one year of seniority.

4.2 Test of the measurement model

The main purpose of this test is to verify the reliability and validity of the measurement tools. More precisely, in this test, it is a question of evaluating and determining the degree of inter-correlation of the items and to check the potential of each item to determine the others. Table 2 summarizes the reliability results of the measuring instrument used in this research.

Table 2: Measurement model test results

ENIEM							
Constructs		**CR**	**AVE**	**Alpha de Cronbach**	**A**	**B**	**C**
A	Quality approach (Training	0,878	0,710	0.891	**0,764**		
B	Quality approach - Internal communication & Involvement	0,798	0.668	0.818	0,456	**0,799**	
C	Development and retention of competent personnel	0,894	0.738	0.846	0,354	0,641	**0,896**

Source: Smart PLS V3
With **α**= Cronbach's alpha, **CR**= Construct reliability, **AVE** = Average shared variance

The data in the above table shows that:

• All the reliability measures recorded in this study are well above the recommended limits[2]. The values of the alpha coefficient vary from 0.818 to 0.899. Moreover, those relating to the composite reliability (CR) index are between 0.798 and 0.920. These results indicate that the internal consistency coefficients are satisfactory, which means that the scale used is quite reliable.

[2]In practice, it is generally considered that the homogeneity of the instrument is satisfactory when the value of the coefficient is at least equal to 0.6 for the Cronbach's alpha and to 0.7 for the composite reliability index.

• All AVE measurements reach or exceed the threshold value of 0.50, which suggests that the convergent validity conditions are satisfied by our operationalization variables.

• The square roots of the AVEs located on the diagonal are greater than the square roots of the AVEs outside the diagonal, which confirms the discriminant validity of our measurement scales.

4.3 Estimation of the structural model

- **Fit test**

The fit of the overall model is estimated by calculating the goodness of fit (GOF), which theoretically must be significant if it is greater than 0.36. It is expressed as:

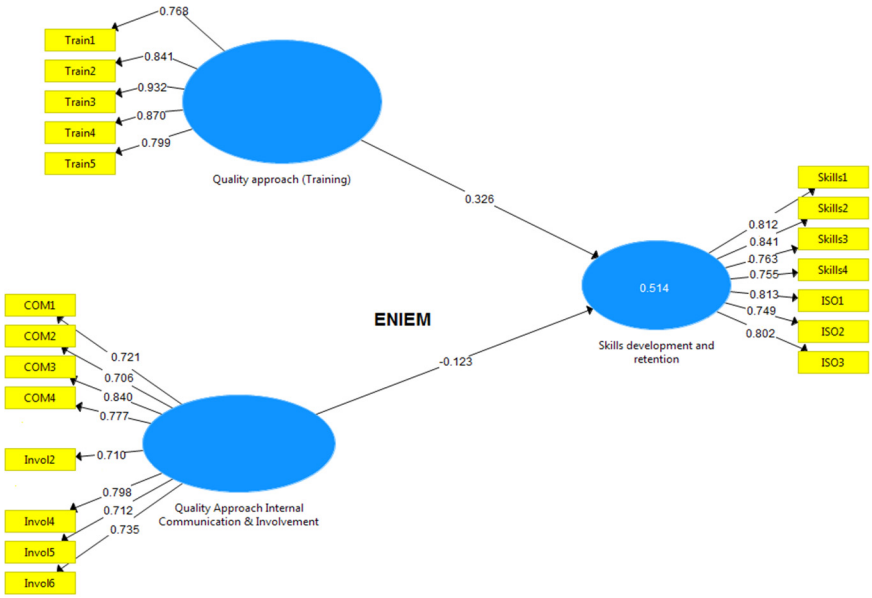
$$GOF = \sqrt{(\overline{AVE}) \times (\overline{R^2})}$$

Where AVE is the average shared variance, and R^2 is the coefficient of determination.

The goodness of fit for ENIEM was calculated (GOF = 0.60) using $R^2 = 0.514$ (average of R^2 of variables presented in the table) and AVE = 0.710 (average of AVE of the variables of the model multiplied by the number of items for each variable). The results obtained for the considered index are within the recommended range.

It is worth indicating that, in view of the tests carried out and according to the most widely accepted standards, the reliability, validity and quality of our model are well confirmed. This therefore allows, at this stage, testing the hypotheses.

Fig 3: Final model after purification and validation of measuring instruments



Source: Smart PLS V3

- **Testing the hypotheses**

For the purpose of checking the hypotheses, it was decided to use the values given by the student's t-test. According to Urbach and Ahlemann (2010), these values make it possible to test the significance of causal relationships. It should be noted that the coefficients are significant if the Student's t calculated on the average of samples is greater than 1.968.

In the PLS approach, the significance of the Student's t coefficients is calculated using the statistical bootstrap technique[3] (500 to 5000 replications), which suggests that the results of the error checking test in the relationships between exogenous variables and endogenous variables (p-Values), for both relationships, should be less than 0.05%. The table below summarizes the coefficients of regression between the latent variables, considering the original sample and using the bootstrap technique.

Note that each hypothesis in the model was treated separately in order to simplify the interpretation of the results. As a first step, and in accordance with the formulated hypotheses, the relationship between training and skills development was examined. Analysis of the results showed that there is a positive and significant correlation between training and skills development (T-statistic values exceed 1.96 and p-value <0.05). These findings confirm those found in the literature. It turns out that training is a powerful tool that companies should use in order to improve the skills of their personnel.

Table 3: Testing hypotheses

ENIEM					
Research hypotheses	**Initial sample (O)**	**Standard deviation (STDEV)**	**T value STDEV**	**P Value**	**Results**
Quality approach (Training) => Development and retention of competent personnel	0,326	0,058	5,610	0.000	Accepted**
Quality approach - Internal communication & Involvement Development and retention of competent personnel	-0.123	0.151	0.813	0.417	Rejected

Source: Smart PLS V3

[3]This method consists in assessing the model on a large number of sub-samples randomly within the main sample.

As a second step, the effect of the two variables, namely internal communication and personnel involvement, on the retention of skilled personnel was examined. This procedure helped to show that the interaction between internal communication and employee involvement variables on one side and skills development and skilled personnel retention variables on the other hand positive effect on performance within the Condor Company. Furthermore, it was found that these same variables have weak, or even insignificant, effects on the development and retention of skilled personnel within the ENIEM Company (T-statistic values are less than 1.96 and p-value > 0.05).

5. Discussion of the results

At the end of this analysis, the main results obtained are as follows:

5.1 Perception of integration of a new project - The ISO 9001 certified quality approach

Any change is first and foremost about establishing a new mindset shared by all the personnel. In this context, the quality approach as a dynamic of change is considered above all as a particularly cultural change project, requiring a high degree of involvement of all actors within the organization.

Analysis of the results of the ENIEM survey shows that the personnel lack the culture of quality, which poses the problem of rejection and resistance to change. This must undoubtedly hamper the achievement of some of the objectives set beforehand.

It should be noted that the lack of quality culture observed within the ENIEM Company is mainly due to the lack of user involvement in the management process, to the absence of sufficiently intense communication to justify and explain the actions carried out, and also to the absence of accompanying measures that would facilitate the transition. Indeed, the actors within the company are forced to make a change whose content and implementation methods are completely beyond their control.

This observation has just confirmed once again the results obtained by Arab, A (2016) who concluded that the participants in the quality approach of this company are satisfied only with certification; continuous improvement and performance only come as a last resort. This is due to the absence of an organizational culture oriented towards quality/customer

5.2 Effects of quality approach on human skills

The results of the survey carried out clearly show that quality management and human skills are closely linked. This organizational model is never without consequences on human skills.

- **Correlation between the practices of the ISO 9001 certified quality approach and skills development**

The latent variable of staff training has positive and statistically significant influences on the development of human skills within the surveyed company.

- **Correlation between the practices of the ISO 9001 certified quality approach and the retention of skill workers**

It was revealed that the staff involvement and internal communication variables have weak, or even insignificant, effects on skills development and retention of skilled personnel within the ENIEM Company.

This leads us to adopt the results of the study carried out by Dhiaf (2007): The "Human Resources" practice has an indirect and largely significant effect on the "Policy and Strategy" practice and the overall Performance defined in the term of internal process. In contrast, with the “internal communication” practice, he had noted the absence of an indirect link with the “Human Resources” practice.

Arab (2016) affirms that the non-capitalization of the learning achieved within the framework of the certification will prevent the company from progressing towards the desired level of competence

At the end of this study, it should be noted that a problem still persists within the ENIEM Company despite the beneficial implications of the quality approach in developing human skills, through various mechanisms. This is probably due to the loss or departure of skilled workers.

6. Conclusion

It is worth recalling that the main objective of the present work is to explain the repercussions of managerial innovation of the Quality Management System type on Human Resources. In this regard, the analysis conducted so far through the approach developed in this study has highlighted the importance of the ISO 9000 standards. It may therefore be asserted that the use of certification involves organizational issues, i.e. a company that decides to start an ISO9001 type certification procedure generally aims to develop skills and present them as new key success factors that must be used to outperform its competitors while producing competitive advantages.

In the skills-based approach, the use of the ISO 9001 standard is then justified by the company’s need to create value and ensure a sustainable competitive advantage while optimizing its organization and mobilizing its skilled personnel. From this perspective, this standard may be viewed as the very essence of skills development within the company. Indeed, competent personnel allow the company to create new knowledge and to strengthen learning capacities.

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STUDIA UNIVERSITATIS BABEȘ-BOLYAI OECONOMICA
VOLUME 67, ISSUE 1, 2022, pp. 44-62
DOI: 10.2478/subboec-2022-0004

THE RELATIVE SUCCESS OF IFRS ADOPTED AFRICAN COUNTRIES TO ATTRACT FOREIGN INVESTMENT

Merwe OBERHOLZER*
North-West University, South Africa

Matthew Olubayo OMOTOSO
North-West University, South Africa

Danie SCHUTTE
North-West University, South Africa

Pieter BUYS
North-West University, South Africa

Abstract: Within the context that the adoption of International Financial Reporting Standards (IFRS) can be linked to institutional isomorphism, the purpose of the study was to determine how successful IFRS-adopted African countries are to convert governance and economic factors into foreign direct investment (FDI) and foreign portfolio investment (FPI). Data envelopment analysis (DEA) was used to develop two models to calculate the technical efficiency (TE) for 16 African countries that adopted IFRS (2014-2019). The first model considered how multiple economic factors as input variables are converted into FDI and FPI, while similarly, the second model considered governance factors as input variables.

JEL Classification: C61; F18; M41
Keywords: International Financial Reporting Standards (IFRS), foreign direct investment (FDI), foreign portfolio investment (FPI), data envelopment analysis (DEA), institutional isomorphism

1. Introduction

Financial reporting is an essential and relevant source of information for various users, including foreign investors (Deegan, 2013). The reality of accounting diversity, however, is that it often prevents investors from getting reliable financial information for strategic investment decisions (Vidal-Garcia et al., 2016). The move

* Corresponding author. Address Private Bag X6001, North-West University, Potchefstroom South Africa, 2520, E-mail: merwe.oberholzer@nwu.ac.za

towards the adoption of a single set of global accounting standards became a reality in 2001 with the advent of the International Accounting Standards Board's (IASB) International Financial Reporting Standards (IFRS) (Ball, 2016). Prockazka (2012) emphasises that such standardised financial reporting is expected to enhance the quality of financial information and improve the inflow of foreign investments, which lends support for the adoption of IFRS in many countries.

The literature suggests that accounting information prepared in accordance with a standardised global accounting framework, often becomes part of the specifc country's institutional structures (Ben-Othman and Kossentini, 2015; Nnadi and Soobaroyen, 2015), and is therefore considered as being influencial to foreign investment decisions (Efobi et al., 2014a). In terms of IFRS adoption, however, one might find that such adoption may be due to normative isomorphism, a segment of the institutional theory, due to pressures from local accounting regulators (Phan, 2014; Rodrigues and Craig, 2007), as well as the influencial role of the Big Four accounting firms (Gillis, 2011; Rodrigues and Craig, 2007), which indicate normative pressure from the broader accounting profession to adopt IFRS. It may therefore seem that IFRS adoption could be influenced by social pressure, which brings into question its validity as a predictor of foreign investment success.

However, research that investigated the association between IFRS and foreign investment hypothesised that IFRS adoption may favour foreign investment (Amiram, 2012; Efobi et al. 2014b). In developing this context, some studies investigated the association between foreign direct investment (FDI) and IFRS adoption (Amiram, 2012; Gordon et al., 2012; Chen et al. 2014; Ng, 2015; Nnadi and Soobaroyen, 2015; Efobi, 2017), while others focused on foreign portfolio investment (FPI) and IFRS adoption (Hong et al., 2014; Ben-Othman and Kossentini, 2015). Complementary hereto, some studies also considered African cases within this context (Efobi et al. 2014b; Nnadi and Soobaroyen, 2015; Efobi, 2017). The interest of IFRS adoption in Africa is explained by Boolaky et al. (2020) as relevant because only about one third of the African countries adopted IFRS in comparison with an almost two thirds adoption rate of countries at a global level.

The aforementioned studies mainly focused on relationship analyses using regression analysis in which a foreign investment indicator (either FDI or FPI) is typically used as the *dependent* variable with IFRS adoption being a dummy variable acting as the main *independent* variable. In ensuring higher deterministic relationships in the analyses efforts, various independent variables could be included as mediators together with IFRS adoption (Gordon et al., 2012; Gumus et al., 2013; Ng, 2015). For purpose of this study, they are split into two sections, namely:

- Economic indicators such as economic growth, capital markets, inflation rates, interest rates and exchange rates; and
- Governance indicators such as trade openness, corruption, regulatory quality index and corporate tax rates.

These above variables, in conjunction with IFRS adoption, are identified in the literature as the traditional (or yardstick) drivers of foreign investment, which indicates that changes therein will impact on foreign investment success. Therefore, these yardstick drivers may be used to some extent as a proxy for the success of IFRS adoption.

Nevertheless, the primary issue of this study is the limitation of using conventional regression analysis, namely that it can only determine which of the independent variables have a statistical (in)significant relationship with the sample countries' foreign investment success. Consequently, it cannot be assumed that IFRS adoption was equally beneficial in African countries in attracting foreign investment. Furthermore, regression analysis cannot indicate how efficient the other mentioned yardstick drivers (factors) in each country were in attracting foreign investment. That entails regression analysis cannot determine how successful the yardstick drivers are to attract foreign investment per country. To fill this gap the purpose of the study was to determine how successful IFRS-adopted African countries are to convert the yardstick drivers into FDI and FPI. To measure the degree of success, a model was needed to determine how efficient these countries' yardstick drivers were to contribute to attracting foreign investment.

In striving to develop a more robust model to evaluate foreign investment success, we consider data envelopment analysis (DEA). As a non-parametric mathematical programming-based method, DEA aggregates the relative efficiency of a decision-making unit (DMU) with multiple inputs and multiple outputs (Cook et al., 2014). It uses a linear programming approach that computes a comparative ratio of weighted inputs to weighted outputs for each DMU in defining a best practice frontier, which, in turn, is used to measure each DMU's relative efficiency (Avkiran, 2011). This efficiency frontier is established by a set of DMUs that demonstrate best practice, before determining an efficiency level of the non-frontier DMUs in relation to the efficiency frontier (Zhou et al., 2018).

In this study, 92 DMUs were obtained from six annual data points (2014 to 2019) for 16 IFRS-adopted countries in Africa. For each of the 92 DMUs, the relative performance was calculated of how the above multiple economic indicator-inputs and governance indicator-inputs are converted into two output indicators, FDI and FPI.

Within the conceptual framework of the institutional theory, and especially the institutional isomorphism process, which includes the pressure on countries to adopt IFRS, it was clear from the findings that the IFRS-adopted African countries experienced widely different degrees of success to attract FDI and FPI. In a recent study, Boolaky et al. (2020) found that social and political forces, rather than economic forces, are the primary drive for IFRS adoption in African countries. This study provides evidence of the importance of economic forces, namely the countries are significantly more efficient to convert the economic indicators into FDI and FPI than they are in the case of the governance indicators. The practical value of the study is that the IFRS adopted countries did not experienced equal success to attract foreign investment. Furthermore, economic forces and governance forces may provide extremely different foreign investment inflow yield. Finally, with this different approach to apply DEA rather than regression analysis, the path is paved to do further studies to compare countries' relative success when adopting IFRS.

The next section of the paper discusses the background of the study, including the conceptual scope and the principles of DEA. This is followed by a literature review, which is summarised by setting specific objectives for the study. The method explains the data and the DEA model, which is followed by the results and a discussion thereof. The study is concluded in the final section.

2. Conceptual framework

The adoption rate of IFRS has increased after the European Union (EU) mandated all EU-listed companies to comply with IFRS from 2005 onwards, which also prompted the adoption of IFRS by many other non-EU countries (Gordon et al., 2012). This move by the EU formed the basis of harmonising financial statements in the place of the national accounting standards of different countries (Marquez-Ramos, 2011). This was also the case in Africa, with many African countries abandoning their own national accounting standards in favour of IFRS. Amiram (2012) and Chen et al. (2014) believe that the adoption of IFRS will have economic consequences in the adopting countries, especially in improving the inflow of foreign investments.

As mentioned, the adoption of IFRS is conceptualised within the context of the institutional theory. The theory evolved from the work of various scholars, including Meyer and Brown (1977), DiMaggio and Powel (1983), and Friedland and Alford (1991). The premise for their research focused on understanding why organisations have *the same degree of similarity* and how an organisational structure can be embraced to bring acceptability to another organisation. Although the institutional theory provides a robust theoretical framework in *organisational* research, the theory has also been the focus of *accounting* researchers, such as Broardbent et al. (2001), Brignal and Modell (2000), Rollins and Bremser (1997) as well as Aldemir and Uysal (2017). Fogarty (1996) and Phan (2014) specifically used the institutional theory as an examination tool for accounting standard-setting development. Research by Dillard et al. (2004) emphasised that institutional theory has gained more relevance in accounting research as a theoretical framework for the study of accounting practice in an entity. Iredele et al. (2020) investigated the influence of institutional isomorphism and organasational factors on environmental management accounting practices by comparing two African countries.

Fernando and Lawrence (2014), Dillard et al. (2004) as well as DiMaggio and Powel (1983) emphasise that the isomorphism dimension of institutional theory is a compelling process that forces one unit or organisation to adapt the *same* features and practices of another unit or organisation that operates in the same conditions or environment. DiMaggio and Powel (1983) identify the three types of isomorphic processes as coercive, mimetic and normative isomorphism. The latter is explained by DiMaggio and Powel (1983) as a pressure emanating from the norms, customs and beliefs of a (professional) group, to adopt a specific institutional practice for all the members in the group. As far as it relates to the adoption of IFRS, the anticipation that accountants will observe and comply with the generally accepted international accounting principles in the work environment could be seen as a form of normative isomorphism (Deegan, 2013).

In this study the African countries represent the “organisation”. To focus on the question why countries adopt the same practices such as IFRS-adoption and enlightening economic and governance practices (measured by the indicated yardsticks), our argument is that they strive to obtain the same level of success or benefit. This study’s purpose is to determine this degree of success on the hand of attracting FDI and FPI. The essence of this will be paramount to researchers in the field of accounting, especially when investigating the relative efficiency of yardstick drivers that are used in conjunction with IFRS adoption in terms of foreign investment success.

3. Data envelopment analysis

As a modelling approach, DEA aggregates multiple inputs and outputs of a sample of DMUs to define an efficiency frontier, which represents the sample benchmark. A DMU not on this frontier is considered as being inefficient, and the distance from the frontier determines the degree of such inefficiency. Anderson (1996) explains that the benchmark is based on the principle that if a specific DMU is capable of producing a specific output for a given set of inputs, the other DMUs in the sample should reasonably also be capable of doing the same. Therefore, in the DEA approach, all the DMUs are combined to find a composite (or virtual) DMU with composite inputs and composite outputs. In theory, therefore, the inefficient DMUs need to either reduce their inputs or increase their outputs, allowing them to move towards the best practice frontier.

To illustrate, the following example is based on an example in Anderson (1996). Say there are three DMUs, i.e. Country A, B and C, all with economic growth rates of 5%. Country A is best at attracting FDI, Country C is best at attracting FPI, while Country B falls somewhere in between.

- Country A: 5% growth rate, $100m FDI, $10m FPI
- Country B: 5% growth rate, $40m FDI, $15m FPI
- Country C: 5% growth rate, $20m FDI, $50m FPI

Per the above, Country A is efficient (1.0) in attracting FDI, while Country C is efficient (1.0) in attracting FPI. Country B, however, is inefficient since it could not attract either the highest FDI or FPI. For illustrative purposes, we use a 50:50 weighting of A and C to calculate a *virtual* vector (efficiency frontier) as a benchmark for B. This means *lambda* = [0.5, 0.5].

$$\lambda = [0.5 * 100 + 0.5 * 20, 0.5 * 10 + 0.5 * 50] = [60, 30]$$

Therefore, Country B needs to attract FDI and FPI of $60m and $30m, respectively, to move to the best practice frontier.

It is widely documented in the literature that Farrel (1957) was the first to address the problem of measuring the productive efficiency of an entity with multiple input variables and a single output variable. Charnes et al. (1978) developed the CCR DEA model to accommodate multiple inputs and multiple outputs, based on the constant return to scale (CRS) assumption. This implies that a DMU is considered fully scale efficient since the scale of operations does not influence the efficiency (Avkiran, 1999; Alvandi et al., 2013). This is perhaps an ambiguous assumption that would require some justification when using this model. Banker et al. (1984) improved on this DEA model by introducing the BCC model, which was based on the assumption of variable return to scale (VRS). This implies a disproportionate rise or fall in outputs when inputs are increased, for example when a DMU grows in size, its efficiency will not remain constant, but will either rise or fall.

For purposes of this paper, the VRS model was helpful in calculating the technical efficiency (TE) of the DMUs, which measures how well inputs are converted into outputs (Avkiran, 1999). In practice, the efficiency problem may be addressed by an input-oriented (input minimisation) approach or an output-oriented (output maximisation) approach. The former calculates the degree to which inputs can be

reduced while maintaining the output level, while the latter calculates the degree that outputs can be raised, given the current input levels (Avkiran, 1999; Cook et al., 2014). Relevant to this study, DEA is able to determine by how much inefficient DMUs' inputs (economic and governance indicators) must decrease to become efficient, or by how much the outputs (FDI and FPI) should increase to reach the efficiency frontier.

Finally, this study does not deal with a real production function, namely there is not a clear link to how multiple inputs (such as inflation rate, interest rate, exchange rate, economic growth rate, etc.) are converted to produce multiple outputs, FDI and FPI. In such a case, Cook et al. (2014) explain that the efficient DMUs do not necessarily form the 'production frontier', but it still yields information on the relative distance to the 'best-practice frontier'.

4. IFRS and foreign investment in Africa

Bughin and Chui (2013) observed that integration in global economies and advances in technology have led to a growth in international financial transactions. They also highlight that these developments require financial reporting information that is more transparent and comparable to ensure the efficient allocation of resources. Before the advent of IFRS, companies prepared their financial reports in accordance with local accounting standards (Cairns et al., 2011), resulting in *non-comparability* of accounting principles and financial reporting, which, in turn, hindered the flow of foreign investments, especially to developing economies (Nobes and Parker, 2008). The development of IFRS was prompted by the rapid growth in economic globalisation and an increase in global financial transactions (Nobes and Parker, 2008). These developments made national accounting standards somewhat irrelevant to the investment decisions of foreign investors. Given this, there was an increase in recognition of IFRS as more relevant in supporting cross-border investment decisions.

Researchers often disagree on an exact definition of, and distinction between, FPI and FDI (Makoni and Marozva, 2018). To conceptually understand foreign investment flow, one should consider the source thereof, which is the *financial account* in the balance of payments (BoP). The IMF (2021) categorises the financial account into (i) direct investment, assets and liabilities, (ii) portfolio investment, assets and liabilities, (iii) financial derivitives, and (iv) other investment, assets and liabilities. Within this context, the World Bank (2021) defines FDI as referring to direct investment equity flows, i.e. the sum of equity capital, reinvestment of earnings, and other capital together with ownership of at least 10 percent. In turn, the OECD (2013) defines FPI as the type of foreign investment that involves investment in equity and debt securities, which does not include instruments classified as direct investment or reserves. Therefore, the *influence of control* in management seems to be key in differentiating between FDI and FPI.

Even though many African countries gained independence by the late 1960s (Dupasquier and Osakwe, 2006), the continent was viewed as an area plagued with economic instability, weak governance, declining economic growth and social conflict.

During the 1970s and 1980s, many African countries showed very little increase in foreign investments (Ghosh et al., 2017). This period also witnessed fundamental economic policies that were primarily inward-looking economic strategies to encourage economic growth and development. These policies ranged from the protection of domestic industries, foreign exchange reserves and the nationalisation of foreign companies (Dupasquier and Osakwe, 2006). The study of Asfaw (2015) emphasised that these inward-looking strategies had a negative effect on the living standard of the people of Africa. Dupasquier and Osakwe (2006) also reported that the poor economic performance caused by these strategies did not allign with the globalisation activities worldwide. Many African countries tried to reverse the economic downturn and improve foreign investment by changing from inward-looking policies to more outward developing strategies. These efforts included embarking on policies to encourage foreign investments, among which was the adoption of IFRS.

Amaya and Rowland (2004) found that capital flows as a source of investment (in terms of FDI and FPI), increased significantly at the beginning of the 1990s in developing economies. The increase in capital flows to developing countries is arguably being attributed to changes in economic fundamentals and country-specific conditions (Ahmad and Zlate, 2014), which occurred due to the removal of various restrictions placed on foreign investments, and developments such as trade liberalisation and privatisation (Khayat, 2016)

Following the studies of Gordon et al. (2012), Gumus et al. (2013), and Ng (2015), we considered the following yardstick indicators that influence foreign investment, namely inflation rate, interest rate, exchange rate, economic growth rate, regulatory quality index, corruption, capital markets, trade openness, and corporate tax rate.

- ***Summary of argument and detail objectives***

The argument of this study can be illustrated by the following scenario: Country A has low corruption levels, reflected in a good (high) corruption rating of 80%. It was also able to attract $100m foreign investments. Country B has high corruption levels, reflected in a bad (low) rating of 40%. It was also able to attract foreign investments of $100m. Therefore, even though Country A has low corruption levels, it can be argued that it is relatively *inefficient* when compared to Country B. From an output-oriented view, Country A should theoretically be able to attract twice as much foreign investment than Country B. Alternatively, from an input-oriented view, Country A's high corruption rating was not very helpful in attacting foreign investment and it could just as well have had the same low corruption rating as Country B. This argument is also valid for the other indicators, which can be used as input indicators to achieve the desired foreign investment inflow (output indicators). It may consequently be argued that the best practice frontier will be the country(ies) that can convert the *weakest* indicator (input) into the *highest* foreign investment (output).

To determine how African countries relatively benefit from IFRS, a model was needed to determine which set of countries demonstrate best practice attracting FDI and FPI, given their selected institutional environmental indicators. Therefore, the detailed sub-objectives of the paper are set out as follows:

1. Develop the requisite DEA models.
2. Extract data to calculate the technical efficiency of each of the 92 DMUs.
3. Determine whether there is a difference in technical efficiencies when economic indicators are used as input variables versus the governance indicators.
4. Rank the countries in sequence of their relative success to attract FDI and FPI.

5. Study population and data sources

The DEA approach is cognisant of evolving efficiency levels over time. Following the practice by Branken (2018), this study employed data for multiple years. The sample used was based on the 18 African countries that have adopted IFRS to date. As Senegal was the latest to adopt IFRS in 2014, annual data from 2014 to 2019 were extracted. The 2020 data were excluded because i) in many instances data points were not available yet, and ii) to avoid possible *abnormal* consequences due to Covid-19's effect. Furthermore, due to incomplete data from various sources from the IMF (2021), TheGlobalEconomy (2021) and the World Bank (2021), the countries Sierra Leone and Zimbabwe were excluded, while some years from Eswatini (2014 and 2015), Kenya (2019) and Senegal (2019) were also excluded due to incomplete data. The usable information of the 16 countries are listed in Table 2 and Table 3. In total, a dataset of 92 DMUs has been established.

FDI and FPI inflow data were extracted from the database of 'International Investment Position' on the IMF website (IMF, 2021). In respect of FDI inflows, 'Liabilities: Direct investment options' were selected, which include i) equity and investment fund shares and ii) debt instruments. In respect of FPI inflows, 'Liabilities: Portfolio investment options' were selected, which included i) equity and investment fund shares and ii) debt securities.

From TheGlobalEconomy (2021) website, the following indicators were extracted: Economic growth rate (*EG* – percentage of change in the GDP); inflation rate (INF – percentage change in the consumer price index); interest rate (*INT* – on bank credit to the private sector); trade openess (*TOP* – exports plus imports as percent of GDP), regulatory quality index (*REG*) and control of corruption (*COR*) (both converted to a scale from 0 to 5, where 5 represents a strong value, implying strong regulatory quality and strong corruption combat, and *vice versa*); and corporate tax rate (*TAX* – percent on commercial profits). As many countries did not indicate their market capitalisation, which is a measurement for capital markets, it was substituted with the *GDP*.

From the literature it is clear that input indicators such as i) economic growth rate (Zeghal and Mhedhbi, 2006), ii) market capitalisation (substituted by the *GDP*) (Gordon et al., 2012), iii) interest rates (Gumus et al., 2013), iv) governance factors, trade openess (Ramanna and Sletten, 2014), and v) regulatory quality index and corruption control (Gordon et al., 2012) are positively associated with foreign investment inflows. It may therefore be assumed that higher indicator values reflect a country scenario that is more attractive to foreign investors than countries with

lower indicators. In the DEA model, countries that can convert low (weak) input-indicators into high output levels (FDI and FPI) will be regarded as efficient, and will form the best practice frontier. Furthermore, literature also indicates that high inflation rates (Gumus et al., 2013) and high tax rates (Gordon et al., 2012) are negatively associated to foreign investment inflows. The expectation is that lower inflation and tax rates should increase foreign investments as investors perceive it as an indication of stability and an investment incentive. For example, Country A, which attracts $100m foreign investment, where the tax rate is 30%, does better (is more efficient) than Country B, which also attracts $100m, but with a tax rate of 20%. For the purpose of the DEA model, which seeks a low input value to convert into a high output value, the inverse of the inflation rate (1/inflation rate) and tax rate (1/tax rate) was used.

Exchange rate as a factor that may influence foreign investment makes sense, as a local currency weakens against the investor's currency, the investor's relative purhasing power increases. For the DEA model, the 16 currencies should be standardised to make them comparable. In doing so, the World Bank's Purchasing Power Parity (*PPP*) conversion factor was used. The PPP is defined as "the number of units of a country's currency required to buy the same amount of goods and services in the domestic market as a U.S. dollar would buy in the United States." (World Bank, 2021). In the literature, it is found that the higher PPP factor (per the exchange rate) will be negatively associated with foreign investment because an undervalued currency is *cheaper* in attracting foreign investment (Gordon et al., 2012). Similarly, the expectation is also that the lower the *PPP* factor is, the more it is attractive to foreign investors. For the purpose of the DEA model, which seeks efficieny, to convert a poor input value into a high output value, the inverse of the *PPP* factor (*1/PPP*) was used.

- ***DEA model and data***

In attaining the first objective, 92 DMUs (datapoints) were considered to be sufficient for a single DEA model, which requires that the number of DMUs should be at least twice the size of inputs plus outputs (Cook et al., 2014); it was decided to develop two separate models to enhance the models' discrimination power. Model 1 included economic indicators as input variables, and Model 2 governance indicators as inputs variables. The models are specified as follows:

Model 1		**Model 2**	
Inputs:	$x_1 = EG$	Inputs:	$x_1 = TOP$
	$x_2 = GDP$		$x_2 = COR$
	$x_3 = 1/INF$		$x_3 = REG$
	$x_4 = INT$		$x_4 = 1/TAX$
	$x_5 = 1/PPP$		
Outputs:	$y_1 = FDI$	Outputs:	$y_1 = FDI$
	$y_2 = FPI$		$y_2 = FPI$

Table 1 summarises the data, namely descriptive statistics of the input variables of both models, Model 1 and Model 2, and the output variables, which are the same for both models. The table exhibits the average, standard deviation, minimum and maximum values for each the nine input indicators and the two output indicators. There is a wide spread in the monetary data, *GDP, FDI* and *FPI*. For example, the *GDP* standard deviation ($127.559bil.) is nearly twice the average value ($72.059bil.). Since the DEA method was applied, these widely extreme data points were not problematic in this study, since DEA is a non-parametric method that uses ranked data instead of continuous data.

Table 1: Descriptive statistics of data

	Input									Output	
	Model 1 (Economic indicators)					Model 2 (Governance indicators)					
	EG	*GDP*	*INF**	*INT*	*PPP**	*TOP*	*COR*	*REG*	*TAX**	*FDI*	*FPI*
	%	$bil.	%	%	0+	%	1-5	1-5	%	$bil.	$bil.
Avg.	4.0	72	6.6	14.8	0.42	71.2	2.3	2.3	31	42.5	19.3
S.D.	2.3	128	5.2	8.1	0.06	29.7	0.6	0.5	9	79.2	56.78
Min.	0.0	2	-1.1	5.1	0.31	20.7	1.2	1.6	14	0.26	0.001
Max.	9.4	547	23.8	44.4	0.59	143	3.4	3.6	55	331	292

** Note: In the DEA model, the inverse values of INF, PPP and TAX were used.*
Note: EG = economic growth; GDP = gross domestic product; INF = inflation rate; PPP = purchasing power parity; TOP = trade openness; COR = corruption; REG = regulatory index; TAX = tax rate; FDI = foreign direct investment; FPI = foreign portfolio investment

For purposes of this study, the following equation (Zhu, 2009) is the less restricted input-oriented VRS DEA model developed by Banker et al. (1984):

$$\theta^* = \min \theta$$
$$Subject\ to$$
$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq \theta x_{i0} \qquad i = 1, 2, \dots, m;$$
$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r0} \qquad r = 1, 2, \dots, s;$$
$$\sum_{j=1}^{n} \lambda_j = 1$$
$$\lambda_j \geq 0 \qquad j = 1, 2, \dots n.$$

The value of θ represents the input-oriented efficiency score of DMU_0 If $\theta^* = 1$, DMU_0 lies on the (best practice) frontier. If $\theta^* < 1$, DMU_0 does not lie on the frontier and should decrease its input levels. DMU_0 represents one of the n DMUs under review and x_{i0} and y_{r0} are the ith input and rth output for DMU_0, respectively. Each observation, DMU_j ($j = 1,...n$), uses m inputs x_{ij} ($i = 1,2,...,m$) to produce s outputs y_{rj} ($r = 1,2,...,s$). The efficiency frontier will be determined by these n observations.

6. Results and discussion

To enhance the reliability of the study, the software purposely developed by Zhu (2009) was used to calculate the input-oriented technical efficiency according to the VRS approach. Table 2 exhibits the results of the second objective, the relative technical efficiency estimates for the dataset of 92 DMUs.

Model 1: Using economic indicators as input data, the TE column shows that 40 of the 92 DMUs were fully efficient (1.000), with an average of 0.914 and the lowest estimate of 0.639 for Uganda in 2019. The sum of 1 - 0.914, namely 0.086 represents the average distance that DMUs are lying from the best-practice frontier. For a real production function applying the input-oriented approach, the average of 0.914 would be interpreted that, on average, the DMUs economic indicators (inputs) should be reduced by 8.6 percent (1 – 0.914) to become fully efficient, i.e. laying on the best-practice frontier. However, DEA was employed in this study to firstly find the benchmark DMUs (fully efficient ones) to establish the best practice frontier. Therefore, the interpretation for this study is that the inefficient DMUs have, on average, 8.6 percent better economic indicators, but were not able to gain any benefit from them to attract foreign investment. In the same vein, for the DMU of Uganda in 2019, a virtual DMU laying on the best-practice frontier that attracts exactly the same amount of FDI and FPI should have 36.1% weaker economic indicators. To summarise, the inefficient DMUs technical efficiencies are an indication how far they are from the best practice frontier. Therefore, the inefficiency number (1 – TE) indicates the degree that input indicators are not contributing (or in other words, are wasted) to attracting FDI and FPI inflows.

Model 2: Using governance indicators as input data, the technical efficiency column shows that 15 of the 92 DMUs were fully efficient, with an average of 0.870 and the lowest estimate of 0.593 for Botswana in 2014. Within the context of this study, the interpretation, from the input-oriented view is that the inefficient DMUs have, on average, 13 percent better governance indicators, but were not able to benefit from them to attract foreign investment. Furthermore, for Botswana in 2014, a virtual DMU laying on the best-practice frontier that attracts exactly the same amount of FDI and FPI would have 40.7% weaker governance indicators.

In attaining the third objective, i.e. determining differences in TEs between economic indicators and governance indicators, further analysis was performed to determine the difference in the results of Model 1 and Model 2. A t-test (paired two sample for means) was executed to determine whether there is a significant difference between the two models' averages, 0.914 and 0.870, respectively.

Table 2: Technical efficiency (TE) of Model 1 and Model 2

No.	DMU	M1 TE	M2 TE	No.	DMU	M1 TE	M2 TE
1	Botswana 2014	0.900	0.593	49	Namibia 2017	1.000	0.684
2	Botswana 2015	1.000	0.609	50	Namibia 2018	1.000	0.653
3	Botswana 2016	0.953	0.598	51	Namibia 2019	0.998	0.661
4	Botswana 2017	0.993	0.607	52	Nigeria 2014	1.000	1.000
5	Botswana 2018	0.967	0.608	53	Nigeria 2015	0.996	1.000
6	Botswana 2019	1.000	0.618	54	Nigeria 2016	1.000	1.000
7	Eswatini 2016	1.000	0.899	55	Nigeria 2017	1.000	1.000
8	Eswatini 2017	1.000	0.895	56	Nigeria 2018	0.899	0.993
9	Eswatini 2018	1.000	0.917	57	Nigeria 2019	0.933	1.000
10	Eswatini 2019	0.995	0.915	58	Rwanda 2014	0.883	0.747
11	Ghana 2014	0.937	0.780	59	Rwanda 2015	0.845	0.744
12	Ghana 2015	1.000	0.782	60	Rwanda 2016	0.862	0.736
13	Ghana 2016	0.965	0.797	61	Rwanda 2017	0.870	0.733
14	Ghana 2017	0.797	0.801	62	Rwanda 2018	1.000	0.741
15	Ghana 2018	0.800	0.778	63	Rwanda 2019	0.717	0.742
16	Ghana 2019	0.752	1.000	64	Senegal 2014	1.000	0.929
17	Kenya 2014	0.835	0.966	65	Senegal 2015	1.000	0.949
18	Kenya 2015	0.764	0.989	66	Senegal 2016	1.000	0.931
19	Kenya 2016	0.744	0.967	67	Senegal 2017	1.000	0.923
20	Kenya 2017	0.753	0.981	68	Senegal 2018	1.000	0.914
21	Kenya 2018	0.747	0.958	69	South Africa ‘14	1.000	0.941
22	Lesotho 2014	1.000	0.756	70	South Africa ‘15	0.974	0.891
23	Lesotho 2015	1.000	0.752	71	South Africa ‘16	1.000	0.923
24	Lesotho 2016	1.000	0.749	72	South Africa ‘17	1.000	1.000
25	Lesotho 2017	1.000	0.725	73	South Africa ‘18	1.000	0.956
26	Lesotho 2018	1.000	0.790	74	South Africa ‘19	1.000	0.974
27	Lesotho 2019	1.000	0.806	75	Tanzania 2014	0.871	1.000
28	Malawi 2014	1.000	0.965	76	Tanzania 2015	0.769	1.000
29	Malawi 2015	1.000	0.962	77	Tanzania 2016	0.741	0.994
30	Malawi 2016	1.000	0.969	78	Tanzania 2017	0.754	1.000
31	Malawi 2017	0.891	0.941	79	Tanzania 2018	0.736	1.000
32	Malawi 2018	0.913	0.926	80	Tanzania 2019	0.742	1.000
33	Malawi 2019	0.883	0.933	81	Uganda 2014	0.767	0.956
34	Mauritius 2014	1.000	1.000	82	Uganda 2015	0.759	0.945
35	Mauritius 2015	1.000	0.894	83	Uganda 2016	0.677	0.962
36	Mauritius 2016	0.992	0.916	84	Uganda 2017	0.693	0.946
37	Mauritius 2017	1.000	1.000	85	Uganda 2018	0.643	0.947
38	Mauritius 2018	0.996	0.989	86	Uganda 2019	0.639	0.983
39	Mauritius 2019	1.000	1.000	87	Zambia 2014	0.958	0.790
40	Mozambique 2014	1.000	0.907	88	Zambia 2015	0.897	0.767
41	Mozambique 2015	0.844	0.927	89	Zambia 2016	0.994	0.782
42	Mozambique 2016	1.000	0.968	90	Zambia 2017	0.847	0.778
43	Mozambique 2017	0.963	0.966	91	Zambia 2018	0.816	0.787
44	Mozambique 2018	0.738	0.963	92	Zambia 2019	1.000	0.810
45	Mozambique 2019	0.722	0.961				
46	Namibia 2014	1.000	0.637		**Avg.**	0.914	0.870
47	Namibia 2015	0.928	0.656		**Min.**	0.639	0.593
48	Namibia 2016	1.000	0.669		**Max.**	1.000	1.000

Note: DMU = decision-making unit; M1 = Model 1; M2 = Model 2; TE = technical efficiency

In the process, the correlation between Model 1 and Model 2's technical efficiency scores have shown a correlation coefficient of 27.86 percent. Nevertheless, the t-test indicated (t-stat = 2.088) p = 0.0396, which implies that the difference in means is significant at 5%.

The software of Zhu (2009) also calculates a virtual vector as a benchmark for each inefficient DMU. Furthermore, it also set targets of either indicating how much each input variable should decrease and/or each output variable should increase that the inefficient DMU can move the shortest path towards the best-practice frontier. For purposes of this study, this information does not provide any practical value. An input-oriented approach was chosen to calculate the degree to which inputs can be reduced while maintaining the output. Again, this was only to indicate which DMUs lie on the best-practice frontier and also to determine the distance that non-efficient DMUs are laying from this frontier. For example, it does not make sense to recommend to a non-efficient DMU to reduce their economic growth, reduce their GDP, increase tax rates, increase corruption levels, etc.

The final objective was to determine how IFRS-adopted African countries relatively to each other benefit to attract FDI and FPI. To reach the objective, the results in Table 2 were further analysed to calculate an average technical efficiency for each country. Table 3 exhibits the results in ranking order, from the most efficient to the least efficient.

Table 3: Ranking countries on the average TE of Model 1 and Model 2

Rank	Country	n	Model 1	Country	n	Model 2
1	Lesotho	6	1.000	Tanzania	6	0.999
2	Senegal	5	1.000	Nigeria	6	0.999
3	Eswatini	4	0.999	Kenya	5	0.972
4	Mauritius	6	0.998	Mauritius	6	0.967
5	South Africa	6	0.996	Uganda	6	0.957
6	Namibia	6	0.988	Malawi	6	0.949
7	Nigeria	6	0.971	Mozambique	6	0.949
8	Botswana	6	0.969	South Africa	6	0.947
9	Malawi	6	0.948	Senegal	5	0.929
10	Zambia	6	0.918	Eswatini	4	0.906
11	Mozambique	6	0.878	Ghana	6	0.823
12	Ghana	6	0.875	Zambia	6	0.786
13	Rwanda	6	0.863	Lesotho	6	0.763
14	Tanzania	6	0.769	Rwanda	6	0.741
15	Kenya	5	0.769	Namibia	6	0.660
16	Uganda	6	0.696	Botswana	6	0.605

Note: n = number of DMUs; M1 = Model 1; M2 = Model 2

The results in Model 1 indicate countries such as Lesotho, Senegal, Eswatini, Mauritius and South Africa are IFRS adopted countries that benefiting substantially more than the others. Consequently, the study concludes that it was easier for those mentioned countries to convert relatively poor economic indicators into FDI and FPI. The remaining countries' efforts to offer a good economic environment did not obtain relatively similar yields to attract FDI and FPI.

The results in Model 2 indicate that Tanzania and Nigeria were fully efficient, implying that the remaining countries with relatively better governance indicators could not obtain relatively similar yields to attract FDI and FPI.

Notably, there are no obvious patters in the ranking results between Model 1 and Model 2. For example, the three top ranking countries in Model 1, Lesotho, Senegal and Eswatini, are all at the bottom half in Model 2. Countries such as Tanzania and Kenya, which are ranked under the top three in Model 2, are ranked third and second last in Model 1. The lesson learnt from this exercise is that there would have been too many widely diverse input variables if a single combined model was applied. That would limit the discrimination power as, for example, a good economic indicator could be nullified by a poor governance indicator.

Following authors in accounting studies such as Broardbent et al. (2001), Brignal and Modell (2000), Rollins and Bremser (1997), Fogarty (1996), Phan (2014), Aldemir and Uysal (2017) and Iredene et al. (2020), we have also used the institutional theory to conceptualise this study. Central to the theory is the concern why countries have the same degree of similarity and more specifically, institutional isomorphism is the concern why one country adopt the same features and practices of other countries which operate in the same conditions or environment. Central to the study was that there is pressure from society on countries to adopt IFRS. The common ground/similarity of the countries investigated is that they all adopted IFRS. We further argued that countries have the similarity to enlight forces such as the economic and governance yardstick driver. By doing so, the argument was that they would expect the same degree of success. However, the degree of success is diverse, between 69.6% and 100%, and 59.3% and 100%, where economic indicators and governance indicators were used as the input indicators, respectively. Furthermore, the TE estimates (on average 8.6% and 13.0%) are an indication of the degree that input variables were not fully efficient (or actually wasted) to attract foreign investment.

7. Conclusion

The purpose of the study was to determine how successful IFRS-adopted African countries relative to each other are in attracting FDI and FPI. Data envelopment analysis was supportive to reach the four objectives: 1) Develop two models using economic input indicators and governance input indicators; 2) Calculate the technical efficiency of each DMU; 3) Calculate whether there is a difference in technical efficiency when economic indicators are used as input variables versus the governance indicators; and 4) Rank the countries in order of their relative success to attract FDI and FPI.

The study found that the technical efficiencies of Model 1 and Model 2, using economic and governance indicators as input data, on average 8.6% and 13%, respectively, of the input indicators did not contribute to attracting foreign investment. Furthermore, there is a statistically significant difference in the average technical efficiencies of Model 1 and Model 2 at a 5% level. Finally, within the models, there is a wide difference between the average technical efficiencies between the different countries and there is no obvious pattern in the ranking of countries' technical efficiencies between Model 1 and Model 2.

Earlier we argued, due to institutional pressure, countries strive to obtain the same degree of success by adopting some practices. Within the conceptual frame of the institutional theory, the study concludes that with IFRS adoption as the similarity between the sample countries, they experienced different degrees of success to attracting foreign investment. The practical value hereof is that it provides valuable implications for a number of interested parties such as policymakers from Africa, policymakers from other developing countries and foreign investors. The lesson is that although there are similarities in countries structures, diverse different outcomes may occur. Furthermore, academic researchers and practitioners may use this study as a base for further research. With the aid of the DEA models, new insights were revealed that could not have been the case when regression analysis was applied. Key to be cognisent of is the understanding that IFRS adoption cannot, and does not, guarantee an equal degree of success to attract foreign investment.

A limitation of this study is that only IFRS-adopted countries were investigated and their success to attract foreign investment was only measured relative to each other. Therefore, no comparison could be made between IFRS adopted and non-adopted countries. Although DEA is a non-parametric method, the scale efficiencies of countries were not determined. That would require that both the VRS and CRS approaches of DEA are applied. Future research may address these limitations.

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STUDIA UNIVERSITATIS BABEȘ-BOLYAI OECONOMICA
VOLUME 67, ISSUE 1, 2022, pp. 63-76
DOI: 10.2478/subboec-2022-0005

HUMAN CAPITAL DEVELOPMENT AND SUSTAINABLE DEVELOPMENT: EVIDENCE FROM NIGERIA

Johnson Kolawole OLOWOOKERE
Osun State University, Nigeria

Wahid Damilola OLANIPEKUN
American International University West Africa, Gambia

Gbenro Matthew SOKUNBI
Michael Otedaola College of Primary Education, Nigeria

Timothy Ayomitunde ADEREMI*
Bells University of Technology, Nigeria

Abstract: The contributions of human capital development in achieving the sustainable development cannot be overemphasized in any economy, this is because investment in education and health has been argued as the strategic impetus for improving the quality of human resources. Against this backdrop, this study investigates the impact of human capital development on the sustainable development goal one (1) – poverty reduction. The study utilizes the Nigerian data combining Johansen Cointegration test, Granger causality test and Fully Modified Least Squares to establish how public investments in both education and health affect poverty reduction in the country between 1981 and 2019. Originating from the findings of this study, both government expenditure on health and capital formation Granger caused poverty reduction in Nigeria. This is a vital signal that human capital development in the form of investment in health of human resources is an important condition for the achievement of the sustainable development goal one (1) – poverty eradication in Nigeria. Similarly, all the selected components of human capital development have positive contributions to poverty reduction in Nigeria. However, the contributions of health expenditures and capital formation are statistically significant. This implies that health expenditures and capital formation have a trickle-down effect on poverty reduction in Nigeria. Therefore, this study recommends the following: any time the Nigerian policymakers want to achieve the sustainable development goal one (1) – poverty reduction, the Nigerian budgetary allocations to

* Corresponding author. Address: Department of Economics, Accounting and Finance, Bells University of Technology, Nigeria. E-mail: taaderemi@bellsuniversity.edu.ng

education and health sectors should be in tandem with the global benchmark; this would ensure material and human resources that could drive the country towards the sustainable development. The enhancement of educational and health facilities by the policymakers would also bring about improvement in the living standard of the Nigerians.

JEL Classifications: F63, I32, O15, C32
Keywords: Human Capital Development, Poverty Reduction, SDGs, FMOLS, Nigeria

1. Introduction

According to World Bank (2015), poverty is a multidimensional concept which is majorly involved the deprivation of well-being as a result of low incomes and the lack of capacity to possess the essential goods and services that guarantee survival and dignity. One of the ravaging monsters in developing economies of the world, especially Africa, is extreme poverty. Combating this monster has been a global concern in the past three decades. One of the drastic attempts to enhance human welfare through reduction of extreme poverty globally led to the institutionalization of the Millennium Development Goals (MDGs) in 1990 by the United Nations with a view to eradicating global poverty by 50% at the end of 2015. Meanwhile, the post assessment of MDGs indicated that between 1990 and 2010, global poverty has been reduced significantly. Most of the nations that harbor huge number of poor people such as China and India recorded a significant improvement in raising the level of human wellbeing. Paradoxically, the situation report of some developing countries, especially, Sub-Saharan Africa showed that poverty is still rising in these countries. This accounted for further commitment of the United Nations to see fight against poverty in developing countries as a continuous exercise through the introduction of the Sustainable Development Goals (SDGs).

However, achieving poverty reduction in Nigeria by 2030, which is the first goal of SDGs Nigeria cannot be overemphasized because poverty is a critical issue in the country. For instance, the number of Nigerians living below poverty line has been expanding rapidly beyond what the GDP growth rate of 8% and 10% could sustain (World Bank, 2013). This assertion was further justified when Nigeria was tagged as the world's headquarters of poverty in the recent time (World Poverty Clock, 2018). In the same vein, poverty is a current burning issue in the country (Aderemi *et al.*, 2020:1; Adebayo, 2018; Aye, 2013).

Consequently, Nigeria is blessed with huge resource endowments in terms of natural minerals and human population which is a paramount factor in driving development yet Nigeria is still the headquarters of poverty globally. Whereas, countries like Japan and Israel with little or no natural resources have subdued their developmental issues such as poverty and inequality through technological development. Therefore, human capital is the foundation for economic growth and development (Romer, 1986; Lucas, 1988; Barro and Sala-i-Martin, 1995). In some recent studies, it has been argued that natural resources contributed less to poverty reduction across the globe (Asaleye *et al.*, 2018; Apergis and Katsaiti, 2018; Goderis

and Malone, 2011). Similarly, in the theoretical literature, there have been several strong arguments in support of human capital as an indispensable variable in enhancing evenly distribution of income, promoting economic prosperity and reduction of unemployment (Fisher, 1946; Schultz, 1962; Becker, 1975; Roemer, 1998; World Bank, 2005; Santos, 2009; Teixeira, 2014; Silva and Sumarto, 2014). Empirical evidence from countries with inadequate resource endowments such as Japan, South Korea, Hong Kong and Taiwan has further proved that human capital led to sustainable economic growth (Becker, 1995).

In view of the above, investment in human capital otherwise known as human capital development becomes highly imperative in driving an inclusive growth in a country like Nigeria. The basic component of human capital development is investment in education and health, which increases the productive capacities of human resources. Although, human capital development has been reported to have a direct link with the creation of equal opportunity for all and sundry in the economy (Larionova and Varlamova, 2015; Ridell and Song, 2011).

Globally, studies regarding human capital development and poverty nexus in developing economies are occupying the frontline of the literature. For instance, recent studies such as Adekoya (2018), Attanasio *et al*. (2017), Olopade *et al.* (2019), Bhukuth, Roumane and Terrany (2018), Shahpari and Davoudi (2014) have provided mixed results in developing economies. In the same vein, further studies focusing on the Nigerian economy like Ogwumike and Ozughalu (2018), Babasanya, Oseni and Awode (2018), Chikelu (2016), Adekoya (2018) have equally showed variations in results. The measurement of poverty in the past studies has been observed as a principal factor responsible for the inconclusive nature of the literature. Therefore, there is an urgent need to resolve the current conflicting results of human capital development and poverty nexus in a country like Nigeria, where there viable policy is critically urgent to address poverty menace in the country. Against this backdrop, this current study has been put in place to examine the contribution of human capital development in achieving the Sustainable Development Goal one (1) - poverty reduction in Nigeria. The uniqueness of this study lies in the adoption of GDP per capita as a poverty measurement in which majority of past studies in Nigeria have ignored in the most recent time.

2. Literature Review

There is a list of research works regarding the nexus between human capital development and poverty reduction across the globe. This signifies that the studies regarding this subject matter are ongoing. Few among the recent studies are enunciated as follows; Babasanya, Oseni and Awode (2018) employed a technique of error correction model technique to estimate the relationship between human capital development and alleviation of poverty in Nigeria between 1990 and 2017. The authors argued that government educational spending and unemployment rate led to the acute level of poverty in the country. Meanwhile, government's health expenditure resulted in an inverse but insignificant impact on the poverty prevalence in the country. In other study, Mathew *et al*. (2018) employed a fully modified ordinary least squares in examining the nexus between investment in humans, electricity

power and growth of the economy from ‘1981 to 2016 in Nigeria. The findings from the study revealed that the relationship between human capital development and growth of the Nigerian economy is insignificant.

Meanwhile, Olopade *et al.* (2019) directed their study towards investigating the link between human capital and poverty in twelve (12) OPEC member countries with the application of a panel fully modified least-square. The authors submitted that the principal components of human capital had s direct impact on poverty reduction in those countries. In the work of Afolayan *et al*. (2019), VECM modelling was utilized to appraise how consumption of electricity and human capital could serve as an agent of unemployment reduction in Nigeria.The authors asserted electricity consumption had a negative relationship with unemployment. Whereas, government spending on education had an inverse relationship with unemployment rate in the country. Chikelu (2016) explored the techniques of Johansen Co-integration and OLS to examine the relationship between human capital development and poverty reduction between 1986 and 2012 in Nigeria. It was discovered from the study that a positive relationship existed between human capital development and poverty reduction in the country.

However, Attanasio *et al.* (2017) data from Ethiopia and Peru to assess how human capital growth in terms of production function between age of 1 and 15 influence poverty. It was discovered from the study that the parents who possessed higher level of income invested more especially at tender ages when the investment have the capacities to bring greatest results. Fosu (2017) researched developing economies by using data of regional trends in GDP growth and reduction in poverty from 1981 to 1995 and 1996 to 2005. It was discovered from the study that growth of income in large number of these countries were responsible for poverty reduction in many parts of the universe. Aderemi *et al*. (2020:2) explored a technique of panel analysis to investigate how inflows of FDI reduced poverty in sixteen (16) ECOWAS countries from 1990 to 2017. The authors asserted that the contribution of FDI to poverty alleviation was significant in the ECOWAS sub region

Consequently, Adekoya (2018) applied a VECM and Granger causality test to investigate the role of human capital development in alleviating poverty in Nigeria between 1995 and 2017. The finding from the study showed there was no existence of causality between educational spending, health spending, infant mortality, poverty indicator and gross enrolment ratio. However, there was a bidirectional feedback between life expectancy, poverty indicator and life expectancy.

In another related study in 35 emerging and developed economies, Zhang (2015) explored a panel analysis in a comparative study that involves how human capital and ICT contributed to producer services advancement in those countries. The study provided an evidence to support the argument that the developmental level of each of the country is the determinant of the joint influence of human capital and ICT. It was discovered that in advanced countries, a significant joint influence was the case, meanwhile, otherwise was the case of emerging countries. In other words, joint influence of human capita and ICT led to producer services in developed countries but the situation of developing country is different. In another perspective, Simplice and Sarale (2017) researched about ICT could build inclusive human development in forty nine (49) countries in Sub-Saharan Africa between 2000 and 2012. The authors applied Tobit regressions to analysis the various relevant

variables of interest with the following conclusions; the strategies designed to provide an improvement in the level of information and communication technology infiltration had the capacity to cause an elevation to inclusive human development in order to achieve the SDGs.

Conclusively, steaming from the above reviewed empirical studies, opinions of scholars have been varied over time regarding the subject matter of this study. This implied that literature is still ongoing and hence, the relevance of this study.

3. Methodology

In providing an empirical evidence to support the impact of human capital development on poverty reduction Nigeria, which is the Sustainable Development Goal one (1) to be achieved comes 2030, this study employs time series data which were sourced from secondary sources. It should be stressed that an ex-post facto research design was adopted in this study due to the fact the main interest of the study is uncover the way in which the explanatory variable predicts variation in the dependent variable from 1981 to 2019. Explicitly, GDP per capita was used to measure poverty index, and the data were equally sourced from the World Bank Development Indicators (WDI) for Nigeria. In the same vein, human capital development was measured by government capital and recurrent expenditures on educational and health sectors in Nigeria, and the data were equally extracted the Central Bank of Nigeria statistical bulletin.

3.1 Theoretical Framework

The theoretical foundation of this study is hinged on the endogenous growth theory propounded by Romer in 1986. The development of this theory could be traceable to the shortcomings identified in the popular neoclassical (exogenous) growth model of Solow. The endogenous growth model basically argued that human capital constitutes a strategic input in the production function. As such, endogenizing technical progress is an impetus for the sustainable growth. However, the recent version of the model emphases that innovation which is an offshoot of investment in human capital and technical improvement are the drivers of economic growth (Ncube, 1999; Mankiw *et al*., 1992; Lucas, 1988). Consequently, the principal assumptions of the theory are firstly attributable to increasing returns to scale orchestrated by positive externalities. In the same vein, human capital such as knowledge, training and skill associated with individuals alongside technical progress are strategic motivators of economic growth in the long run. it is important to stress that the development of research and innovation gives birth to progressive technologies. And some of non-rival good is knowledge or technical advances.

3.2 Empirical Model

In building an empirical model to estimate the relationship between human capital development and the sustainable development goal - poverty reduction in this work, an insight was drawn from studies such as Aderemi *et al*. (2021), Aderemi

et al. (2020:2), Ogunleye *et al*. (2020), Olayemi *et al*. (2019), and Babasanya, Oseni and Awode (2018) by adapting their model through elimination of some irrelevant variables that have nothing to do with this study focus.

Thus the model is stated as follows;

PRD = F (HCD) (1)

PRD = F (EDE, HEE, GCF, INFL) (2)

If model two is log linearized, it gave birth to model (3) expressed as below:

$$PRD_t = \beta_0 + \beta_1 Log\ EDE_t + \beta_2 LogHEE_t + \beta_3 \text{Log}GCF_t + \mu t \quad (3)$$

Succinctly put, PRD is used to denote poverty reduction, and is measured by GDP per capita. EDE is used to proxy real government expenditure on educational sector. HEE is used to capture real government expenditure on health sector. GCF is the real gross fixed capital formation, and u is error term, this represents any other variables that could not be captured in the model. t ranges from 1981 to 2019. It is expected that the apriori expectation of the model follows this pattern; $\boldsymbol{\beta_1, \beta_2, \beta_3 > 0}$.

4. Result and Discussion

Table 1: Descriptive Statistics of Variables

Descriptive Statistics	PRD	Log EDE	Log HEE	Log GCF
Mean	1291.000	21.19923	22.71973	24.40135
Median	892.5000	21.14703	23.49048	24.39304
Maximum	3223.000	27.53341	26.99236	25.71382
Minimum	270.0000	19.19056	17.50439	23.23637
Std. Deviation	890.5159	1.449555	2.988246	0.621434
Skewness	0.610332	0.089436	0.299636	0.067511
Kurtosis	1.977697	10.57645	1.664366	2.028116
Jargue-Bera	4.013948	1.18.5373	3.393156	1.524416
Probability	0.134395	0.000000	0.183310	0.466635
Sum	49058.00	805.5709	863.3499	927.2514
Sum. Sq. Deviation	29341690	77.74480	330.3956	14.28867
Observation	38	38	38	38

Source: Authors' Computation (2021)

The analysis of this study started with the presentation of summary of the descriptive statistics of the employed variables of interest which are as follows; government expenditures on health and educational sectors, gross fixed capital formation, all in log form and GDP per capita. The descriptive features of data such

as mean, median, maximum, minimum, standard deviation, skewness and kurtosis with respect to each of the variables are important in a study that utilizes econometrics as technique of estimation because econometric analysis becomes ‘‘BLUE’’ when the data set fulfils the assumption of the normal distribution. Therefore, it could be drawn from table 1 that PRD which is used to measure poverty reduction in Nigeria from 1981 to 2019 has a mean value of $129, the value of maximum and minimum sides of the variable show that the GDP per capita rose as high as $3223 and fell as low as $270 in Nigeria in the last 38 years respectively. It could be stressed that the mean value of this variable is greater than that of its standard deviation. This shows that GDP per capita data dispersed moderately from its mean area. The skewness of the variable is equally positive with Kurtosis value that is not too far from 3. This is an indication that the GDP per capita data show some degree of agreement with the symmetrical distribution assumption.

Similarly, Log EDE which is government educational spending in log form between 1981 and 2019 has mean value of $21 million. The maximum and minimum values show that the government spending on education rose as high as $27 million and fell as low as $19 million in Nigeria in the last 38 years simultaneously. It was observed that the mean value of this variable is greater that the value of its standard deviation. This implies that the dispersion of the data from its mean point is moderate. Though the variable is positively skewed, its kurtosis value is bigger than 3, which connotes that the variable does not show agreement with the assumption of symmetry in data distribution. The skewness of the variable is equally positive with Kurtosis value that is not too far from 3. This is an indication that the GDP per capita data show some degree of agreement with the symmetrical distribution assumption

Consequently, Log HEE which represents government expenditures on health in log form from 1981 to 2019 has a mean value of $22 million. Its maximum and minimum values show that the government spending on health rose as high as $26.9 million and fell as low as $17.5 million in Nigeria in the last 38 years simultaneously. The variable has standard deviation which its value is less than that of the mean value. Therefore, the variable is moderately dispersed from its mean value.

In the same vein, Log GCF real gross fixed capital formation in log form has a mean value of $24.4 billion. The maximum and minimum values show that the GCF rose as high as $25.7 billion and fell as low as $23.4 billion in Nigeria in the last 38 years respectively. The variable has a mean value that is greater than its standard deviation. This shows that Log GCF data dispersed moderately from its mean area. The skewness of the variable is equally positive with Kurtosis value that is not too far from 3. This is an indication that the real gross fixed capital formation data show some degree of agreement with the symmetrical distribution assumption.

One of the basic requirements that could not be undermined when employing time series data for empirical analysis is the testing of unit root. This is usually done with a view to determining the stationarity status of such data, because the adverse effect of using non-stationary data in a study that involves econometric technique is emergence of spurious results. Against this backdrop, this study utilized the popular Phillips and Peron (1981) and the Augmented Dickey-Fuller (ADF) by Dickey and Fuller(1988) unit root tests to investigate whether Log EDE, Log HEE, Log GCF and PRD are stationary or not. It is instructive to state that, in table 2, the estimated results show that all the variables of importance in this work are not

stationary in their original form. Hence, the tendency of arriving at spurious empirical results has been eliminated with the use of these series. Therefore, the Cointegration test is imperative to the achievement of this objective.

Table 2: Unit Root Test

Variables	**ADF Test**				
	Level	**Probability**	**1st Diff**	**Probability**	**Remark**
PRD	-2.943427	0.7104	-2.943427	0.0078	I(1)
Log HEE	-2.951125	0.5781	-2.943427	0.0000	I(1)
Log EDE	-2.941145	0.9410	-2.943427	0.0000	I(1)
Log GCF	-2.943427	0.3087	-2.945842	0.0146	I(1)
Variables	**PP Test**				
	Level	**Probability**	**1st Diff**	**Probability**	**I(1)**
PRD	-2.941145	0.6735	-2.943427	0.6735	I(1)
Log HEE	-2.941145	0.7776	-2.943427	0.0001	I(1)
Log EDE	-2.941145	0.9410	-2.943427	0.0000	I(1)
Log GCF	-2.943427	0.2601	-2.945842	0.0216	I(1)

Source: Authors' Computation (2021)

Table 3: Johansen Cointegration Test (Trace Statistic)

Hypothesized Number of CEs	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob****
None*	0.653272	56.30513	47.85613	0.0066
At most 1*	0.307785	18.17345	29.79707	0.5533
At most 2*	0.127738	4.930539	15.49471	0.8162
At most 3*	0.000294	0.010577	3.841466	0.9178

Table 4: Johansen Cointegration Test (Maximum Eigen Statistic)

Hypothesized Number of CEs	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob****
None*	0.653272	38.13168	27.58434	0.0015
At most 1*	0.307785	13.24291	21.13162	0.4301
At most 2*	0.127738	4.919962	14.26460	0.7519
At most 3*	0.000294	0.010577	3.841466	0.9178

Notes: *denotes rejection of the null hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Non stationarity status of series could cause a short run disequilibrium among the dependent and explanatory variables. However, there is a possibility for this disequilibrium to disappear in the long run if the variables possess a long run convergence. In view of the above, the authors employed Johansen Cointegration test advanced by Johansen (1991) to verify if the explanatory and explained variables have a long run convergence. The estimated results presented in both tables 3 and 4 indicate that both the Trace statistic and the Maximum Eigen Statistic confirmed the presence of 3 cointegrating equations which exist among the relevant variables. Therefore, this corroborates that there is a long run relationship relationship between poverty reduction, human capital development and capital formation in Nigeria.

Table 5: Pairwise Granger Causality Test between Poverty Reduction and Human Capital Development

Null hypothesis	F-statistic	Prob.	Decision	Causality
Log HEE does not Granger Cause Log EDE	3.13458	0.0571	Reject	Unidirectional
Log EDE does not Granger Cause Log HEE	0.95217	0.3966	Accept	
Log GCF does not Granger Cause Log EDE	0.05761	0.9441	Accept	None
Log EDE does not Granger Cause Log GCF	1.23169	0.3057	Accept	
PRD does not Granger Cause Log EDE	0.63891	0.5345	Accept	None
Log EDE does not Granger Cause PRD	0.53212	0.5925	Accept	
Log GCF does not Granger Cause Log HEE	1.12215	0.3384	Accept	None
Log HEE does not Granger Cause Log GCF	14.9006	3.E-05	Accept	
PRD does not Granger Cause Log HEE	0.50932	0.6057	Accept	
Log HEE does not Granger Cause PRD	4.86752	0.0143	Reject	Unidirectional
Log GCF does not Granger Cause PRD	2.71048	0.0423	Reject	Unidirectional
PRD does not Granger Cause Log GCF	0.55109	0.5819	Accept	

Source: Authors' Computation (2021)

Having established the cointegrating relationship among the variables, the authors made further efforts to investigate the existence or otherwise of causal relationship between the various relevant variables. Meanwhile, the estimated results of the Granger Causality test were presented in table 5. From the table, it could be deduced that a unidirectional causality exists in only three (3) pairs among all the considered pairs. In an explicit form, there is a unidirectional causal relationship

flowing from government expenditures on health to government expenditures on education. Similarly, one way feedback flows from government expenditure on health and poverty reduction. Also, real gross fixed capital formation Granger causes poverty reduction.

In conclusion, since both government expenditure on health and capital formation Granger caused poverty reduction in Nigeria, this is a vital signal that human capital development in the form of investment in health of human resources is an important condition for the achievement of the sustainable development goal one (1) – poverty eradication in Nigeria.

Table 6: Relationship between Human Capital Development and Poverty Reduction

Dependent Variable: PRD
Method: FMOLS

Regressors	Coefficient	T-statistics	Prob. Value
Log HEE	1.347364***	3.754450	0.0007
Log EDE	0.103210	0.103636	0.9181
Log GCF	10.26082***	4.016203	0.0003
R-Squared	0.848403		

Source: Authors' Computation (2021)

***Significant at1%; **significant at 5%; *Significant at 10%

Table 6 reported the estimates of the long run relationship between human capital development and poverty reduction using the Fully Modified Ordinary Least Square technique. Firstly, the result of the R-Squared is 0.85, this implies that human capital variables and other selected macroeconomic variable jointly explained about 85% of the systematic variations in poverty reduction. This justifies the fact that the model employed to run this analysis is relatively good.

Furthermore, government expenditures on health have a direct link with GDP per capita in Nigeria. A unit change in government health expenditures leads to a rise in GDP per capita by 1.3% in the country. This implies that government health expenditures, as a component of human capital development caused a significant poverty reduction in the country. In the same vein, government educational expenditures have a positive relationship with GDP per capita, though the relationship is not significant at 10% level of significance. The reason for this insignificant result might be traced to the past educational budgets in Nigeria that are far below 26 per cent global benchmark. This accounts for non-trickle-down effect of educational expenditure on poverty reduction in the country. Meanwhile, real gross fixed capital formation and GDP per capita have a positive and significant relationship. A unit change in capital formation brings about 10% increment in GDP per capita in Nigeria. The implication of this is that capital formation has a significant impact on poverty reduction in the country. By and large, it is instructive to state that all the selected components of human capital development caused poverty reduction in this study. However, the majority of the components are statistically significant.

Hence, this study submits that human capital development led to poverty reduction in Nigeria. This conclusion further reinforced the earlier discoveries of the long run equilibrium relationship and unidirectional causality between human capital development and poverty reduction in this study. The finding in this study is in tandem with conclusions of Chikelu (2016) and Olopade *et al.* (2019) in related studies in Nigeria and twelve (12) OPEC countries respectively. Conversely, the finding contradicts the arguments of Babasanya, Oseni and Awode (2018) and Adekoya (2018) in similar studies in Nigeria.

5. Conclusion

The contributions of human capital development in achieving sustainable development cannot be overemphasized in any economy, this is because investment in education and health has been submitted as the strategic impetus for improving the quality of any country's human resources. Against this backdrop efforts have been made to investigate the impact of human capital development on the sustainable development goal one (1) – poverty reduction. The study utilizes the Nigerian data combining Johansen Cointegration test, Granger causality test and Fully Modified Least Squares to establish how public investment in both education and health affect poverty reduction in the country between 1981 and 2019. It was discovered that the unit root test results from ADF and PP indicates that all the variables are not stationary in their natural form but after first differencing, which means there are integrated of order one. It was also reported that all the variables possess a long-run relationship. Meanwhile, the estimated results of the Granger Causality test confirms that a unidirectional causality exists in only three (3) pairs among all the considered pairs as follows; there is a unidirectional causal relationship flowing from government expenditures on health to government expenditures on education. One way feedback flows from government expenditure on health and poverty reduction. Also, real gross fixed capital formation Granger causes poverty reduction.

Moreover, both government expenditures on health and real gross fixed capital formation have a significant positive relationship with GDP per capita in Nigeria. Whereas, government educational expenditures have a positive but insignificant on GDP per capita in the country

Originating from the findings of this study, it is expedient to know that both government expenditure on health and capital formation Granger caused poverty reduction in Nigeria, this is a vital signal that human capital development in the form of investment in health of human resources is an important condition for the achievement of the sustainable development goal one (1) – poverty eradication in Nigeria. In the same vein, all the selected components of human capital development have positive contributions to poverty reduction in this study. However, the contributions of health expenditures and capital formation are statistically significant. This implies health expenditures and capital formation have a trickle-down effect on poverty reduction in Nigeria. Therefore, this study recommends the following: any time the Nigerian policymakers want to achieve the sustainable development goal one (1) – poverty reduction, the Nigerian budgetary allocations to education and health sectors should be in tandem with the global benchmark this would ensure

material and human resources that drive the country towards sustainable the development. The enhancement of educational and health facilities by the policymakers would also bring about improvement in the living standard of the Nigerians. It is instructive to state that the limitation of this paper lies in the fact it only examined first goal of the sustainable development. Therefore, future researches could explore the contribution of human capital development to other remaining goals.

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