Economic Growth Benefits more from Population Health than Foreign Direct Investment: Evidence from Tanzania

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Abstract
This paper uses annual secondary data for the period 1990-2019 to establish and compare the contributions of population life expectancy and foreign direct investment (FDI) on economic growth, controlled for inflation and exports of goods and services in Tanzania. It applies autoregressive distributed lag (ARDL) model as an estimation technique. The findings show that, FDI and export of goods and services have no significant impact on economic growth in the short run. Only life expectancy shows a positive and significant effect on economic growth in the short run. The long run findings show that FDI inflows have no significant impact on economic growth. However, population life expectancy and exports of goods and services all show positive and significant impact on economic growth in the long run. The magnitude of population life expectancy on economic growth is greater than that of FDI inflows or exports, meaning that economic growth benefits more from population health. We suggest the government to implement policies that improve population health such as expanding access to priority public health interventions (i.e. increase health facilities, better nutrition, medical care and other universal health coverage) to boost longevity, and with it, the economy. Overall, we conclude that investments in health should be prioritized because high levels of population health are associated with high levels of economic growth (i.e. income).

Keywords: FDI; Population Health; Economic Growth; ARDL

JEL Classification Codes: F63, I15, C32

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1. Introduction

Human capital (e.g., health, education) and foreign direct investment inflows are crucial factors for sustainable economic growth (See, Kinyondo and Byaro, 2020; Qadri and Waheed, 2014; Hermes and Lensink, 2003; Belloumi, 2014; Ogundari and Awokuse, 2018). Economic growth is one of the prerequisites for economic development, but it is insufficient on its own. The primary role of economic development is to improve the value of human life and increase people's long life through better nutrition, sanitation and advance in medical technologies (Byaro *et al.*, 2017; Akram *et al.*, 2008; Filmer *et al.*, 1999). In turn, these improvements feed economic growth.

Healthier individuals can acquire education and potentially longer life expectancies, increasing labour output and investment accrual (Bloom *et al.*, 2004). Better health also reduces number of days lost to sickness, increases wages and contributes optimistically to economic growth (Ogundari and Awokuse, 2018; Sharma, 2018; Qadri and Waheed, 2014 Narayan *et al.*, 2010; Bloom *et al*., 2004; Mayer, 2001; Arora, 2001; Bhargava *et al.*, 2001; Sachs & Warner, 1997). Conversely, deprived health may lead to low wages, low productivity and absence from work.

Economic growth and population life expectancy do not, however, form a straightforward virtuous circle. Economic growth can also be detrimental to health (Spiteri and Von Brockdorff, 2019). For instance, an increase in income can be linked to increased stress and to lifestyle changes that lead to cardiovascular disease. Booming economies also create refugees, some of whom may bring new infectious diseases. Furthermore, increased income can lead to hurtful behaviors and spending patterns such as tobacco and alcohol use (Weil, 2014). Further, as the society/nation becomes richer, the impact of economic growth on population health becomes weaker giving diminishing returns (Cole, 2019). This suggests, as Preston (1975) argued that in poor nations raises in state income generate dramatic gains in population life expectancy, with higher diminishing returns as countries become wealthier.

Poor countries, given their lower savings rate and earnings levels, tend to see attracting FDI as more important (Alsan *et al.*, 2006). In both poor and rich countries, FDI inflows increase export capability, generate new jobs, reinforce technology transfer, increase tax revenue and boost overall economic growth (Latif *et al.*, 2018; Nguyen, 2017; Lamsiraroj, 2016; Tiwari and Mutascu, 2011). However, empirical studies examining the overall effect of FDI inflows on economic growth are uncertain. For instance, the key role of FDI on economic growth appear to be positive and country based (Latif *et al.*, 2018; Nguyen, 2017; Lamsiraroj, 2016; Oladipo, 2012), negative (Jilenga *et al.*, 2016; Belloumi, 2014), or insignificant (De Mello, 1999; Nath, 2009) depending on the financial, institutional arrangement and technological progress in the given country (Li and Liu, 2005).

It is believed that FDI inflows in poor countries generally are directed in the health care sector (Outreville, 2007). Thus, in developing countries, overall FDI could have a positive impact on population life expectancy (Burns *et al.*, 2017). This view suggests a bidirectional relationship between FDI inflows and health (Burns et al., 2016). Indeed, when attracting foreign direct investment, a healthy workforce is important (CMH, 2001): raising population life expectancy by one year led to FDI inflows about 9% (Alsan *et al.*, 2006). Disentangling these relationships to locate causal channels among FDI inflows, population health and economic growth is thus extremely difficult. It is made more difficult by previous studies (e.g., Alsan *et al.*, 2006) that jointly

investigated population health, FDI and economic growth using regression analysis but didn't consider the effect of bias known as "endogeneity" or "reverse causality".

This study contributes to the existing literature through investigating the growth impact of FDI inflows and population life expectancy, so as to provide a clearer picture of key strategy used to boost economic growth in Tanzania. It seeks to understand the relationship that population health and FDI inflows have with economic growth, so as to help in the design of adequate economic growth promoting policies. The study also applies an Autoregressive Distributed Lag (ARDL) technique which has got several advantages. It can be used irrespective of whether the underlying regressors are stationary at first difference I(1) or stationary at levels I(0). Further, it estimates both short and long run coefficients of variables concurrently with lagged regressors and covariates (Byaro *et al.*, 2022b; Nkoro and Uko, 2016). It also addresses endogeneity issues in estimation procedures (See, Byaro *et al.*, 2022b; Pesaran and Shin, 1999; Nkoro and Uko, 2016; Byaro and Lemnge, 2018b). This endogeneity could occur as a result of economic growth leading to FDI and then to life expectancy or vice versa (See, Lamsiraroj, 2016). Endogeneity is unlikely to develop using ARDL method because regressors are frequently lagged levels or lagged differences, while keeping the errors serially uncorrelated (See Eqs. 4).

In this context, our study fills a gap in the literature by using the extra structural break unit root test, in which most previous time series studies on FDI inflows, life expectancy nexus growth (See, Odhiambo, 2021; Sunde, 2017; Lema and Dimoso, 2011; Akram *et al.*, 2008; Alexiou and Tsaliki, 2007) failed to address. Previous time series study relied on the Augmented Dickey Fuller (ADF) and Dickey Fuller (DF-GLS) unit root tests, which ignore the possibility of structural breaks. Furthermore, there are very few African country-specific and Tanzanian-specific studies (See, Odhiambo, 2021; Shawa and Shen, 2013; Lema and Dimoso, 2011).

The novel contribution from this study is that, surprisingly, economic growth benefits more from population health than from FDI inflows and increased export of goods and services. This means, the impact of population life expectancy on economic growth over time is greater than the effect of FDI inflows and exports of goods and services. Preliminary findings indicate that population life expectancy has a positive and statistically significant effect on economic growth in Tanzania. FDI inflows have an insignificant impact on economic growth in the short and long run.

The remainder of this study is organized as follows. Section 2 examines the literature review linking economic growth, human capital and foreign direct investment (FDI). The methodology is presented in Section 3, and the empirical results and discussion are reported in Section 4. Section 5 concludes.

2. Literature review

The Gross Domestic Product (GDP) is a key factor of economic growth. In the neo-classical growth theory proposed by Solow (1956), Harrod (1939), Domar (1946), economic growth is seen as driven in part by FDI which increases physical investments and requires capital investments. In the Solow (1956) growth or exogenous model, per capita gross domestic product (GDP) is a utility of capital accumulation, labor or population growth, and increases in productivity that are largely driven by technological progress to explain long-run economic growth. This was further extended in Mankiw et al. (1992) to account for health and education accumulation to assume growth is a key function of human capital (health and education), technology, labour and physical capital. In this way, education and health enters into the growth framework becoming recognized as one of the most essential contributors to economic growth (Mankiw *et al.*, 1992).

Both Neoclassical and endogenous growth models have been applied in many empirical studies to prove the importance of FDI and human capital (education and health). FDI inflows have been shown to directly impact growth by capital accumulation, the inclusion of new inputs and foreign technologies in the production function (Almfraji and Almsafir, 2014). The effect of FDI inflows on economic growth preserve to be positive (e.g. Lamsiraroj, 2016; Oladipo 2012; Tiwari and Mutascu, 2011) as the previously mentioned theories stipulate and it is common for FDI initiatives to fail to promote economic growth (See, Nguyen, 2017; Jilenga *et al.*, 2016; Dritsakia and Stiakakis, 2014; Belloumi, 2014; Hermes and Lensink, 2003; Nath, 2009).

As Tables 2(a) and 2(b) show, the observed empirical literature on the impact of FDI inflows and economic growth reveal mixed results. These differences might be accredited to regional and country specific variation in that capital flows and their agents are not uniform (Kose *et al.*, 2009). Recently, the contribution of economic growth made by health and healthcare investments (See Table 2(b)) has also received attention (See; Sharma, 2018; Silva *et al.*, 2018 and Boachie, 2017).

Table 2(a): Review of the effect of FDI on Economic Growth

Author/s and Year	Methodology	Main findings
Odhiambo (2021)	Autoregressive Distributed Lag (ARDL) using secondary data of Kenya from 1980-2018	Unidirectional flows from Economic growth to FDI. FDI is driven by strong economic growth in Kenya
Nguyen (2017)	Autoregressive Distributed Lag (ARDL) using secondary data of Vietnam for period 1985-2015	Foreign Direct Investment (FDI) has significant effect on Vietnam Economic Growth while Export has negative effect. Both FDI and export do not lead to Economic Growth
Lamsiraroj (2016)	Two stage least square approach of 124 cross-country data over the period 1971-2010	The effects of FDI are positively associated with GDP growth. Trade openness is key determinants of FDI.
Dritsakia & Stiakakis (2014)	Autoregressive distributed lag (ARDL) using secondary data of Croatia from 1994 -2012	Long run cointegration exists among export, FDI and GDP growth. Export has positive effect to GDP growth of Croatia. FDI does not generate GDP growth of Croatia.
Belloumi (2014)	Autoregressive distributed lag (ARDL) using secondary data of Tunisia for the period 1970-2008.	No cointegration exists among FDI, trade openness and GDP growth when economic growth. FDI fails to create positive productivity for the host country.
Jilenga et al. (2016)	Secondary data collected over time (1971-2011).The ARDL model	FDI reveals a negative effect on GDP growth in Tanzania. Meanwhile, no causality exists between FDI and GDP growth.
Umoh et al. (2012)	Secondary data of Nigeria over 1970-2008 using econometric techniques.	There is a bidirectional feedback from FDI to GDP growth in Nigeria
Tiwari and Mutascu (2011)	Longitudinal analysis in Asian Countries using data from 1986 to 2008	Both FDI (foreign direct investment) and exports enhance economic growth
Shaikh (2010)	Secondary data ordinary least regression (OLS) of Malaysia from 1970-2005	There is a significant association between Foreign Direct Investment Inflows (FDI) and economic growth in Malaysia.

Oladipo (2012)	16 developing countries in Latin America and Caribbean Countries using Granger causality	FDI has a positive impact on economic growth
Hermes and Lensink (2003)	Panel method covered 67 developing countries over the period 1970-1995	Countries with developed financial market like Asia and Latin America, FDI contributes positive to GDP growth. Sub-Sa haran Africa have weak financial system, FDI does not add anything to GDP growth.
Shawa &Shen (2013)	Time series data in Tanzania from 1980-2012 using Granger causality and Johansen test	FDI has no impact on GDP growth in Tanzania.
Author/s and Year	**Methodology**	**Main findings**
Nath (2009)	Fixed effect method in transition economies of Central and Eastern Europe from 1991 to 2005	Results showed positive impact of trade on GDP growth. FDI had no impact on GDP growth
Kersan & Zubin (2009)	Time series analysis using VAR model and VECM model in Croatia	FDI do not have impact on economic growth and export
Sarkar (2007)	Autoregressive distributed lag using 51 smaller developed countries from 1970-2002	The findings showed no long term association between FDI and GDP growth
Alexiou and Tsaliki (2007)	Granger causality for Greece from the year 1945 to 2003.	No proof suggested the causality between FDI and GDP growth.
De Mello (1999)	Stationary tests using 32 rich and poor countries from 1970-1990	Weak evidence for FDI effects on GDP Growth

Table 2(b): Review of the Effect of Population Health on GDP Growth

Author/s and Year	**Methodology**	**Main findings**
Kinyondo and Byaro (2020)	GMM using panel data of sub-Saharan Africa from 2000 to 2016.	Human capital (life expectancy) has a positive effect on sub-Saharan Economy
Ogundari and Awokuse, (2018).	GMM using panel data in Sub Saharan Africa over the period 1980-2008.	Health and education have positive impact on GDP growth. The impact of Health (life expectancy) is moderately larger than the education.
Sharma, (2018).	Use of generalized method of moment (GMM) approach for panel data	Life expectancy exerts a positive impact on both real income per capita and growth.
Silva et al. (2018).	Quantile regression approach using 92 countries over the period 1980-2010	Better health relates to growth at all quantiles.

Boachie (2017)	Use of ARDL approach for time series data of Ghana from 1982-2012.	Economic growth is determined by life expectancy. Progress in health status of the population raises productivity in Ghana economy.
Azam and Ahmed (2015)	Fixed effects approach for panel data of commonwealth states over 1993-2011	Human capital (health & education) are critical for economic growth.
Sarpong et al (2018)	Use of panel cointegration, granger causality and OLS estimator in Sub Sahara Africa over the period 1997-2016.	Health capital is a key determinant of economic growth. There is bidirectional causal link between health and GDP growth
Author/s and Year	**Methodology**	**Main findings**
Khan & Chaudhry (2019)	Fixed and random effect using data for developing countries	Life expectancy is important engine of growth opportunities in poor countries
Brempong & Wilson (2004)	Using model and panel data in sub-Sahara Africa and OECD countries	A large percent of the transition growth rate and per capita income in Sub Sahara Africa and OECD was attributed to health.
Akram et al (2008)	Causality and error correction model using Pakistan data for the period 1972-2006	Health variables (life expectancy) determine economic growth. Bidirectional relationship exist between health and GDP growth
Bloom et al (2004)	Using two stage (2SLS) techniques	Life expectancy has positive impact on GDP. Improvement in life expectancy increases labour productivity and capital accumulation.
Mayer (2001)	Granger causality tests of 18 Latin American countries using life tables over 1950-1990 and economic indicators over 1975-1990	The effect of health on economic growth is sustainable and long term

3.0 Data Sources and Model Specification

3.1 Data sources

Annual secondary data (1990-2019) on economic growth (GDP per capita), foreign direct investment (% of GDP), life expectancy (total years), inflation and the export of goods and services (% of GDP) was taken from the World Bank Development Indicators online database (2020). Population health is proxied by life expectancy at birth. Life expectancy at birth is a most important indicator of population health and is frequently used to contrast health levels between nations or regions across a period of time (Byaro *et al.*, 2021; Kulkarni *et al.*, 2011; Jacob and Rapaport, 2002; Bloom and Canning, 2002). It also has a strong relationship with most other indicators of population health such as adult mortality and child mortality (Sharma, 2018). GDP per capita represents economic growth and measures the size of the economy. Foreign Direct Investment (FDI) is the value of net inflows to GDP ratio. This indicator is commonly used by previous researchers such as Awadhi *et al* (2022), Odhiambo (2021) and Nguyen (2017). Export of goods and services are expressed as a ratio of GDP. This indicator was used by Nguyen (2017) and Belloumi (2014). Inflation, the persistent rise in general price of goods and services, is measured in annual percentage of consumer prices. This indicator is widely used as a control variable in growth determinants literature, such as Kinyondo *et al* (2021), Adams and Opuku (2015).

3.2 Modeling techniques

Gross Domestic Product (GDP) is defined as a function of investment and human capital (health), controlling for other factors associated with economic growth like inflation, export of goods and services as follows**:**

$$GDP_t = f(\ FDI_t, LIFE_t, EX_t, IFL_t,) \quad (1)$$

Where GDP is the real gross domestic product per capita, EX is the export of goods and services, FDI is the foreign direct investment, LIFE is the life expectancy (health measures), IFL is the inflation rate and *t* represents time. These variables are based on the Solow model, previous studies and availability of the data. In a linear form, for estimation purposes, equation (1) reads as follows:

$$GDP_t = \alpha_0 + \alpha_1 FDI_t + \alpha_2 LIFE_t + \alpha_3 EX_t + \alpha_4 IFL_t + \mu_t \quad (2)$$

The variables are then converted into logarithms to reduce variance (heteroskedasticity) and to have a constant mean and variance (homoskedasticity) as follows:

$$LGDP_t = \alpha_0 + \alpha_1 LFDI_t + \alpha_2 LLIFE_t + \alpha_3 LLEX_t + \alpha_4 LIFL_t + \mu_t \quad (3)$$

Where L represents natural logarithm and μ_t is an error term.

On a theoretical basis, the effects of population life expectancy, foreign direct investments (FDI) inflows and the export of goods and services are likely to be positives for economic growth. Inflation is expected to be negative for economic growth.

3.3 Model estimation

The ARDL (Autoregressive Distributed Lag) approach was used. One essential prerequisite for estimating ARDL cointegration is to establish whether the data series in their levels are stationary or non-stationary, i.e. whether there exists a long-run equilibrium relationship, despite of whether variables used in the analysis are stationary at levels I(0), or stationary at first difference I(1), or a combination of I(0) and I(1) (Pesaran *et al*., 2001). ARDL operates accurately when the sample size is small and does not require pre-testing of the orders of integration (Pesaran and Shin, 1999; Pesaran *et al.,* 2001). It does not need all the variables incorporated in the model to be integrated at order one I(1), and cannot work if the variables are integrated at order two, I(2) (Pesaran and Shin, 1999; Pesaran *et al.*, 2001). ARDL predicts both short and long term elasticity's and employs different lag lengths for different variables added to the model. Lastly it addresses the model's autocorrelation and endogeneity issues (Byaro *et al.*, 2022b; Murshed, 2021).

The ARDL test identifies asymptotic critical value bounds, indicating whether variables are integrated at first differences, I(1); or integrated at level, I(0) series (Pesaran *et al.*, 2001). Critical values for I(1) series are the upper bound while the critical values for I(0) series are the lower bound. Following to Pesaran *et al* (2001), the lower bound critical values assume that the explanatory variables are integrated of order zero I(0) while the upper bound assumes that, explanatory variables are integrated of order one I(1). If the F test statistics exceed their respective critical values, this is evidence of a long run relationship between variables regardless of the order of integration of the variables (Pesaran *et al.*, 2001). If the test statistic is below the upper critical values, the null hypothesis of no cointegration cannot be rejected. If the computed *F*-statistic falls between the lower and upper bound values, the results are uncertain.

Based on growth model in equation 1, 2 and 3, the ARDL cointegration equations for Foreign Direct Investment (FDI) and human capital (LIFE expectancy), Export (EX) and Inflation (IFL) on real GDP per capita (GDP) is given as:

$$\Delta L(GDP)_t = \alpha_0 + \sum_{i=1}^{q} \alpha_{1i} \Delta L(GDP)_{t-i} + \sum_{i=1}^{q} \alpha_{2i} \Delta L(FDI)_{t-i} + \sum_{i=1}^{q} \alpha_{3i} \Delta L(LIFE)_{t-i} + \sum_{i=1}^{q} \alpha_{4i} \Delta L(EX)_{t-i} + \sum_{i=1}^{q} \alpha_{5i} \Delta L(IFL)_{t-i} + \lambda_1 L(GDP)_{t-1} + \lambda_2 L(FDI)_{t-1} + \lambda_3 L(LIFE)_{t-1} + \lambda_4 L(EX)_{t-1} + \lambda_5 L(IFL)_{t-1} + \mu_t \quad (4)$$

Where Δ denotes the first difference operator, L is the natural logarithm and q is the optimal lag length. The left side of the equation represents the dependent variable while the right side shows the explanatory variables. The first until fifth expressions ($\boldsymbol{\lambda_1 - \lambda_5}$) on the right side correspond to the long-run relationship. The remaining expressions with the summation sign ($\boldsymbol{\alpha_1 - \alpha_5}$) represent the short-run dynamics of the model and μ_t represent the error term. The null and alternative hypotheses tested between the examined variables are: -

H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$ indicating no cointegration or long-run relationship of variables.
H_1: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 = 0$ indicating cointegration exist or long-run relationship of variables. If cointegration exists, the long run and short run models can be estimated. The short run model is as follows:

$$\Delta L(GDP)_t = \alpha_0 + \sum_{i=1}^{q} \alpha_{1i} \Delta L(GDP)_{t-i} + \sum_{i=1}^{q} \alpha_{2i} \Delta L(FDI)_{t-i} + \sum_{i=1}^{q} \alpha_{3i} \Delta L(LIFE)_{t-i} + \sum_{i=1}^{q} \alpha_{4i} \Delta L(EX)_{t-i} + \sum_{i=1}^{q} \alpha_{5i} \Delta L(IFL)_{t-i} + \gamma ECM_{t-1} + \mu_t \quad (5)$$

Where as ɣ is the coefficient of the error correction term. Equation (5) represents the ARDL short run specification derived from the formulation of the error correction term (ECM). The ECM represents the speed at which the dependent variable adjusts to equilibrium as a result of shocks. To show that there is an adjustment to equilibrium, this must be negative and statistically significant.

4. Empirical findings and discussion

Table 3 shows descriptive statistics of the variables before their transformation into logarithms. Transformation of the data into logarithms makes it a more linear and normal distribution.

Table 3: Summary of Variable Values

Variables	Description	Mean	Std Deviation
GDP	Real Gross Domestic Product per capita (constant 2010 US dollars)	$660.20	166.58
FDI	Foreign Direct Investment is the value of net inflows to GDP ratio	2.61	1.57
EX	Export of goods and services as a ratio of GDP	16.58	3.70
LIFE	Life expectancy (years)	55.40	5.67
IFL	Inflation, consumer prices (annual %)	12.32	9.62

Source: (Author estimates, 2022)

Figures 1 and 2 show normalized data of economic growth (GDP per capita), life expectancy (LLIFE) and FDI inflows from 1990 to 2019. The data trends were transformed to stationary values before normalization (Byaro and Kinyondo, 2018c). Figure 1 show that in Tanzania, income (GDP per capita) and population life expectancy are positively correlated.

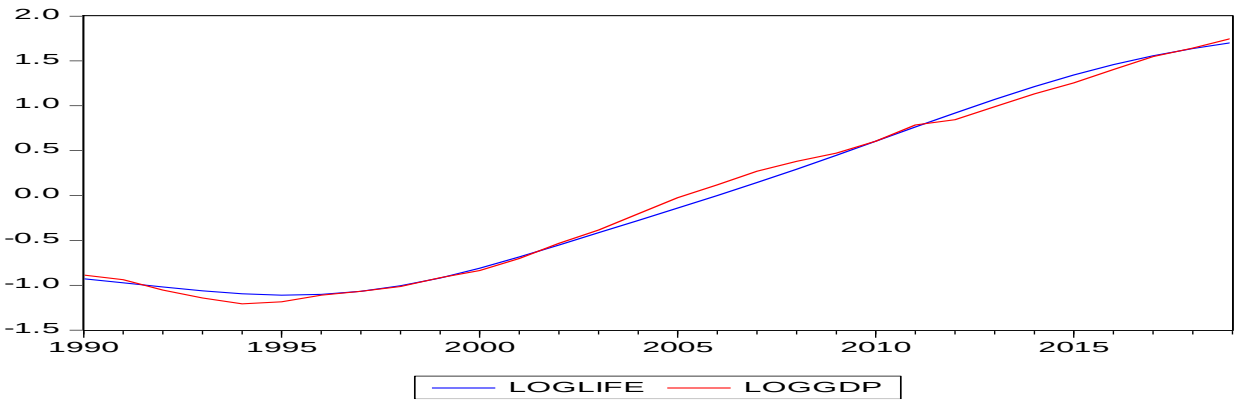

Figure1: Link between population life expectancy and GDP growth in Tanzania

The strong positive correlation between population life expectancy and per capita income (GDP) seems to have become more robust over time. Healthcare performance is thus strongly linked to economy (Byaro et al, 2018a). Both life expectancy at birth and GDP per capita (income) increased between 1996 and 2019 and the increase in GDP per capita link with better health.

In contrast, Figure 2 shows that FDI and GDP per capita are not strongly related. An increase in FDI inflows is not strongly correlated with GDP per capita. From 1990 to 2019, there is a huge divergence between FDI inflows and GDP per capita. While GDP increases slightly over the years, FDI inflows fluctuate. For instance in some periods, FDI inflows are decreasing while GDP per capita increases. It is clear that FDI inflows lack a strong relationship with economic growth.

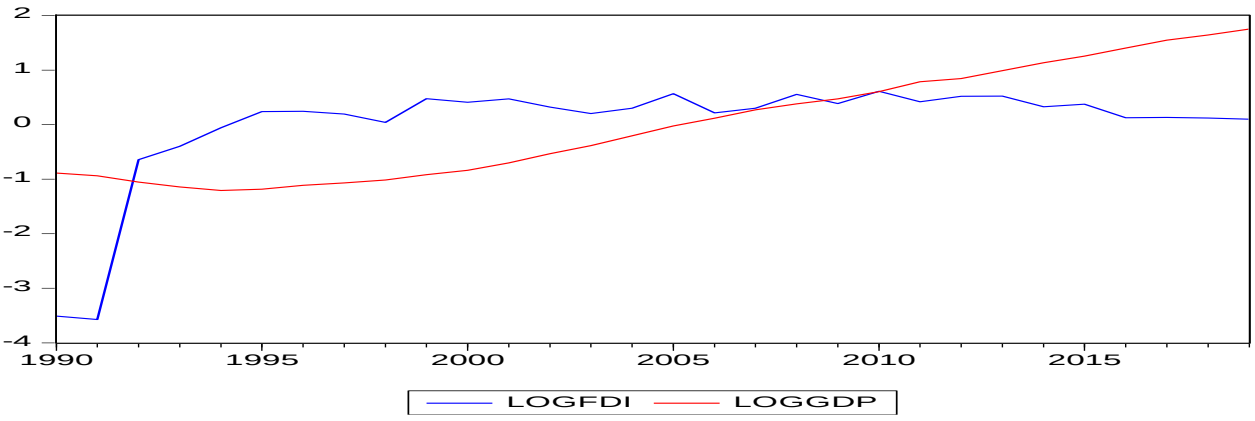

Figure 2: Relationship between FDI inflows and economic growth in Tanzania

4.1 Time Series properties of the data

Most time series data are non-stationary, and using non-stationary data leads to spurious regression (Byaro and Kinyondo, 2018c). If the variables are non-stationary, the assumption of Ordinary Least Squares (OLS) becomes inconsistent and biased. For this reason, the modified Dickey-Fuller test (DF-GLS (Eliott, 1996) and the ADF unit root test were applied to determine the stationarity of variables. DF-GLS is more powerful than other conventional tests such as the Augmented Dickey Fuller test (ADF). The plot of the time series (*not reported here*) shows that all the variables contain stochastic trends. Therefore, the unit roots tests are run with constant and trend (See Table 4).

Table 4: Unit roots (non-stationary) test

	ADF		DF-GLS	
Variables	**At level**	**1st Difference**	**At level**	**1st Difference**
LGDP	-5.18***	--	-2.00**	-1.70
LFDI	-3.17	-5.84***	-2.57	-6.15***
LEX	-3.84	-4.86***	-3.85***	--
LLIFE	-4.22***	--	-3.89***	--
LIFL	-2.15	- 5.17***	-1.89	-4.85***

Source: Author Analysis (2022)

***= P value statistically at 1% critical values and P < 0.001; **= P value statistically at 5%, *= P value statistically at 10% critical value; L=Natural logarithm, GDP = Gross domestic product per capita, FDI = Foreign Direct Investment LIFE= life expectancy, EX= Exports of goods and services, IFL=Inflation

Neither Augmented Dickey Fuller (ADF) nor Dickey Fuller (DF-GLS) tests take into account the possibility of structural breaks. Therefore, either test may lead to a misleading result when accepting the null hypothesis of a unit root (See Perron, 1997). Structural break is a sudden jump or fall in an economic time series which occurs due to economic changes, policy reform or changes in institutional arrangements that can create difficulties in unit root test. For instance, a stationary series which has a structural break may be regarded as non-stationary by the Augmented Dickey Fuller (ADF) and Dickey Fuller (DF-GLS). To address the structural break issues, the results of unit root test with structural breaks are reported in Table 5. The break point results indicate that all variables are significant at their break points. Further, the structural breaks unit roots test indicates that; all variables were stationary in levels. These results show that the series are integrated of order I(1) but not of order two, I (2). Since the order of the series in Table 5 are not differenced twice I(2), the ARDL bounds test can be used to test the existence of cointegration among the variables (FDI, EX, LIFE, IFL and GDP). The ARDL techniques is appropriate when the variables are purely integrated at first difference, I (1); or a combination of integrated at level, I(0) and I(1).

Table 5: Structural breaks unit root test

Variables	At level	Break Date	Order of Integration
LGDP	-7.27**	2002	I(0)
LFDI	-4.53**	2018	I(0)
LEX	-5.88***	2009	I(0)
LLIFE	-5.67***	2001	I(0)
LIFL	-5.07**	2009	I(0)

Source: Author Analysis (2022).

***= P value statistically at 1% critical values, **= P value statistically at 5% critical value, * = P value statistically at 10% critical value. L=Natural logarithm, GDP = Gross domestic product per capita, FDI = Foreign direct Investment LIFE= life expectancy, EX= Exports of goods and services, IFL= Inflation

As shown in Table 5, an FDI structural break occurred in Tanzania in 2018 due to a decrease of FDI inflows in the country. Structural breaks for exports occurred in 2009 due to a rise in goods and services exported. A structural break for GDP per capita in 2002 was due to economic changes in the country. Thus, from 1990 to 2019, structural breaks occurred in all variables indicated in Table 5.

Based on equation 4, the maximum lag in the ARDL model to cointegration is (1, 2, 2, 2,2), selected automatically by AIC (Akaike Information Criteria) out of top 20 models, meaning that the low values of AIC, the better the model. To confirm the existence of long running relationship among the variables, the next step is to carry out an ARDL bound test. This indeed shows that the F statistics are greater than the critical values. The results of the bound test are shown in Table 6.

Table 6: ARDL bound test

Null Hypothesis: No long run relationship exist		
Test Statistic	**Value**	**k**
F- Statistic	**5.07**	**4**
Critical value bound		
Significance	Lower Bound, I(0)	Upper Bound I(1)
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: Author estimation in Eviews 9. K= Number of explanatory variables.

The F-test results (Table 6) show whether cointegration exists between the variables. The computed F- test statistic (5.07) is compared to the critical values (10%, 5%, 2.5%, and 1%). The computed F-statistic is above the upper bound at 1% critical value of 5.06. This indicates the existence of cointegration meaning that both long run and short run ARDL models can be estimated. Table 7 shows the results of the short run (i.e. equation 5) and long run (i.e. equation 4) models for ARDL. The dependent variable is the natural logarithm of real GDP per capita.

Table 7: Short run and Long run results of ARDL

A: Short run Model				
Variable	**coefficient**	**std. error**	**t-statistic**	**probability**
FDI inflows	0.003	0.005	0.53	0.59
Export of goods	0.007	0.016	0.44	0.66
Life expectancy	3.811	0.517	0.11	0.04**
Inflation	-0.003	0.005	- 0. 56	0.58
$\mathbf{ECM_{t-1}}$	-0.450	0.137	-3.26	0.00***
B: Long run Model				
FDI inflows	- 0.008	0.011	- 0.650	0.52
Export of goods	0.118	0.037	3.114	0.01**
Life expectancy	2.407	0.124	19.287	0.000***
Inflation	- 0.093	0.023	-3.971	0.001***
Constant	-3.303	0.504	-6.550	0.000***
D: Diagnostic Tests				
Breusch-Godfrey Serial Correlation LM Test				0.12
Heteroskedasticity Test				0.81
Observations **(N) = 30**				

Source: Author Estimation (2022)

Significant at 5%, * significant at 1% value, **ECM**=Error Correction Model.

All variables are expressed in natural logarithm

In the short run, as Table 7 indicates, both FDI inflows and export of goods and services have positive and/or statistically insignificant effects on economic growth (GDP per capita). In both short and long run models, the diagnostic test shows neither autocorrelation ($p > 0.1$) nor heteroskedasticity ($p > 0.1$). A model check showed the results to be robust and sensitive to model specification and diagnostic tests.

In the short run, population health (i.e. life expectancy) is positive and significantly related to economic growth. A ten percent increase in life expectancy increased economic growth (i.e. GDP per capita) by 38%. Inflation rate showed a negative sign and was statistically insignificant on economic growth. The coefficient of the error correction model (ECM) is negative and statistically significant. This coefficient always ranges between -1 and 0, meaning the system corrects its previous period disequilibrium at a speed of 45%. This indicates a sizeable speed of adjustment of disequilibrium correction for reaching rapid long run equilibrium taking place.

In the long run, population life expectancy and export of goods and services have a positive and statistically significant impact on economic growth (GDP per capita). A 10% increase in the export of goods and services led to approximately 1.2% more in economic growth. A 10% increase in life expectancy at birth resulted in a 24% increase in economic growth. The magnitude of the effect of population life expectancy on economic growth is thus far greater than those of FDI inflows and export of goods and services.

4.2 Robustness check

To check the robustness of the results presented in Table 7, we ran separate models for the main variables (FDI and life expectancy as a proxy for health) and aligned each to the appropriate growth theory for better results. Table 8 shows the new ARDL bound test result.

Table 8: New ARDL Bound Test for FDI and Health (Life expectancy)

	FDI (value)	**Health (Life expectancy) value**
F- statistic calculated	**19.9**	**8.99**
Critical value bounds (Upper) **Significance**		
10%	3.77	3.77
5%	4.35	4.35
2.5%	4.89	4.89
1%	5.61	5.61

Source: Author Estimation (2022)

The calculated F-statistic for both models (FDI and life expectancy on economic growth) is greater than the upper critical value bounds, indicating that variables are cointegrated (i.e. there is long run relationship between the variables).

Table 9 shows new ARDL model estimates after passing the bound test. The results from Table 9, still confirms the results presented in Table 7, that economic growth continue to benefits more from health (i.e. life expectancy) than FDI inflows. Foreign Direct Investment (FDI) inflow has a positive and statistically insignificant impact on economic growth. Life expectancy is positive to the economy and statistically significant at 1%. In the long run, exports of goods and services continue to have a positive and statistically significant impact on the economy. An increase of inflation rate continues to harm the economy. The error correction term (ECM) is negative and statistically significant. Both models pass the diagnostic tests.

Table 9: Effects of FDI and Health (Life expectancy) on economic growth

Variables	Model 1 (FDI)	Model 2 (Health)
A: Short run		
FDI inflows	0.001 (0.002)	-
Life expectancy	-	1.52***(0.34)
Export of goods	-0.01(0.01)	0.003(0.01)
Inflation	-0.01(0.02)	0.001(0.01)
ECM(-1)	-0.03*(0.02)	-0.29***(0.09)
B: Long run		
FDI inflows	0.02 (0.06)	-
Export of goods	1.16**(0.45)	0.10*(0.05)
Life expectancy	-	2.08***(0.13)
Inflation	-0.99**(0.37)	-0.08**(0.03)
Constant	6.2***(0.99)	-1.95***(0.49)
C: Diagnostic Tests		
Serial LM Test	[0.76]	[0.11]
Heteroskedasticty	[0.28]	[0.25]
Observations	30 YEARS	30 YEARS

Source: Author Estimation (2022)

* *Significant at 5%, * significant at 10% level, *** significant at 1% level, **ECM**= Error Correction Model,
N.B: All variables expressed in natural logarithm, and standard error in parenthesis ( ).

The mechanism through which population life expectancy increases economic development is increased productivity via higher work supply and increased capital investment via a longer working life. Longer life expectancy is linked with better health and a healthy person would probably have more incentives to invest in education and training. If this is true, then longevity increases the chances that people will save more, create more economic activity (e.g., earning more income) and raise their standard of living, resulting in higher economic growth.

The modeling presented here reveals that, inflation has a negative and statistically significant effect on economic growth. It also shows that, in the long run, FDI inflows have no significant impact on economic growth. One possible reason for the insignificant impacts for FDI inflows in Tanzania might be due to the poor legal framework governing investment. For instance, land acquisition and compensation practices are very poor and there is lack of productive engagement between investors and local communities (Massay and Kassile, 2018), and poor regulatory infrastructure may explain the weak link between FDI inflows and economic growth (Adams and Opoku, 2015). In terms of poor regulatory structure, Tanzania is similar to many developing countries.

The findings in the present study are consistent with Jilenga *et al* (2016), who found FDI inflows to have no impact on economic growth in Tanzania. It is also consistent with Wang *et al* (2004) who argued that, while international trade is more vital for low income countries, FDI inflows are moderately more useful to high income countries. This relative benefit, Makki and Somwaru (2004) argued, may differ across countries depending on the level of human capital, infrastructure quality, market size, macroeconomic stability and trade policies such as free trade zones. Thus, to realize the benefits of FDI inflows, Tanzania needs to strengthen its government regulatory infrastructures related to FDI.

The short-term findings reveal that, a percentage increase in economic growth can be derived from a percentage increase in life expectancy at birth. A higher life expectancy at birth implies lower child mortality, a higher adult survival rate and a low prevalence of disease burden in the working age group, all promoting a significant gain of human capital (e.g., health and education). These, in turn, contribute to economic production. The findings are consistent with those of Kinyondo and Byaro (2020); Ogundari and Awokuse (2018); Sharma, (2018); Boachie, (2017); Azam and Ahmed (2015) who have found that population health has a positive impact on economic growth.

Overall, our study contributes to the existing literature by disentangling causal channels between population health, economic growth and FDI inflows. It also overcomes the endogeneity problems of previous studies (e.g., Burns *et al.,* 2017; Alsan *et al.,* 2006) that had neither applied the ARDL nor explicated theoretical backgrounds examining this relationship to low and middle income countries. The novel contribution from this study is that, surprisingly, economic growth benefits more from population health than from FDI inflows and increased export of goods and services.

5. Conclusions

The importance of FDI inflows in accelerating economic growth of Tanzania has been found to be negligible. The empirical results presented here fail to confirm that FDI has had a statistically significant effect on economic growth in Tanzania and support the need to undertake reforms that will build efficient institutions with clear goals and strong responsibility. Such institutions would help the country realize the potential of FDI, including employment creation and spillover effects that could stimulate the overall economy. The results here show that population life expectancy has a positive and significant effect on economic growth. This emphasizes the need to increase the stock of health human capital, for example, by prioritizing public health interventions (i.e. increase health facilities coverage, better nutrition, health care and other public health measures) that improve population health to achieve high returns on economic growth in sustainable way. FDI and export of goods and services do not have any significant effect on growth in the short run; instead effects are significant for life expectancy in the long and short term. The magnitude of the contribution life expectancy makes to economic growth is greater and stronger than FDI inflows and export of goods and services. This enables us to conclude that, the effect of life expectancy on economic growth in Tanzania is a sustainable one. This is important not just for Tanzania: It has policy implications for other developing countries. Overall, the study suggest interventions that focus on improving health, and export policies that specifically consider the effects of export industry on public health. This should be a goal of government, private and foreign firm's partnerships.

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