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Does foreign direct investment in Ghana promote welfare?

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ABSTRACT

Beyond the economic indicators of development is the welfare of citizens. This paper assessed the effect of foreign direct investment on welfare (human development) in Ghana. Unlike other studies on the subject that did not account for the unit interval property of the human development index (between 0 and 1 inclusive), we departed from existing studies on the welfare effects of foreign direct investment by accounting for the unit interval property (between 0 and 1, inclusive) of the human development index. Unlike country-specific studies on the subject that used time-series data with the associated time series modelling, we employed an unbalanced panel data of 41 countries in Africa over the period 1990 to 2019. We relied on the elasticities of the generalised estimation equations and isolated the effect of Ghana. Following the elasticities of the generalised estimation equations, the partial effect of foreign direct investment on welfare in Ghana was not statistically significant. The total effect of foreign direct investment on welfare in Ghana was also found to be statistically insignificant. Further, the total effect of foreign direct investment on welfare in other African countries was found to be statistically insignificant. Ghana and other African countries should re-assess their foreign direct investment policies vis-à-vis their effect on welfare. The interaction of policy could produce different results and can be researched subsequently.

1. Introduction

Beyond the economic indicators of development is the welfare of citizens. Several studies have proxied welfare as the human development index (HDI) (Adegboye, Adesina, Olokoyo, Ojeka, & Akinjare, 2021; Agbloyor, 2019; Allou, Adeleye, Cheng, & Abdul, 2020; Atitianti & Dai, 2022, Ganiyu, 2016; De Groot, 2014; Kolster, 2015; Ranjkeshan, 2021; Gohou & Soumaré, 2012; Ramalho, Ramalho, & Murteira, 2011). The HDI is a summary measure of average achievement in key dimensions of human development; namely, a long and healthy life, knowledge and having a decent standard of living. The HDI is the geometric mean of normalised indices for each of the three dimensions (UNDP, 2021). These are a long and healthy life, being knowledgeable and having a decent standard of living. The health indicator is life expectancy at birth whilst the education dimension is assessed as the mean years of schooling for adults aged 25 years as well as the expected years of schooling for children of school-entering age. The standard of living dimension is captured as the gross national income per capita (UNDP, 2020). The resulting index of human development, HDI, ranges between 0 and 1. The UNDP segregates the HDI into four; low human

development, medium human development, high human development, and very high human development.

One of the investment options to fund welfare is foreign direct investment (FDI). This connotes cross-border dealings resulting in a lasting interest by a denizen firm in one economy in a firm that is a dweller in an economy other than that of the direct investor (Chen, Yu, & Zhang, 2019; Djokoto, 2021; OECD, 1999; Punthakey, 2020; UNCTAD, 2009). The inflow of foreign direct investment into recipient countries is beneficial (De Mello Jr., 1997; Djokoto, 2022; Gallová, 2011; Obeng, 2014; Oualy, 2019; Romer, 1993). Firstly, the inflow of FDI induces local investment by adding on to domestic investment through connections in the production chain when foreign firms procure domestically made inputs or when foreign firms furnish intermediate inputs to domestic firms. Secondly, FDI supplements the provision of funds for investment thus, enhancing capital formation. Thirdly, the inflow of FDI raises the ability of the host country to export, increasing foreign exchange receipts. As final merit, new job prospects and promotion of technology transmission are associated with FDI inflow thereby furthering overall economic growth.

The inflow of FDI is often induced by fiscal incentives such as tax

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exemptions, holidays, rebates, and waivers of import duties on machinery and other inputs (Peters & Kiabel, 2015). These deprive host nations such as Ghana of needed revenue for expenditure on social services such as health and education. Some recent studies have reported the detrimental effects of FDI in Ghana (Adu, 2018; Nubuor, 2017; Umar Gingo & Demireli, 2017; Wang, Garti, & Chibsah, 2019). Whilst Umar Gingo and Demireli (2017) noted FDI into Ghana is not growth-enhancing, Wang et al. (2019) showed that FDI inflows negatively impact the stock market development in the long run. Adu (2018) noted the weak institutional capacity in Ghana shown via the pro-investor mining sector regulatory regime and the ineffectual and tainted mining support institutions. Also, the capital-concentrated character of mining activities and the restricted reach of corporate social responsibility, have forced the ability of the extractive industry to decrease deprivation in mining communities in Ghana. Moreover, the undesirable income effect of mining activities denying residents of their land, together with the consequential societal and ecological effects deteriorated the predicament of the mining societies in Ghana. Nubuor (2017) reported that FDI had a negative effect on the environment (carbon dioxide emissions). These findings of the downsides of FDI in Ghana have implications for health, education, and livelihoods which would impact human development (HD), as measured by the HDI. Notwithstanding the negative effects, Atitianti and Dai (2022), Arogundade (2022), Gohou and Soumaré (2012) and Tamer (2013) have reported a positive effect of foreign direct investment on the welfare of sub-Saharan Africa. From the foregoing, will FDI into Ghana promote or enhance human development?

In the existing literature, some country studies on the effect of FDI on welfare or human development (HD) used time-series data (Cote d'Ivoire – Allou et al., 2020; Nigeria – Fagbemi & Osinubi, 2020; Morocco – Mansouri, 2019; Pakistan – Minhaj, Ahmed & Hai, 2007). The authors employed the autoregressive distributed lags estimation, fully modified ordinary least squares, dynamic ordinary least squares, and vector error correction model. These found a positive or no effect of FDI on human development. Whilst depriving the analysis of the cross-sectional properties, the estimators did not recognise that the HDI is within the unit interval, that is, between 0 and 1. The estimators used would make the predicted values of the HDI fall outside the unit interval. This presupposes those estimates are inappropriate for the dependent variable. This study makes the following contributions. First, panel data is employed with the isolation of the effect of Ghana based on the computation of the Wald. This permits the utilisation of both the time series and cross-sectional properties of the data. The approach also helps in overcoming the challenges of the short time series for estimations that could have created inefficient estimates. Second, the approach enables the computation of the HD effects of FDI of Ghana and other African countries. Third, appropriate transformations have been applied to the dependent variable. In these departures from existing studies, this study assesses the effect of foreign direct investment inflow into Ghana on welfare. Identifying the effect of FDI on HD in Ghana provides an opportunity to evaluate FDI in Ghana, especially the effect on welfare. The outcome of this study would also inform future policies on FDI.

Ghana is one of the sub-Saharan African nations to execute economic-friendly policies to create a favourable atmosphere for enticing FDI (UNCTAD, 2003; Yakubu, 2020).¹ As the first African country south of the Sahara to gain independence, Ghana has had a stable multiparty democracy since 1992. With a population of 30.42m in 2019 (World Bank, 2022), Ghana is a lower-middle-income country and has been classified as a medium HD country by the UNDP based on 2019 data. Thus, studying Ghana within the context of FDI and welfare is relevant.

The rest of the paper is sectioned into five. An overview of FDI and HD in Ghana is presented next. This is within the context of previous

studies on FDI in Ghana, and the trend of FDI, HDI and the relationship between the two over time. After detailing the development literature, the state of evidence on the relationship between FDI and HD is presented. As some variables also explain HDI apart from FDI, their effect on HDI has been presented based on past studies largely from Africa and developing countries. The general model as well as the estimable equations have been presented and described in the data and methods section. The description of the data as well as the estimation procedure are also outlined. The outcome of the estimations is presented and explained considering the literature. The concluding remarks constitute the last section.

2. Foreign direct investment and human development in Ghana

Ghana's key FDI institution is the Ghana Investment Promotion Centre (GIPC). GIPC was established in 1994, under legal instrument Act 478, and revised in 2013 as GIPC Act 865 (2013). GIPC seeks to reduce hindrances to and generate inducements for FDI (Aryeetey et al., undated, Cotton & Ramachandran, 2001; Djokoto, 2012; GIPC, 2022). The GIPC Act acclaimed as the most excellent in Africa (UNCTAD, 2003) empowered the GIPC to render services including investment enablement, monitoring and evaluation, managing investment systems, surveying the investing atmosphere, and aiding infrastructure for investing in Ghana (Djokoto, 2012; GIPC, 2011). The efforts of GIPC and its predecessor have yielded dividends in terms of FDI inflow.

The time path of Ghana's nominal FDI inflows can be staged into three (Tsikata, Asante, & Gyasi, 2000; Yakubu, 2020). The first stage spans 1983–1988 and is described as the sluggish stage. During this period, Ghana experienced an insufficient amount of FDI inflow. The moderate stage, the second, started in 1989 and ended in 1992. The amount of FDI inflow was moderate. The absolute stage is the third. From 1993 to 1996, there was a significant increase in FDI inflows. This was attributable to the Ghana Privatisation programme in 1990 and the implementation of Ghana's Investment Code in 1994 (Tsikata et al., 2000; Yakubu, 2020). Beyond the absolute stage, Ghana experienced a sharp decline in FDI inflows in the early 2000s to US\$ 166m (Yakubu, 2020). The decline was due to the uncertainty in the political climate of Ghana following the general elections in the year 2000. There were further declines to \$89m and \$59m in 2001 and 2002, respectively (Yakubu, 2020). There was however a rise from 2002 to US\$145m in 2006. Yakubu (2020) noted that from 2006 to 2009, Ghana realised significant inflows of FDI, from \$636m in 2006 to US\$855m in 2007. The FDI inflow in 2009 was a 50% increase in value over that of 2008. This was obviously on the back of Ghana's oil find (Yakubu, 2020). The rate of growth from 2010 to 2016 has, however, been sluggish (Yakubu, 2020).

Regarding FDI to gross domestic product ratio, the situation is a mix. There was a slight rise in 1994 with turnings between 1995 and 2005 (Fig. 1). However, the trend declined from 1994 to 2005. The oil find seemed to have increased the FDI more than the gross domestic product, hence skyrocketing the ratio from 1.04 in 2005 to 9.4 in 2008. Following minimal gyrations, a declining trend is observable from 2008 to 2019.

The pattern of Ghana's HDI can be categorised into three stages (Fig. 2). Stage one is below 0.500. This occurred from 1990 to 2000. Stage two is above 0.500 but below 0.600. This is observable from 2010 to 2015. In the final stage, the HDI was above 0.600. It would be observed from Fig. 2 that Ghana's HDI had risen steadily since 1990 with the highest rate of growth between 2000 and 2014. As the UNDP (UNDP, 2021) has classified Ghana as belonging to the medium HD group as of 2019, the medium HD line was represented in Fig. 2. Ghana was above the medium HD threshold between 1990 and 2000. After the year 2000 however, Ghana has persistently remained below the medium HD line. Although the gap between the line for Ghana and that for the medium HD widened after the year 2000, the gap narrowed slightly in 2018. From Fig. 2, whilst Ghana is clearly above the lower HD line, it appears to be lower than the high HD line than it is above the low HD

¹ These are outlined in the next section.

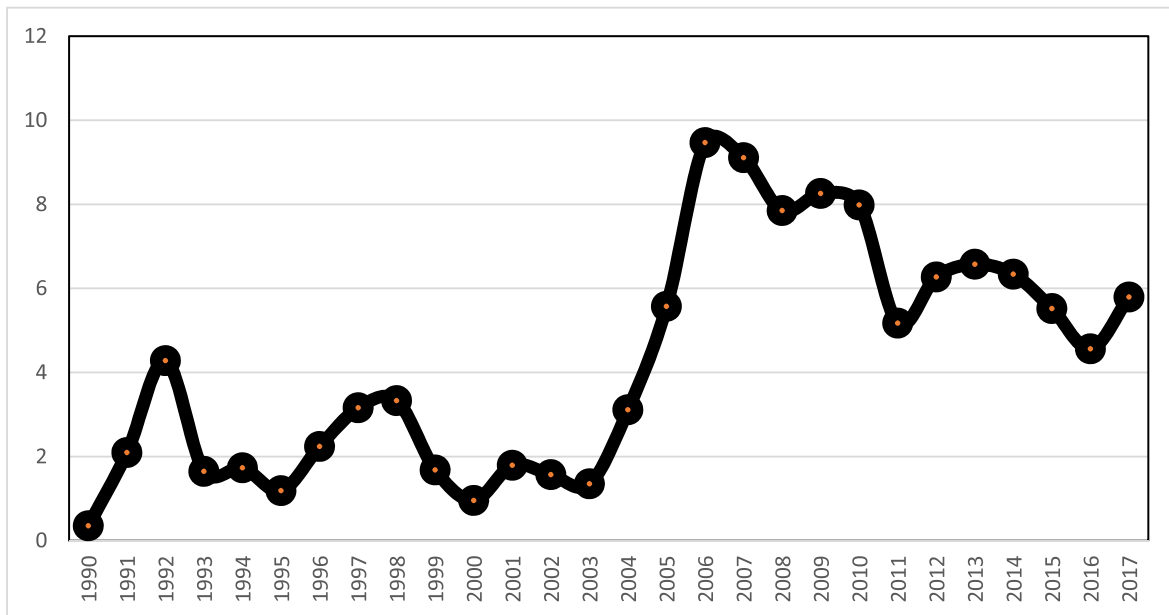


Fig. 1. Time path of Ghana's foreign direct investment to gross domestic product ratio.

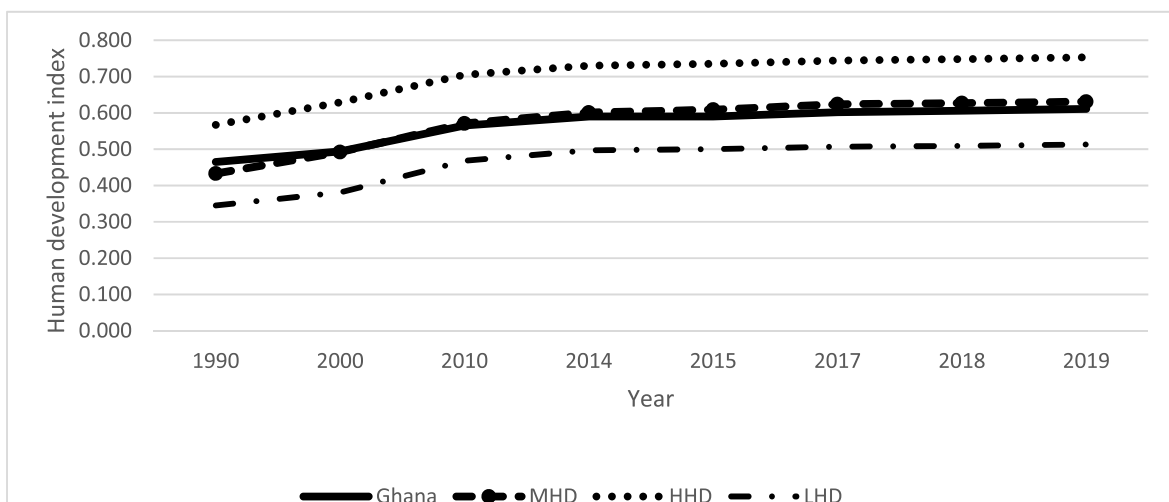


Fig. 2. Trend of Ghana's human development index.

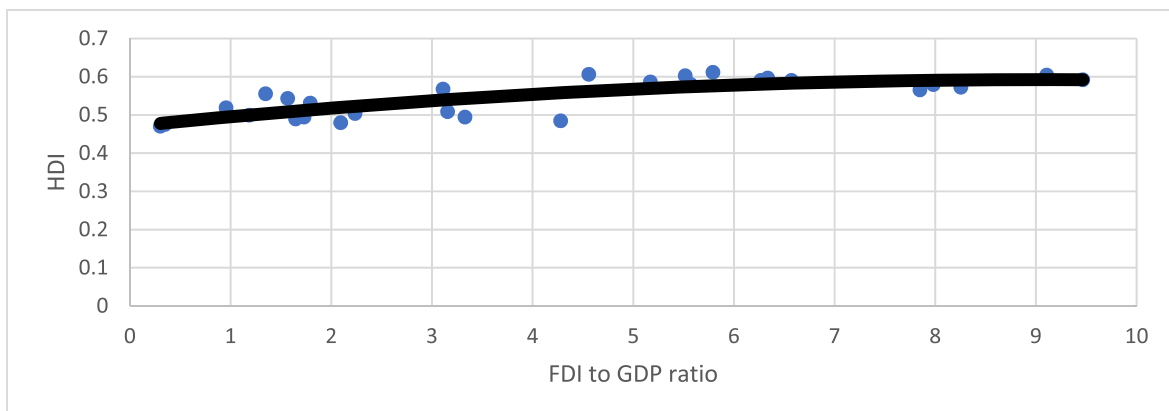


Fig. 3. Scatter plot of foreign direct investment to gross domestic product ratio and human development.

line. Thus, Ghana has more work to do to reach the high HD category than it has accomplished so far remaining above the low HD line.

Fig. 3 depicts the scatter plot of the relationship between FDI and HDI. The plots show a rising non-linear trend, hence the upward-sloping line of best fit. As this is a bivariate analysis, it remains to be seen if the multiple variate analysis will confirm this.

3. Literature review

Sen (1992, 1987, 1997, 1998) have acknowledged that several social and economic pointers are known to underwrite variations and the broad enrichment of the quality of life of a person. However, early studies on economic growth and welfare had concentrated on the use of only tangibles; incomes and commodities to evaluate a person's benefit, indigence, and deprivation (Sen 1987; 1992). In recent times, studies have highlighted the need to redirect focus to measures that people consider inherently of value to HD (Afoakwa, 2016; Djokoto, Gidiglo, Srofeyno and Agyeiwaa-Afrane, 2022a; Gökmenoğlu, Apinran, & Taşpınar, 2018; Sen, 1987, 1992; Sharma & Gani, 2004; Kaukab and Surwandono, 2021).

Technical advancement is the eventual energy of continued economic progress (Djokoto, Agyei-Henaku, & Badu-Prah, 2022; Sharma & Gani, 2004; Solow, 1956) and has become influential in societal progress. As FDI promotes technology transmission and corporate integration between foreign and local businesses, this enhances human resources development. The benefit for developing countries lies in technology and development catch-up or convergence (Menon, 2013; Kaukab and Surwandono, 2012). Thus, the well-being of FDI recipient countries would be enhanced because of the benefits of FDI such as employment creation, skill development, income generation and technological improvements (Kaukab and Surwandono, 2012).

The implications of these theories are demonstrated in empirical studies: Cote d'Ivoire (Allou et al., 2020), Nigeria (Fagbemi & Osinubi, 2020), Morocco (Mansouri, 2019), Pakistan (Minhaj et al., 2007), Africa (Gohou & Soumaré, 2012; Korle, Amoah, Hughes, Pomeyie, & Ahiabor, 2020; Nakouwo, 2019; Tamer, 2013) and regions of Africa (sub-Saharan Africa – Adegboye et al., 2021; Afoakwa, 2016; Ganiyu, 2016; Ranjakeshan, 2021; north Africa – Kolster, 2015). As expected, the country studies used time-series data with the Granger causality test, autoregressive distributed lags, fully modified ordinary least squares, dynamic ordinary least squares, and vector error correction models. Those that used panel data studies employed generalised least squares, fixed effects, the general method of moments and seemingly unrelated regressions.

In the long run, FDI promoted HD in Cote d'Ivoire (Allou et al., 2020), Morocco (Mansouri, 2019) and Pakistan (Minhaj et al., 2007). A neutral effect exists for Nigeria (Fagbemi & Osinubi, 2020). In the short run, FDI also promoted HD in Nigeria (Fagbemi & Osinubi, 2020) and Pakistan (Mansouri, 2019). Allou et al. (2020) acknowledged improvements in the HDI which, in the aggregate, improved social welfare, arose from investing in health, education, agriculture, infrastructures, and information and communications technology (Djokoto, Agyei-Henaku, & Badu-Prah, 2022). No reasons were assigned for the no effect of FDI on HD.

FDI has a positive effect on HD in Africa (Gohou & Soumaré, 2012; Tamer, 2013). However, Korle et al. (2020) found a neutral effect for Africa. Whilst it is the same for sub-Saharan Africa (Ganiyu, 2016), Afoakwa (2016) and Ranjakeshan (2021) found a negative effect of FDI on HD. For North Africa, Kolster (2015) found a positive effect of FDI on HD. Ganiyu (2016) cited job creation, local skills development, and stimulation of technological progress, as reasons for the positive HD effect of FDI. Policymakers generally do face budget constraints that compel certain spending choices. Allocating more resources to promote FDI may result in lower expenditures on social services such as health and education. This could imply a negative relationship between promoting FDI and declining levels of HD (De Groot, 2014; Djokoto,

Agyei-Henaku, & Badu-Prah, 2022).

Aside from the FDI, other variables explain HD. Trade creates the environment to exchange commodities and services. Whilst these could be for direct consumption, they could also be used for producing other commodities and services. The utilisation of these would enhance human satisfaction and welfare. Trade enhances HD (Tamer, 2013) however, a neutral effect has also been found (Nakouwo, 2019).

Inflation reduces the purchasing power of consumers hence, a negative relationship between inflation and HD (Nakouwo, 2019). The effect was similar for Africa from 1990 to 2007 (Gohou & Soumaré, 2012) and from 1980 to 2011 (Tamer, 2013). Government final expenditure had a neutral effect on HD (Gohou & Soumaré, 2012; Tamer, 2013). Tamer (2013) found a positive effect of infrastructure on HD.

The evidence from the empirical review suggests that not only is there no study on Ghana, but the country studies also used time-series data, and the estimation did not take into account the unit interval (index) property of the dependent variable, the HDI. Further, the results of the effect of FDI on HD are mixed hence, inconclusive. The current paper fills these gaps by applying panel data to assess the HD effect of FDI using generalised estimations equations.

4. Data, models, and estimation

4.1. Modelling

From the objectives of the study and the literature, FDI and other variables explain HD (Adegboye et al., 2021; Afoakwa, 2016; Allou et al., 2020; Djokoto, Agyei-Henaku, & Badu-Prah, 2022; Fagbemi & Osinubi, 2020; Ganiyu, 2016; Gohou & Soumaré, 2012; Kolster, 2015; Mansouri, 2019; Minhaj et al., 2007; Nakouwo, 2019; Ranjakeshan, 2021; Tamer, 2013).

Specifically,

$$HDI = f(FDI, INFRAS, TO, INFLA, POPG, GE) \tag{1}$$

Where HD is defined as HDI. The variables and sources are outlined in Table 1. In a time series environment, Equation (2) can be specified as

$$HDI_t = \alpha_0 + \alpha_1 FDI_t + \alpha_2 INFRAS_t + \alpha_3 TO_t + \alpha_4 INFLA_t + \alpha_5 POPG_t + \alpha_6 GE_t + \epsilon_t \tag{2}$$

The data on the relevant variables for Ghana covers only 29 years (1990–2018).

We recognised that taking differences to attain stationarity of the variables, lag specifications in the estimation procedure for time series analysis coupled with six variables in equation (3), would result in a loss

Table 1
Variable definitions, labels, and sources.

Variable	Definition	Proxying ...	Source
<i>HDI</i>	Human development index	Human development	UNDP
<i>FDI</i>	Foreign direct investment to GDP ratio for Africa	foreign direct investment	WDI
<i>GHFDI</i>	Foreign direct investment to GDP ratio for Ghana	foreign direct investment	WDI
<i>INFRAS</i>	The sum of fixed and mobile telephone subscriptions per 100 persons	Infrastructure	WDI
<i>TO</i>	The sum of exports and imports to GDP ratio	Openness to trade	WDI
<i>INFLA</i>	The annual growth rate of the consumer price index	Inflation	WDI
<i>POPG</i>	Population growth rate	Growth in population	WDI
<i>GE</i>	Final government expenditure	Government expenditure	WDI

Note: 1. UNDP – United Nations Development Programme. 2. WDI – World Development Indicators of the World Bank.

of degrees of freedom that may create inefficient estimates. To avoid the inefficiency, we added data on other African countries to the Ghana data to create a panel of 41 countries in Africa (Appendix 1). This ranged from 1990 to 2019. Consequently, we specified equation (4).

$$HDI_{i,t} = \beta_0 + \beta_1 FDI_{i,t} + \beta_2 GH_FDI_{i,t} + \beta_3 INFRAS_{i,t} + \beta_4 TO_{i,t} + \beta_5 INFLA_{i,t} + \beta_6 POPG_{i,t} + \beta_7 GE_{i,t} + \epsilon_{i,t} \tag{3}$$

With *i* countries and *t* years. β are parameters to be estimated and ϵ is the idiosyncratic error term. We specified the GH_FDI to isolate the effect of Ghana's FDI on HDI.

4.2. Estimation procedures

The UNDP-constructed HDI is within the unit interval. Thus, the family of functions such as logit, probit, loglog and cloglog (Djokoto, 2015; Djokoto & Afari-Sefa, 2017; Djokoto & Gidiglo, 2016; Djokoto, Srofeyo, & Arthur, 2016; Papke & Wooldridge, 1996; Ramalho, Ramalho, & Henriques, 2010) are applicable. Some options exist for addressing dependent variables within the unit interval: estimate the model with fractional regression (Djokoto, 2015; Djokoto et al., 2016; Djokoto & Gidiglo, 2016; Papke & Wooldridge, 1996; Ramalho et al., 2010), employ generalised estimation equations with the appropriate distribution and link function (Gyimah, Kwansa, Kyi, & Sikochi, 2021; Papke & Wooldridge, 2008; Xu, Solanki, & Fink, 2021), and transforming the dependent variable from the unit interval pattern to a linear form using the appropriate link functions (Ramalho, Ramalho, & Coelho, 2016). We employed the second and third options to estimate equation (4). For the latter, we transformed the dependent variable using logit, probit, loglog and cloglog transformations.

$$y_{Logit} = \log\left(\frac{HDI}{1 - HDI}\right) \tag{4}$$

$$y_{Probit} = \text{Inverse normal}(HDI) \tag{5}$$

$$y_{Loglog} = -\log(-\log(HDI)) \tag{6}$$

$$y_{Cloglog} = \log(-\log(1 - HDI)) \tag{7}$$

Equations (4)–(7) are the link functions. These transformations convert the HDI from the non-linear to the linear form. These replaced HDI in equation (3). Subsequently, the estimation of the model is straightforward, with the use of OLS to collect information criteria, Akaike information criterion (Akaike, 1974) and Schwartz's Bayesian information criterion (Schwarz, 1978). This is used to select the appropriate transformation of the HDI. Consequently, we estimated equation (3).

The interaction of $GH = 1$ and 0 otherwise, with *FDI*, gives *GH_FDI*. The effect of FDI on HD in Ghana will be the Wald, the sum $\beta_1 + \beta_2$. Although the data includes other African countries, the sum of the estimates is the total effect for Ghana. This is statistically acceptable as the total effect for Ghana (Hosmer, Lemeshow, & Sturdivant, 2013; Tarlov, Ware, Jr., Greenfield et al., 1989; Wells, Hays and Burnam, 1989). The use of interaction terms and consequent calculation of the Wald across countries or country groups are not uncommon in the FDI literature (Al Faisal & Islam, 2022; Amaefule & Ebelebe, 2022; Dash, 2022; Djokoto, 2021, 2022; Ercegovic & Pucar, 2022; Gómez, Oinas, & Wall, 2022; Hamdi & Hakimi, 2022; Hu, Wan, Yang, & Zhang, 2023; Islam & Islam, 2022, pp. 1–29; Narteh-Yoe, Djokoto, Obeng-Sarkodie, & Dauda, 2018). The chi-square statistic will then be the square of the *z*-statistic. This is compared with the Chi-square table values to establish statistical significance or otherwise (Djokoto, Gidiglo, Srofeyo, & Agyeiwaa-Afrane, 2022; Hosmer et al., 2013; Tarlov et al., 1989; Wells et al., 1989).

5. Results and discussions

5.1. Profile of the data

The mean HDI for Ghana is 0.5444 (Table 2). This exceeds that of other African countries in the data and the total African sample. This implies on average; Ghana has a higher HDI than other African countries (in the data) and the continent on average. As the standard deviations are less than 1 and the HDI is within the unit interval, the square of the standard deviation, the variance, would not only be within the unit interval but will certainly be less than the mean. Thus, the HDI has a narrow dispersion around the mean.

In the case of *FDI* and *GH_FDI*, whilst the former has a higher mean than the standard deviation for the Ghana sub-sample, it is the reverse for the other Africa sub-sample and the total sample. Regarding the latter, the mean of *GH_FDI* has a narrower spread for Ghana than for Africa. The higher standard deviation and consequent variance higher than the mean, signify an overdispersion of the data of the variable around the mean. Overdispersion can also be seen for *INFRAS* and *INFLA* for Ghana, other Africa, and Africa, except for the Ghana subsample where the standard deviation for *INFLA* is lower than that of the mean.

The number of observations for the Ghana sub-sample is 29. However, the observations for the HDI differ from other variables for the other African sub-sample and the combined, African sample. This is because, for some countries, there were no data on the HDI. Thus, the number of observations in the analysis is limited by the observations of the HDI.

5.2. Results

We estimated equation (4) by OLS to collect information for the information criteria (Akaike, 1974; Schwarz, 1978). The results in Table 3 show that the dependent variable with the probit transformation is selected. The average marginal effects of the panel GEE are reported in Table 4. The highest VIF is 2.57 (Appendix 2) suggesting all the variables can go into the model together. Although the estimates of *FDI* and *GH_FDI* are consistent across models 1 to 7, the estimates of the control variables in their respective models (2–6) are like that in model 7. This suggests the robustness of the estimates to control variables.

Table 2
Descriptive statistics.

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Ghana					
HDI	29	0.544	0.048	0.470	0.611
FDI	29	4.111	2.791	0.303	9.467
FIXMOBILET	29	46.632	53.389	0.306	138.452
TO	29	76.516	17.834	42.488	116.048
INFLA	29	18.318	12.109	0.407	59.462
POPG	29	2.490	0.198	2.163	2.896
GE	29	10.696	2.039	7.070	15.308
Other Africa					
HDI	650	0.494	0.133	0.012	0.804
FDI	720	3.723	6.339	-11.625	86.990
FIXMOBILET	720	42.130	46.011	0	218.740
TO	720	74.208	39.876	19.101	347.997
INFLA	720	41.026	885.960	-8.975	23,773.130
POPG	720	2.305	0.907	-2.629	4.271
GE	720	15.371	6.201	0.952	41.888
Africa					
HDI	679	0.496	0.131	0.012	0.804
FDI	749	3.738	6.238	-11.625	86.990
GH_FDI	749	0.160	0.960	0	9.470
FIXMOBILET	749	42.304	46.286	0	218.740
TO	749	74.297	39.250	19.101	347.997
INFLA	749	40.147	868.630	-8.975	23,773.13
POPG	749	2.312	0.891	-2.629	4.271
GE	749	15.190	6.159	0.952	41.888

Table 3
Selection of models based on the transformation of the HDI.

Selection test	Logit	Probit	Loglog	Cloglog
AIC	940.412	208.733	267.419	661.749
BIC	976.577	244.898	303.584	697.914

5.3. Human development effects of foreign direct investments in Ghana

Following the consistency of the estimates in Table 4, the Wald is presented in Table 5. The coefficients of *GH_FDI* are statistically insignificant, just like that of *FDI*. This implies that the *FDI* of Ghana and other African countries do not influence *HDI* (Table 4). To obtain the total effect of *FDI* on *HDI* in Ghana, the coefficients of *FDI* and *GH_FDI* were summed. The sum of the coefficients was divided by the square root of the sum of the square of the delta method standard errors. The quotient resulted in a *z* statistic. The square of the *z* statistics yielded the chi-square statistic (Table 5). The computed statistics were then compared with the chi-square statistical table readings at 1 degree of freedom. The Wald for Ghana is statistically indistinguishable from zero. Hence, there is no effect of *FDI* on *HD* in Ghana. The negative sign is contrary to the positive bivariate effect shown in Fig. 3. The negative effect can be attributable to the influence of the control variables. The finding of the neutral effect of *FDI* on *HD* in Ghana is consistent with the finding of Fagbemi and Osinubi (2020) for Nigeria. However, the positive effect results of Allou et al. (2020), Mansouri (2019) and Minhaj et al. (2007) respectively for Cote d'Ivoire, Morocco, and Pakistan are inconsistent with the finding of the current study.

Statistical and economic reasons account for this finding. The magnitudes of the coefficients of *GH_FDI* and *FDI* are small. The statistical insignificance arose from the relatively large standard errors of the coefficient of *FDI* and *GH_FDI*, greater than the size of the coefficient. In the case of *GH_FDI*, although the standard error is smaller than the coefficient, the quotient of the latter to the former is still lower than the critical values in the statistical tables.

The *HDI* is a combination of knowledge, health, and gross national income. Although the inflow of *FDI* into Ghana may contribute to increased income, the increasing population does reduce the gross national income per capita. Also, the incentives granted to multinationals deprive the social sector of resources. This creates an environment that leads to slow growth of the health and education components of the *HDI*. Policymakers generally face budget constraints that compel certain spending choices (De Groot, 2014). Allocating more resources to promote *FDI* may result in lower or deprivation of expenditures on social services such as health and education. Further, the concentration of *FDI* into non-labour-intensive sectors such as mining and the adoption of

Table 4
Estimates of the average marginal effects of the selected probit transformation.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>FDI</i>	0.002 (0.002)	7.00E-04 (0.001)	0.002 (0.002)	0.003 (0.002)	0.002 (0.002)	0.002 (0.002)	1.00E-04 (0.001)
<i>GH_FDI</i>	0.031*** (0.002)	-0.007 (0.006)	0.032*** (0.002)	0.030*** (0.003)	0.033*** (0.002)	0.032*** (0.003)	-0.005 (0.006)
<i>INFRAS</i>		0.003*** (0.001)					0.003*** (0.001)
<i>INFLA</i>			-5.96E-06*** (6.17E-07)				-3.00E-06*** (7.01E-07)
<i>POPG</i>				-0.035 (0.051)			0.032 (0.036)
<i>TO</i>					0.001 (0.001)		2.00E-04 (6.00E-04)
<i>GE</i>						0.002 (0.006)	0.001 (0.005)
Model diagnostics							
Observations	679	679	679	679	679	679	679

Note: 1. Robust standard errors in parenthesis. 2. **p < 0.01, ***p < 0.05, *p < 0.10.

labour-saving technologies in labour-intensive sectors such as agriculture would result in the under-achievement of the job creation role of *FDI*. This incidence is greater with labour-saving technology transfer into Ghana.

5.4. Discussion of control variables

The effect of *TO* is positive and statistically indistinguishable from zero. Many African countries are exporters of primary products, especially agricultural products (Djokoto, Gidiglo, et al., 2022). They in turn import machinery to support their agricultural sectors among other sectors. Although trade provides the opportunity for African countries to export what they have and import what they need thereby improving welfare (Agbloyor, 2019; Djokoto, Agyei-Henaku, & Badu-Prah, 2022), the effect of trade does not appear to promote the welfare of Africans. The finding of the current study is inconsistent with the empirical evidence of Tamer (2013). Nakouwo (2019) found a neutral effect of trade on *HD* which is consistent with the finding of this study.

Fixed and mobile phone ownership per 100 persons was used as a proxy for infrastructure and the coefficient is statistically distinguishable from zero with a positive sign. Tamer (2013) found a positive effect and statistically significant effect of infrastructure on *HD*. Infrastructure is important for development and hence should promote welfare in Ghana.

The coefficient of inflation is statistically significant with a negative sign. This suggests that decreasing inflation will induce an increase in *HD*. This is expected. Inflation erodes the purchasing power of consumers. Decreasing inflation would, therefore, increase their purchasing power hence the capacity to make expenditures that improve welfare. The negative relationship between inflation and *HD* found by Nakouwo (2019) agrees with our findings.

Population growth and government final expenditure on goods and services are statistically insignificant. These imply that based on the data and methods used, changes in population growth and government expenditure do not influence welfare in Ghana. This agrees with the

Table 5
Effect of foreign direct investment of welfare based on the Wald.

	Generalised estimation equations model
Ghana	-0.005 [0.220]
Other African countries	1.00E-04 [0.070]
Welfare effect (Ghana)	No effect

Notes: Chi-square statistics in square brackets.

findings of Gohou and Soumaré (2012) and Tamer (2013).

5.5. Policy implications

The government of Ghana should reconsider the incentive scheme for FDI. These should be skewed in favour of social sectors as well as more labour-consuming sectors such as agriculture. Waivers on machinery imports should be reconsidered. These should be reviewed by way of requiring multinational enterprises to pay tax on machinery imports for example. Aside from generating revenue to fund social services, it would attract more labour-intensive production processes and industries. This would enhance the job creation role of FDI. More workers earning wages would mean more income for households. Aside from registering as a contribution to gross national income, households will have the income to fund their health and education needs.

The results regarding inflation show that this economic indicator continues to be a problem in Ghana and Africa. Central banks in Africa and Ghana must effectively deploy inflation management tools. This must be supported by fiscal measures that would increase output and promote the production of goods with high import bills such as food, given the large arable and fertile land in Ghana and Africa. This would substantially increase HD.

6. Concluding remarks

Unlike other studies on the subject, this study departs from existing studies on the HD effects of FDI by employing the generalised estimation equations estimator for Ghana. Following other country-specific studies on the subject that used time-series data, panel data has been used. We

found that the partial effect of FDI on HD in Ghana was negative, and the total effect of FDI on HD was also negative and found to be statistically insignificant. FDI into Ghana does not promote welfare. As these are independent effects of FDI on welfare, the role of moderating variables such as monetary and fiscal policy variables could shed more light on this effect. This can be explored in further research. As Ghana has been addressed in this study, consideration of other geographical regions and sources of FDI can be studied in further research.

CRediT authorship contribution statement

Ferguson K. Gidiglo: Conceptualization, Validation, Review & Editing, Writing – review & editing, Project administration. **Akua Agyeiwaa Afrane:** Conceptualization, Validation, Review & Editing, Writing – review & editing, Project administration. **Kofi A.A-O. Agyei-Henaku:** Conceptualization, Validation, Review & Editing, Writing – review & editing, Project administration. **Charlotte Badu-Prah:** Conceptualization, Validation, Review & Editing, Writing – review & editing, Project administration. **Francis Srofenyoh:** Conceptualization, Validation, Review & Editing, Writing – review & editing, Project administration. **Justice G. Djokoto:** Conceptualization, Methodology, Validation, Formal analysis, Data curation, Writing – original draft, Writing – review & editing, Supervision, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1. List of countries in the data

Algeria	Djibouti	Madagascar	Sierra Leone
Angola	Egypt	Malawi	South Africa
Benin	Eswatini	Mali	Sudan
Botswana	Ethiopia	Mauritania	Tanzania
Burkina Faso	Gambia	Mauritius	Togo
Cabo Verde	Ghana	Morocco	Tunisia
Central African Republic	Guinea	Mozambique	Uganda
Chad	Guinea-Bissau	Namibia	Zimbabwe
Congo, Democratic Republic	Kenya	Niger	
Congo, Republic	Lesotho	Nigeria	
Cote d'Ivoire	Liberia	Senegal	

Appendix 2. Multicollinearity test

Variable	VIF	1/VIF
HC	2.57	0.389212
POPG	2.13	0.470146
FIXMOBILET	1.65	0.606477
TO	1.39	0.717932
GE	1.25	0.797433
FDI	1.16	0.860351
GH_FDI	1.05	0.953973
INFLA	1.01	0.991030
Mean VIF	1.53	

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