

Ennin, Anthony; Wiafe, Emmanuel Agyapong

Article

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Cogent Economics & Finance

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Suggested Citation: Ennin, Anthony; Wiafe, Emmanuel Agyapong (2023) : The impact of mining foreign direct investment on economic growth in Ghana, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 11, Iss. 2, pp. 1-16, <https://doi.org/10.1080/23322039.2023.2251800>

This Version is available at:

<https://hdl.handle.net/10419/304195>

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To cite this article: Anthony Ennin & Emmanuel A. Wiafe (2023) The impact of mining foreign direct investment on economic growth in Ghana, Cogent Economics & Finance, 11:2, 2251800, DOI: [10.1080/23322039.2023.2251800](https://doi.org/10.1080/23322039.2023.2251800)

To link to this article: <https://doi.org/10.1080/23322039.2023.2251800>



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Received: 14 December 2022
Accepted: 21 August 2023

*Corresponding author: Emmanuel A. Wiafe, Business School, Ghana Institute of Management and Public Administration (GIMPA), GIMPA Takoradi Campus, Achimota Accra AH 50, Ghana
E-mail: ewiafe@gimpa.edu.gh

Reviewing editor:
Goodness Aye, Agricultural Economics, University of Agriculture, Makurdi Benue State, Nigeria

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DEVELOPMENT ECONOMICS | RESEARCH ARTICLE

The impact of mining foreign direct investment on economic growth in Ghana

Anthony Ennin¹ and Emmanuel A. Wiafe^{2*}

Abstract: This paper investigates the impact of mining foreign direct investment on economic growth in Ghana using quarterly time series data from 1996–2015. The study employs the Autoregressive Distributed Lag bounds testing approach to cointegration and the error correction model to investigate the existence of a long-run and short-run equilibrium relationship between foreign direct investment into the mining sector and economic growth. The study established that foreign direct investment into the mining sector hurts economic growth in Ghana in the long run but a positive in the short run. The study also finds that private sector credit, capital stock, government spending, and labour participation rate have a statistically significant positive relationship with economic growth in the long run. Trade openness exhibited a statistically significant negative long-run relationship with economic growth, while inflation had a positive but insignificant impact on economic growth for the study period. The study recommends that government should encourage research and development in the mining sector and align mining and other environmental policies to ensure sustainable growth. It is further recommended that government tactfully provide investment incentives to ensure the development of other sectors to avoid the Dutch disease.

ABOUT THE AUTHORS

Anthony Ennin holds a Master's in Finance and Investment from the Kwame Nkrumah University of Science and Ghana Education Service, Ghana. His research interest includes financial management, investment management, corporate finance, and international finance.

Emmanuel Agyapong Wiafe is a Senior Lecturer at the Accounting and Finance Department of the Business School, Ghana Institute of Management and Public Administration (GIMPA), Achimota, Ghana. He holds a Master of Philosophy in Economics and currently pursuing his PhD at the University of KwaZulu Natal. His main areas of expertise are development economics, macroeconomics, international and monetary economics, applied econometrics, and sustainable development for developing countries.

PUBLIC INTEREST STATEMENT

Over the past decades, there have been massive FDI inflows into Ghana's economic sectors. Statistics indicate that mining receives Ghana's most significant portion of FDI inflows. Ghana has become the preferred nation for most mining investors in Sub-Saharan Africa. Given this, the paper concentrated on mining FDI's impact on Ghana's economic growth. The results from the study validate the dependency theory, which states that FDI could positively and significantly affect economic growth in the short-run but may adversely impact economic growth in the long run. The results further validate the resource curse hypothesis for Ghana. Our findings suggest implementing mining policies that target the value addition of mineral resources instead of exporting raw mineral resources. Finally, the government should encourage research and development in the mining sector and align mining and other environmental policies to ensure sustainable growth.



Subjects: Economics and Development; Economics; Finance

Keywords: cointegration; mining FDI; economic growth; Ghana; ARDL; FDI-growth nexus

1. Introduction

Growth and economic development agenda are agreeably driven by Foreign direct investment (FDI) in developing economies (Anwar & Sun, 2012; Cantah et al., 2018; Lugemwa, 2012, 2014; Wiafe & Anning, 2021). The poverty reduction and inequality effect (Agarwal et al., 2017; Jensen & Rosas, 2007; Mahutga & Bandelj, 2008) of FDI is affirmed in the literature. Economic growth theories envisage FDI to engender growth multiplier effects such as increased production efficiency, improved human capital, innovation, investment and capitalisation, internalisation, technology transfer, and broadening of host nations' markets and generation of employment (Agosin & Machado, 2005; Bosworth & Collins, 1999; Harzing & Sorge, 2003; Javorcik, 2004; Sakyi et al., 2015). Despite the theoretical consensus that FDI increases economic growth, empirical proof offers mixed conclusions. Although many studies have established a positive correlation between FDI and economic output (Antwi et al., 2013; Frimpong Magnus & Oteng-Abayie, 2006; Mahmoodi & Mahmoodi, 2016; Sothan & Zhang, 2017; Sultanuzzaman et al., 2018; Wiafe & Anning, 2021), other studies find no such relationship (Carbonell & Werner, 2018; Carkovic & Levine, 2005; Sakyi et al., 2015). The effect of FDI on economic growth is negative among studies (Carkovic et al., 2005; Mencinger, 2003; Türkcan, Duman, & Yetkiner, 2008).

Despite the divergent results, FDI is believed to affect economic growth through the absorptive capacity of the host country, and estimates may be affected by country heterogeneity. Given this, we argue that even in a specific country, the absorptive capacity is heterogeneous across sectors. Hence, it calls for particular attention to sectoral FDI inflows impact studies. Therefore, the appropriate question to ask in this time of limited capital inflows and a highly competitive environment for FDI destinations is; what is the required sectoral foreign investment for the economic growth of a country? The answer to this question would help policymakers and governments to strategise in their quest for foreign direct investment. FDI to different sectors produces different results in a host country's economy. Manufacturing and mining FDI are noted for technology transfer and productivity spillover. However, "service FDI tends to be associated with technical, management and marketing know-how, expertise, organisational skills, and information in general" (Doytch & Narayan, 2016). Studies that have attempted to disaggregate FDI are scanty—a few found investments in the natural resources sector to impact growth and development. For instance, in Zimbabwe, mining sector FDI significantly affects economic growth more than domestic investment and non-mining sector FDI (Gochero & Boopen, 2020). Nonetheless, Asiedu (2013) confirms the natural resource curse among sub-Saharan African Countries.

We study the mining sector due to its central role in the development of Ghana. Ghana's mining sector contributes approximately 40% of Gross Foreign Exchange earnings, accounting for about 5.2% of GDP (Cobbinah, 2011). Ghana has become the desired destination for most mining investors. Statistics reveal that the mining sub-sector was the second contributor to GDP in Ghana for the year 2019, making it a key sector for the growth and development of the country. Moreso, economic reform and structural adjustment programs targeted the mining sector. The ERP era resulted in a significant transformation of the mining sector regulatory framework in the country ranging from exchange rate management to small-scale mining activity as well as the establishment of the Minerals Commission by the Minerals and Mining law in 1986 (Ayee et al., 2011). These programs aimed to turn around the economic downturn, ameliorating the effects of the 1980 debt crisis and stimulating increased FDI flow into Ghana (Forward, 2000). The reforms undertaken by the government spurred a positive investor outlook and increased mineral productivity, leading Ghana to become a force in the mining space in West Africa (Tsuma, 2010). In furtherance, almost all existing empirical studies for Ghana on FDI and economic growth nexus focused overwhelmingly on the aggregate effect of FDI on economic growth, neglecting sector-

specific studies. To the best of our knowledge, very few empirical studies exist in the academic world on the sectoral effect of mining FDI on economic growth (Gochero & Boopen, 2020; Imoudu, 2012; Imoughele & Ismaila, 2013). Also, none of these has considered the Ghanaian case. To fill this vacuum in literature, we concentrate on the mining sector as a response to the research gap and conduct a robust investigation of how mining FDI influences economic growth in Ghana, where empirical evidence seems non-existent. Also, the paper employs a suitable methodology to avert contradictions in findings. Moreover, the results would be relevant for other developing nations with similar socioeconomic and demographic conditions identical to Ghana. Our findings would also lay the foundation for further studies on mining FDI and the economic growth linkage of Ghana.

2. Theoretical and empirical review

The FDI-growth nexus theories are rooted in endogenous growth theories. Endogenous growth models demonstrate that liberal economic policies that permit the free movement of capital lead to long-run economic growth. In this respect, liberalised markets result in a large amount of FDI inflow needed for economic growth. Similarly, capital enhances returns to scale and is a precursor of developing economies' economic growth (Gochero & Boopen, 2020). FDI net inflows augment the needed capital; hence, FDI positively influences development through capital and technology. The neo-classical growth model considers technology an exogenous variable but sees labour and capital as contributing factors to economic growth (Solow, 1956; Swan, 1956). Therefore, this growth model suggests that FDI significantly impacts real GDP growth with its attendant administrative, marketing, and professional skills and access to the market through MNCs' networks.

Moreover, the modernist school assumes that FDI and portfolio investment are requisite for growth (Awolusi, n.d.). Thus, perfect competition and removing bottlenecks to capital flow promote growth-engendering investment inflows. The linkage theories lend credence to the apparent effect of FDI on the mining sector to growth. For instance, Bunte et al. (2018) assert that the mining sector's diverse input requirements lead to backward consumption linkages in an economy. These linkages and integration of firms in the local market of FDI may result in economic expansion, creating multiplier effects that boost the host economy's growth and development.

Nonetheless, the dependency school of thought suggests that FDI is estimated to exert a negative impact on growth because FDI generates monopolistic tendencies in the industrial sector and eventually causes under-deployment of domestic resources (Bornschier & Chase-Dunn, 1985). The dependency theory, therefore, states that FDI could positively impact economic output in the short-run but may negatively affect economic growth in the long run.

FDI-growth nexus studies have divergent outcomes. Some studies found that FDI engenders the host country's economic growth (Ciobanu, 2021; Rao et al., 2020; Sothan & Zhang, 2017). Despite this, other studies found no relationship between FDI and economic development (Agbloyor et al., 2016). Wu et al. (2020) found a non-linear relationship between economic growth and FDI. The study showed that the effect of FDI diminishes in the presence of a high fiscal deficit. Such a scenario may be due to the crowding-out effect of government spending. Other papers believe that the impact of FDI on growth is contingent on certain prevailing conditions like well-developed financial sectors, the quality of institutions, and human capital development (Adegboye et al., 2020; Asamoah et al., 2019; Sirag et al., 2018). At the sectoral level, Imoudu (2012) estimated the connection between FDI and economic growth in Nigeria. The study employed annual data from 1980–2009 and the Johansen Cointegration methodology. The paper established an insignificant relationship between FDI in agriculture, manufacturing, and petroleum sectors and economic growth for Nigeria in the long run. Telecom and mining FDI significantly impacted development in the long run with positive and negative signs, respectively. Thus, the absorptive capacity and the ability to utilise the FDI are relevant to economic growth and government effort. From the endogenous growth theory and International Business, the interplay of government and MNCs

has remarkable growth-enhancing mechanisms (Ozawa & Castello, 2001). In other words, FDI and government efforts are complementary in developing the host economy.

Few papers examining FDI's role in the host economy focused on sector-specific FDI. Studies on manufacturing FDI have found a positive effect of FDI on the productivity of manufacturing firms in a host country, economic growth, and employment (Amighini & Franco, 2013; De & Nagaraj, 2013; Wang, 2009). In Agriculture, FDI affects economic growth positively (Awunyo-Vitor & Sackey, 2018; Djokoto et al., 2022; Edeh et al., 2020; Epaphra & Mwakalasya, 2017). The channels of transmission of the Agricultural FDI to the economy works through improving the cultivation methods and impacting the agricultural value chain. However, some studies predict a negative effect of Agric FDI on growth or even weaker relationships.

Cademartori (2002) focused on the impact of FDI on the development of the Chilean mining regions and found that the growth in income does not compensate for resource depletion and other human development challenges. Thus, according to the study, FDI may negatively affect environmental and economic sustainability. Awolusi (n.d.) focused on South African Countries and confirmed the positive effect of mining sector FDI on economic development. Awolusi concluded that the resource curse does not affect the South African economies that engage in mining activities. In Zimbabwe, FDI in the mining sector is weakly growth-inducing. The indication is that it takes much longer for the economic benefits of FDI to manifest in the economy's growth (Gochero & Boopen, 2020).

A summary of the literature indicates that few empirical studies have been conducted on the sectoral impact of FDI on economic growth. Perhaps, the lack of attention to empirical works on the sectoral implications of FDI could account for the failure of some developing countries like Ghana to benefit from FDI abundantly. Furthermore, extant studies on the FDI—growth nexus, especially in Ghana, fail to examine the mining sector FDI on economic growth relationship. Nonetheless, the mining sector in Ghana plays a vital role in the growth process and attracts FDI in the country. Therefore, estimating the extent of mining sector's FDI impact on the growth of the host country is essential.

3. Model specification and data

We model the economic growth function following the Solow growth models. Employing the Cobb-Douglas production function with constant elasticity and technology factor and applying natural log to the function to arrive at the estimated equation for the study. The association between mining FDI on economic growth is evaluated using the following econometric model:

$$\ln \text{RGDP}_t = \beta_0 + \alpha_1 \ln \text{FDIM}_t + \alpha_2 \ln \text{NRR}_t + \alpha_3 \ln \text{PSC}_t + \alpha_4 \ln \text{LAB}_t + \alpha_5 \ln k_t + \alpha_6 \ln \text{INF}_t + \alpha_7 \ln \text{GOV}_t + \alpha_8 \ln \text{TRA}_t + \varepsilon_t \quad (1)$$

Where RGDP represents real gross domestic product measuring economic growth, FDI represents mining FDI, NRR is the total natural resources rent, PSC represents private sector credit, LAB stands for labour participation rate, K is capital stock, INF represents inflation, GOV represents government spending, and TRA represents trade openness. Also, β_0 is a constant, α_1 to α_8 stands for coefficient of the respective independent variables, ε_t Represents the error term, \ln represents the natural logarithm, and t is the time considered (i.e., 1996 to 2015). The following $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7, \alpha_8$ are coefficient.

The study engaged quarterly time series data from 1996 to 2015 for Ghana due to the availability of data on the variables used for the study. Data on mining FDI were obtained from the Minerals Commission of Ghana. Also, data on economic growth (as measured by real GDP), natural resources rent, private sector credit, labour force, capital stock, inflation, and government spending and trade openness were accessed from the World Development Indicators database.

Existing empirical and theoretical studies informed the choice of the variables. The inclusion of capital and labour followed from the endogenous growth models (Solow, 1956; Swan, 1956). The study measured labour as a population between 18 and 60 years, and capital was proxied with gross fixed capital formation (Ho & Iyke, 2018; Wiafe & Anning, 2021). The inclusion of resource rent, inflation, government expenditure, trade openness, and credit to the private sector was informed by empirical studies (Adams & Atsu, 2014; Asamoah et al., 2019; Asiedu, 2006; Awolusi, n.d.; Bunte et al., 2018; Gochero & Boopen, 2020; Ho & Iyke, 2018; Ozawa & Castello, 2001; Wiafe & Anning, 2021; Wu et al., 2020)

4. Estimation strategy

The study conducted stationarity tests to ensure that the variables used were stationary by determining the variables' order integration. The stationarity test is critical because it aids in the determination of the appropriate estimation technique to be employed for the study. The study uses the Phillips-Perron (PP) test and the Augmented Dickey-Fuller (ADF) test to ascertain the stationarity characteristics of the variables employed in the study. The Phillips-Perron (PP) test and the Augmented Dickey-Fuller (ADF) tests test the null hypothesis of unit root against the alternate view of the nonexistence of unit root. In this case, rejecting the null hypothesis suggests that a variable is non-stationary and thus has a unit root and vice versa.

The results of the Phillips-Perron (PP) test and the Augmented Dickey-Fuller (ADF) test necessitated the use of an Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration. The ARDL has the advantage of robustness to small sample-size observations. It can be employed if the variables are a mix of I (0) and I (1), I (0), or I (1) only and also assumes that all the variables are endogenous. It also provides estimations for long-run and short-run coefficients of variables concurrently. Finally, the ARDL model permits the inclusion of different optimal lags in the model (Pesaran et al., 2001).

The ARDL technique involves three (3) stages to establish a long-run equilibrium relationship between variables. The first step consists of the application of the OLS method on the model equation as follows:

$$\begin{aligned} \Delta \ln RGDP_t = & \beta_0 + \sum_{i=1}^k \alpha_1 \Delta \ln RGDP_{t-1} + \sum_{i=1}^k \alpha_2 \Delta \ln FDIM_{t-1} + \sum_{i=1}^k \alpha_3 \Delta \ln NRR_{t-1} \\ & + \sum_{i=1}^k \alpha_4 \Delta \ln PSC_{t-1} + \sum_{i=1}^k \alpha_5 \Delta \ln LAB_{t-1} + \sum_{i=1}^k \alpha_6 \Delta \ln K_{t-1} \\ & + \sum_{i=1}^k \alpha_7 \Delta \ln GOV_{t-1} + \sum_{i=1}^k \alpha_8 \Delta \ln INF_{t-1} + \sum_{i=1}^k \alpha_9 \Delta \ln TRA_{t-1} \\ & + \alpha_{10} \ln RGDP_{t-1} + \alpha_{11} \ln FDIM_{t-1} + \alpha_{12} \ln NRR_{t-1} + \alpha_{13} \ln PSC_{t-1} \\ & + \alpha_{14} \ln LAB_{t-1} + \alpha_{15} \ln K_{t-1} + \alpha_{16} \ln GOV_{t-1} + \alpha_{17} \ln INF_{t-1} + \alpha_{18} \ln TRA_{t-1} \\ & + \epsilon_{t-1} \end{aligned} \quad (2)$$

Where Δ represents the first difference, k symbolises lag length, and β_0 symbolises the intercept. The remaining variables maintain their earlier descriptions. Also, the first part of equation (2) with coefficients α_1 to α_9 represents the short-run parameters of the ARDL model, while the other factor with coefficient α_{10} to α_{18} also defines the long-run parameters of the model. The study employed Schwartz Bayesian Information Criterion (SIC) to specify the lag length of the variables. The second step comprises the calculation of the F-statistic as proof of cointegration among the variables. The null hypothesis of no cointegration among the variables was evaluated against the alternate postulation of cointegration, as stated below.

$$H_0: \alpha_9 = \alpha_{10} = \alpha_{11} = \alpha_{12} = \alpha_{13} = \alpha_{14} = \alpha_{15} = \alpha_{16} = \alpha_{17} = \alpha_{18} = 0$$

$$H_1: \text{At least one of } \alpha_9, \alpha_{10}, \alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14}, \alpha_{15}, \alpha_{16}, \alpha_{17}, \alpha_{18} \neq 0$$

For certainty of cointegration among the variables, the computed F-statistic must be compared with the 5% upper and lower bounds critical values. It must be noted that when the F-statistic falls below the 5% lower bound critical, there is no cointegration among the variables and vice versa. In this case, there is the presence of long-run linkage between the variables under investigation. Conversely, the cointegration decision is inconclusive when the F test falls within the 5% critical bounds. The third step of the ARDL technique is the estimation of the long- and short-run coefficients.

5. Empirical results and discussion

This section of the paper presents and discusses in detail the results obtained from data analysis.

6. Unit root tests results

The results from the unit root test are in Tables 1 and 2. The paper employed an Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test to check for the stationarity characteristics of the variables used in the study. The ADF and PP stationarity tests showed that LnRGDP, LnGOV, LnTRA, LnK, LnLAB, LnNRR, and LnPSC of order one while LnFDIM and LnINF

Table 1. Augmented Dickey-Fuller test

Variables	Level		First difference	
	ADF statistics	Critical value (5%)	ADF stat.	Critical value (5%)
LnRGDP	-1.3240	-2.9036	-2.9914**	-2.9036
LnFDIM	-3.7076***	-2.9012		
LnNRR	-2.1867	-2.9036	-2.9913**	
LnPSC	-1.6553	-2.9036	-2.9626**	
LnLAB	-2.4139	-2.9049	-2.9974**	
LnK	-1.4019	2.9012	-3.7351***	
LnINF	-3.0557**	2.9012		
LnGOV	-0.4104	-2.9012	-3.2099***	
LnTRA	-1.4354	-2.9036	-2.9996**	

***, **, and * mean statistically significance at 1%, 5%, and 10%, respectively.

Table 2. Philips – Perron test

Variables	Level	First difference
	PP statistics	PP statistics
LnRGDP	-0.8760	-5.2461***
LnFDIM	-2.9788**	
LnNRR	-1.6529	-5.1102***
LnPSC	-1.2911	-4.9250
LnLAB	-0.7445	-2.9383**
LnNK	-2.1297	-5.1381***
LnINF	-3.0373**	
LnGOV	-0.3386	-4.4803***
LnTRA	-1.7623	-4.7233***

Critical value at 5% significant level at first difference = -2.8991, Levels= 2.8986.

***, **, and * mean statistically significance at 1%, 5%, and 10%, respectively.

were stationary at levels. This further authenticates the appropriateness of the use of the ARDL technique.

7. Results of ARDL bounds testing

The ARDL bounds testing results confirm cointegration among the variables employed in the study, as presented in Table 3. The Schwartz-Bayesian Criterion was the basis for selecting the lag length, and the maximum lag length specified is three (3). As indicated in Table 3, the computed F-statistic (34.7185) is larger than the 5% upper-bound critical value of (3.15).

The results indicate a long-run association among the variables when real GDP is the dependent variable.

8. Model diagnostic and stability tests

After estimating the regression model, diagnostic tests (See Table 4) were conducted to ensure the model's fitness. The model is free from problems such as heteroscedasticity, serial correlation, functional form, and residual normality. Also, the stability test was performed.

Table 4 shows estimated ARDL model passed the normality test with a T-statistic of 2.8431 and a probability value of 0.2413. Also, the Serial Correlation LM test shows the nonexistence of serial correlation between the variables since the T-statistic of 1.0241 and the probability value of 0.3662 was statistically insignificant. Moreover, the Heteroscedasticity test also disclosed the nonexistence of heteroscedasticity in the error term of the estimated model, as indicated by a t-statistic of 0.4360 and a probability value of 0.9939. Furthermore, the test for functionality shows that the estimated model is free from specification errors as the T-statistic of 1.0213 and p-value of 0.3126 were also statistically insignificant. The diagnostic tests lend support to the reliability and suitability of the estimated model for policy purposes from the diagnostic test results. Again, regarding the model stability, the plots of CUSUM and CUSUMSQ (see Figure A1 and Figure A2 in the appendix) showed that the model is stable as the plots fall inside the critical bounds at a 5% significance level.

Table 3. ARDL bounds testing for cointegration relationship

Test Statistic	Value	Sig.	I(0)	I(1)
F-statistic	34.7185***	10%	1.85	2.85
K	8	5%	2.11	3.15
		1%	2.62	3.77

***, **, and * mean statistically significance at 1%, 5%, and 10%, respectively.

Table 4. Diagnostic test results

Diagnostic test	Test statistic	Probability value
Normality	2.8431	0.2413
Serial correlation	1.0241	0.3662
Heteroscedasticity	0.4360	0.9939
Functional form	1.0213	0.3126
CUSUM	Stable	
CUSUMSQ	Stable	

Source: Authors.

Table 5. Estimated short-run results

Variable	Coefficient	Std. Error	T-Statistic	Probability
D(lnRGDP(−1))	0.2099***	0.0346	6.0629	0.0000
D(lnRGDP(−2))	0.2032***	0.0369	5.5152	0.0000
D(lnRGDP(−3))	0.2002***	0.0351	5.6979	0.0000
D(lnFDIM)	0.0830***	0.0195	4.2585	0.0001
D(lnNRR)	0.4760***	0.0234	20.3632	0.0000
D(lnPSC)	−0.4120***	0.0339	−12.1618	0.0000
D(lnLAB)	−3.3387***	0.8939	−3.7349	0.0005
D(lnK(−3))	0.0799**	0.0371	2.1548	0.0364
D(lnINF)	−0.1409***	0.0155	−9.1107	0.0000
D(lnINF(−1))	−0.0268*	0.0151	−1.7773	0.0821
D(lnINF(−2))	−0.0270*	0.0151	−1.7826	0.0813
D(lnINF(−3))	−0.0290**	0.0140	−2.0712	0.0440
D(lnGOV)	0.2391***	0.0483	4.9465	0.0000
D(lnGOV(−1))	−0.1005*	0.0550	−1.8284	0.0740
D(lnGOV(−2))	−0.0971*	0.0549	−1.7675	0.0838
D(lnGOV(−3))	−0.0835*	0.0466	−1.7904	0.0800
D(lnTRA)	0.0542**	0.0259	2.0959	0.0416
CointEq(−1)	−0.3303***	0.0159	−20.7847	0.0000
R-squared	0.9542	Mean dependent var		0.0147
Adjusted R-squared	0.9376	SD dependent var		0.0512
SE of regression	0.0128	Akaike info criterion		−5.6500
Sum squared resid	0.0090	Schwarz criterion		−5.0059
Log-likelihood	235.6985	Hannan-Quinn criteria.		−5.3926
Durbin-Watson stat	1.9497			

***, **, and * mean statistically significance at 1%, 5%, and 10%, respectively.

9. Estimated short-run results

Table 5 presents the short-run regression results from the ARDL model. The short-run estimates indicate that past economic growth leads to significant economic growth in light of standard macroeconomic thinking of the rational expectation hypothesis. Intuitively, increases in the GDP of an economy indicate a healthy economy. Investors use such information as a sign of economic expansion, trigger investment and increase productivity. This further means that real GDP of the preceding three quarters of the year positively affects the real GDP of the current quarter. The results also show that mining FDI is positively and significantly associated with GDP growth at a 1 per cent significance in the short run.

The coefficient of mining FDI indicates that an increase in mining FDI by 1% would increase economic growth by 0.08 per cent. This finding is consistent with prior expectations. The small coefficient of mining FDI signifies that FDI in the mining sector takes some time for its comprehensive rippling effect to be felt within the entire economy. Bucaj (2018) and Gochero and Boopen (2020) found similar results for Zimbabwe and Kosovo. Also, the results revealed that natural resource rent has a positive and statistically significant relationship with economic growth. Our findings indicate that this relationship is statistically significant at a per cent significant level with economic growth in the short run. Thus, a percentage increase in natural resources rent will increase economic growth by 0.48%. The economic implication of this finding is that revenue derived from natural resources has the potential to boost economic growth in the country in the short run. This finding is consistent with Adabor et al. (2022), who found that natural resources rent significantly positively affects economic growth in the short run in Ghana.

Furthermore, the coefficient of private sector credit is negatively and statistically significant at a 1 per cent significance level with GDP in the short run. This means a percentage increase in private-sector credit will decrease the GDP by 0.41 per cent. The economic implication of this finding is that if domestic credit to the private sector is channelled into innovative activities, projects, and businesses, the anticipated positive impact will not be experienced in the short term. Instead, it will take some time for the benefits of these investments to ripple in the economy. This finding further suggests that if private firms misapply domestic credit given to them by banks for capital investment to meet recurrent expenditure, it will hurt economic growth in the short term. This empirical result confirms the findings of (Abubakar & Gani, 2013; Olowofeso et al., 2015; Yeboah, 2020), who found that private-sector credit harms economic growth in Nigeria and Ghana in the short run. Again, the past level of capital stock (lag 3) positively impacted economic growth in Ghana and is significant at a 5% level. Thus, past capital stock favourably affects economic growth in the last quarter. The role of capital stock is attributed to the fact that when companies acquire tangible non-current assets such as vehicles, plants and machinery, buildings, and other tools, they are used for producing goods and services, consequently improving the economy's state. This finding validates the findings of (Githanga, 2015; Bal et al., 2016) for Kenya and India, respectively.

The results indicate that inflation has a negative and statistically significant relationship with economic growth in the short run. This association is statistically significant at the 1 % significance level. We find that all others being constant, a percentage point increase in inflation will impede economic growth by 0.14 per cent. Similarly, the past inflation levels (lags 1, 2 and 3) negatively impacted economic development in Ghana but were all insignificant, except lag 3, which was significant at 5%. This finding is consistent with the economic theory that inflation is negatively related to economic growth, given that it reduces the purchasing power of individuals. Inflation increases the prices of goods and services and reduces aggregate household spending. The effect causes a reduction in firms' production as factor cost increases and demand decreases, resulting in a decline in economic growth. This finding is consistent with Datta and Mukhopadhyay (2011) in Malaysia and Bal et al. (2016) in India.

Government spending positively impacted economic growth and was statistically significant at 1% significance. All things being equal, a percentage point increase in government expenditure boosts economic growth by 0.24 per cent in the short term. This finding indicates that increased government spending will increase production, consumption, and investment in Ghana, translating into GDP growth in the short run. Our result is consistent with Okoye et al. (2019) and Poku et al. (2022). Additionally, the past levels of government spending (lags 1, 2, and 3) influence economic growth negatively. This may result from a situation where government expenditure is significantly financed through debt. In that case, future debt financing depletes resources through interest payments leading to government financing constraints and constricting economic growth.

Trade openness exerted a positive effect on real GDP growth and was significant at 5% significance. Nevertheless, the degree of the impact is small because a percentage-point increase in trade openness leads to economic growth by 0.5 per cent. This result meets a priori expectations. This finding authenticates the trade-growth hypothesis that an increase in trade culminates in more significant growth of a country's economy. This finding aligns with the findings of (Keho, 2017; Mangir et al., 2017; Sakyi et al., 2015). However, it contradicts the findings of (Lawal et al., 2016; Polat et al., 2015), who found an adverse or insignificant effect of trade on GDP growth.

The error correction coefficient, which measures the adjustment speed of the variables before converging to long-run equilibrium, was negative and statistically significant. Specifically, the coefficient of -0.3303 implies that 33% of the disequilibria are restored every quarter. Finally, the estimates from the regression indicate that the Autoregressive Distributed Lag model perfectly matches the data as depicted by a very impressive R^2 and adjusted R^2 values of 0.9542 and 0.9376, respectively. The adjusted R^2 value suggests that 94% of Ghana's economic growth deviations, as

Table 6. Estimated long results

Variable	Coefficient	Std. Error	T-stat.	Probability
LnFDIM	−0.0990***	0.0299	−3.3137	0.0016
LnNRR	0.0050	0.0429	0.1158	0.9083
LnPSC	0.3653***	0.0675	5.4128	0.0000
LnLAB	6.2536***	0.5243	11.9274	0.0000
LnK	0.2192***	0.0811	2.7038	0.0091
LnINF	0.0261	0.0312	0.8351	0.4073
LnGOV	0.6918***	0.0863	8.0160	0.0000
LnTRA	−0.2375***	0.0545	−4.3540	0.0001
Const.	−25.5340***	2.2749	−11.2250	0.0000

***, **, and * mean statistically significance at 1%, 5%, and 10%, respectively.

measured by real GDP growth, can be ascribed to the fluxes in the independent variables employed in the analysis after adjusting for degrees of freedom.

10. Estimated long run results

The outcomes of the long-run estimated results are presented in Table 6. From the results, mining FDI has a negative and statistically significant effect on real GDP growth in Ghana in the long run. The negative relationship between mining FDI and economic growth means massive FDI in the mining sector affects Ghana's growth adversely in the long run. This finding agrees with the dependency theory, which states that FDI may negatively affect economic growth in the long run (Bornschieer & Chase-Dunn, 1985), and Imoudu (2012) who found that mining FDI significantly negatively impacts economic growth in Nigeria.

The results suggest a possibility of neglect of other productive sectors of Ghana's economy due to the mining activities. Thus, excessive concentration of investment in the mining sector may cause Dutch disease in the Ghanaian setting. Therefore, the intense, long-term focus on the mining sector affects the productivity of other industries (Botta et al., 2016). The mining sector development through FDI causes a rise in real wages in the mining sector (which drives labour mobility out of agriculture and the manufacturing sectors that may cause lopsided growth), currency appreciation, and land loss for agricultural purposes, leading to a negative growth effect.

Similarly, large-scale mining in Ghana results in agricultural land loss (Brahmbhatt et al., 2010; Doso Jnr et al., 2016), loss of agricultural labour, lower yields, and land degradation just to mention a few of the repercussions that could affect agriculture. As a result, local food costs may increase. Farmers' livelihoods are also affected by joblessness and reduced income. The outcome of the large-scale mining activities thus affects long-term agricultural export and raw material production for agro-industries, slowing economic growth in the long run. Moreso, the limited spillover effect due to a lack of human resource development, capacity, proper linkages, and development of technology or new industries, which are essential growth-inducing sectors, may have a long-run negative effect on economic growth.

Natural resources rent showed a positive but insignificant impact on economic growth. This result indicates that total natural resources rent does not stimulate economic growth in Ghana. This result agrees with Mehar et al. (2018) and Yeboah (2020), who found that natural resource rent does not boost economic growth in the long run in Pakistan, India, and Ghana. This finding suggests the presence of the resource curse hypothesis or the "Dutch disease" in Ghana. Consequently, a significant upsurge in natural resource income will likely hamper the overall economy's growth.

Furthermore, the results indicate that private sector credit is positively and significantly associated with Ghana's economic growth in the long run. Thus, financial sector development is critical to the economy's long-term growth. A well-developed financial sector reduces the cost of transactions, reduces information asymmetry, and ensures efficient allocation of resources. This result implies that a robust financial sector that makes funds available for investment enables firms to finance economic and productive activities that promote economic growth. Access to credit boosts businesses' productive capacity and develops their potential to undertake expansion and provide goods and services for consumption. The result will invariably reduce unemployment and inflation and engender economic growth and development. Therefore, continual provision of access to finance to the private sector is vital for economic development. This result supports the works of Olowofeso et al. (2015).

Again, the empirical results also show that the labour force exerts a positive and statistically significant long-run association with economic growth in Ghana. This finding means that a percentage increase in the labour force is associated with a 6.25 % increase in economic growth in the long run at a 1% significance level. Thus, labour force and economic growth show an elastic association. This further means that when labour force participation increases by one per cent, it will boost economic growth by 6.25 per cent. The result conforms with economic theory, showing a positive and significant relationship between labour force participation and economic growth and confirming the theoretical expectation that increased labour participation should lead to economic growth and development. Impliedly, the more involvement from Ghana's active labour force, the more they stimulate economic growth and development. This finding agrees with studies (Appiah, 2018), which found that labour force positively impacts the economic growth of developing nations.

Also, the results indicate a positive and statistically significant long-run relationship between that capital stock and economic growth in Ghana in the long run at a 1% significance level. Hence, capital and economic growth show an elastic relationship. This further means that when capital stock increases by one per cent, it will increase economic growth by 0.219 per cent. This result suggests that higher capital formation contributes to Ghana's economic growth in the long run. This finding is not surprising, especially for Ghana. This finding corroborates the results of (Bal et al., 2016; Githanga, 2015; Poku et al., 2022), who find that capital formation significantly positively impacts economic growth in the long run in Kenya, India, and Ghana. Again, from fundamental growth theories, either the classical economist or the Keynesian School, capital accumulation or investment is seen as a means to enhance productivity.

Also, the result indicates a positive and insignificant relationship between inflation and GDP growth in the long run. The study supports the work of Adu (2013), who found that inflation has no significant effect on economic growth in the long run, and Datta and Mukhopadhyay (2011), who also find inflation to affect economic growth in Malaysia insignificantly.

Furthermore, the results indicate that government spending positively correlates with GDP growth at the 1% significance level. Thus, a percentage point increase in Government spending will cause GDP growth to increase by 0.69 percentage points in the long run. This finding supports Poku et al. (2022). These studies found a positive long-run association between government spending and GDP growth in South Africa and Ghana, respectively. The economic implication of this finding is that when the government takes draconian measures to drastically reduce the cost of running government activities or borrow money from its trade partners, such actions have the potential to make funds available for the provision of basic infrastructures and other social amenities such as an extension of electricity to rural areas, hospitals, schools and roads construction which help to promote economic growth in the long-run.

Finally, the findings indicate that trade openness has a negative and significant relationship with GDP growth in the long run. The coefficient of trade openness is statistically significant at a 1%

significance level. The results mean that a percentage point increase in trade openness will cause GDP growth to decrease by 0.24 in the long run. This finding is consistent with Githanga (2015) who find a negative long-run relationship between Trade Openness and GDP growth in Kenya and Pakistan. Our findings, however, contradict some existing studies (Ijirshar, 2019; Malefane & Odhiambo, 2018; Nowbutsing, 2014). Trade liberalisation may negatively impact growth by displacing domestic businesses (Rodrik, 1997). In developing economies, nations open their markets to imports. Domestic producers cannot compete with lower-priced imports and might have to shut down, leading to unemployment, lower income, and slower economic growth (Rodrik, 1997). Evidence abounds in Ghana's poultry and textile industry, where imported commodities have led to these sectors' collapse (Nagguja, 2020; Safoa, 2019).

11. Conclusions

This paper investigated the long-run impact of mining FDI on economic growth in Ghana within the endogenous growth literature from 1995 to 2015. We employed the ARDL estimation technique for econometric analysis. The analysis focused on the trends and long and short-run relationships. The study investigated the short-run and the long-run relationship between the mining sector's FDI and GDP. The mining sector FDI impacts affect economic growth positively in the short run. Similarly, natural resource rent and trade openness influenced GDP growth positively, whereas inflation negatively affected the short run. Thus, macroeconomic instability dampens economic growth in the short run. Similarly, the positive impact of the mining FDI reverses, in the long run, suggesting the possibility of the economy exhibiting the signs of Dutch Disease syndromes. It was observed from the study that private sector credit, capital stock, government spending, and labour force economic growth have positive and significant impacts on economic growth in the long run. In contrast, trade openness negatively impacts development in the long.

The results and the findings from the study indicate that increased mining sector FDI may not be a long-term source or policy approach to improve or spur economic growth. The positive contributions of FDI to the mining sector only enhance economic growth in the short-run period. Mining sector FDI concentration in Ghana should consciously be guided and pushed into productivity and efficiency to ensure growth. However, Ghana must be careful not to over-rely on mining sector FDI as a means to ensure economic growth in the long run. Government should regulate the investments in the mining sector to not negatively affect the productivity of other sectors like agriculture, which will hamper growth in the long term. Similarly, the government should be conscious of developing other productive sectors and ensure linkages of the mining activities with other sectors to ensure sustainable growth of the economy in the long run.

Also, trade openness had a positive effect in the short run. However, it impacts economic growth negatively in the long run. The results of trade openness suggest that a wholesale liberalisation policy may not spur long-term economic growth for Ghana as it may not lead to sustained growth in the long run periods. Government spending plays a significant role in long-run economic growth. The government could use government spending or expenditure as a tool for long-run economic growth. However, there exists a negative short-run relationship between growth and government expenditure. Hence government must be tactful in using its expenditure to influence development. We recommend maintaining a balance in fiscal policy to avoid clouding out effect of government spending. This is so since the short run effect of credit to the private sector is negative while government expenditure is positive at the initial periods. Thus, the government must reduce domestic borrowing to allow space for domestic credit to the private sector.

Furthermore, capital influences growth positively in the short and long run. The results imply that strategic capital investment by the government and agencies boost efficiency and production for economic growth. The government can leverage investment into a long run capital investment to lead to sustained long run growth.

Future studies could examine the relationship between mining FDI and economic growth with other supplementary policy variables to provoke positive effects of mining FDI on economic growth. Future studies may investigate the threshold levels at mining FDI that influences economic growth positively. Future studies might consider structural breaks over the study period. Future studies may explore mining FDI and employment.

Author details

Anthony Ennin¹
 Emmanuel A. Wiafe²
 E-mail: ewiafe@gimpa.edu.gh
 ORCID ID: <http://orcid.org/0000-0002-7593-7493>
¹ Bompeh SHS, Ghana Education Service (GES), Sekondi-Takoradi, Ghana.
² Business School, Ghana Institute of Management and Public Administration (GIMPA), Accra, Ghana.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Citation information

Cite this article as: The impact of mining foreign direct investment on economic growth in Ghana, Anthony Ennin & Emmanuel A. Wiafe, *Cogent Economics & Finance* (2023), 11: 2251800.

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Appendix

Figure A1. Plot of Cumulative Sum of Squares of Recursive Residuals.

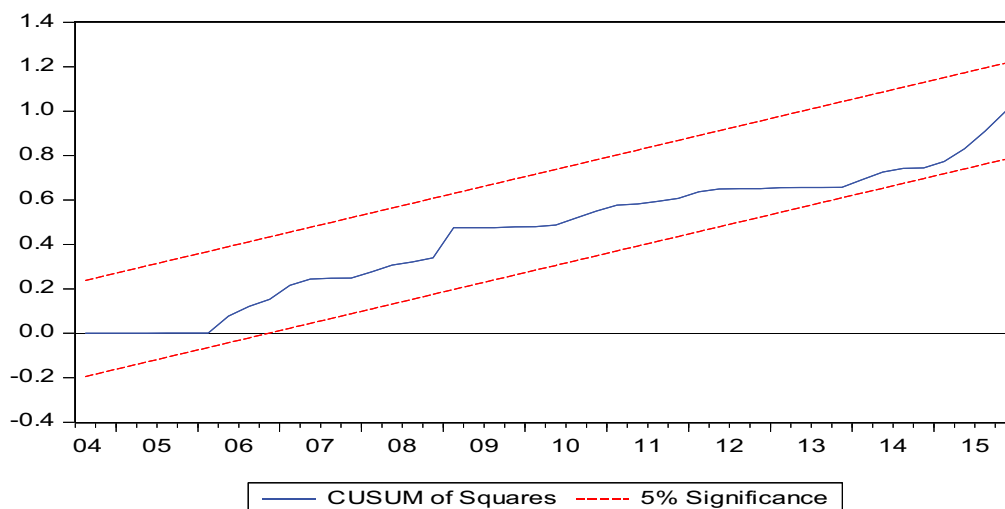


Figure A2. Plot of Cumulative Sum of Recursive Residuals.

