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Article

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A vector autoregression (VAR) analysis of corruption, economic growth, and foreign direct investment in Ghana

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Abstract: The paper investigated the dynamic and causal relationship among corruption, foreign direct investment, and economic growth simultaneously, a largely overlooked area in empirical studies, using a dataset from Ghana. It is among the few studies that explore the confluence of these variables and therefore contributes to understanding the contextual realities of the impact of FDI inflow, an often-prioritised policy choice, on widely used measures of social coherence and welfare. The study employed a vector autoregressive (VAR) estimation approach to empirically explore the relationships among corruption, foreign direct investment, and economic growth. The findings suggest that there is a reverse causality among corruption, foreign direct investment, and economic growth. This indicates that these variables are complementary rather than contradictory. These findings imply that central government and policymakers should not pursue any of these variables as a policy goal, but rather treat them as complements when modelling or formulating economic policies. This means that policies aimed at promoting foreign direct investment will not jeopardize or compromise the control of corruption and economic growth and vice versa.

Subjects: Macroeconomics; International Trade; incl; International Trade (incl. trade agreements & tariffs); Development Economics

Keywords: Corruption; foreign direct investment; economic growth; vector autoregression

1. Introduction

While the quality of FDI inflows, corruption and economic growth have been touted as critical to the achievement of the Sustainable Development Goals (SDG), it remains unclear how the simultaneous interaction of these variables should impact policy decisions. This paper examines the relationship(s) between corruption (or its control thereof), economic growth and foreign direct investment (FDI hereafter) in a bid to explore the impact of FDI inflow on corruption (or its control) in developing countries using a dataset from Ghana. It juxtaposes the current theoretical disposition that FDI inflow reduces corruption, with the hypothesis that FDI inflow can contribute to egregious and highly skewed rent creation in the host country (Leal et al., 2021; Zhu, 2012) by exploiting high-entry-barrier markets, pushing anticompetitive strategies that curtail the opportunities for potent and fair industry competition and hence resulting in more corruption (Krifa-Schneider et al., 2022). Ades and Di Tella (1999) suggest that high rents exacerbate corruption with FDI inflows because it improves the absorption capacity of firms to internalise the cost of corruption while, at the same time, increasing bureaucrats' incentives to engage in the quid pro quo exchange of their "control rights" for bribes.

Our approach of a tripartite and simultaneous simulation of economic growth, FDI, and corruption, using VAR, is innocuous and has an empirical basis. The general presumption, within empirical studies, is that each of the variables enumerated above impacts or is impacted by at least one of the other (Zhu, 2012). Besides, policy considerations about one variable often have embedded considerations of at least one of the other variables (Aragón & Rud, 2013; Li et al., 2021). Seemingly, the empirical consensus is that high levels of corruption (Wijeweera et al., 2010) and/or low levels of FDI inflows impact(s) economic growth negatively (Ades & Di Tella, 1999; Hanousek et al., 2021). On the flip side, low levels of economic growth can increase corruption and reduce FDI inflows (Brazys et al., 2017). Although from a theoretical perspective corruption can either act as a "grabbing hand" (also referred to as "sand in the wheel") or a "helping hand" (also referred to as "grease in the wheel") for FDI inflow (Onody et al., 2022), there is anecdotal evidence that high corruption within the public service reduces FDI inflow. However, the empirical evidence of the impact of FDI inflow on corruption is convoluted.

FDI signifies economic integration, and generally, economic integration is theoretically presumed to reduce corruption through various mechanisms. One argument is that economic integration enhances market competition and also the diffusion of good governance. The practical realities have contested this theoretical disposition. FDI inflows from large organisations such as Wal-Mart have been confirmed to lead to the bribing of public officials in emerging economies such as Mexico, Brazil, China, and India. The New York Times[1] confirms that "*Wal-Mart de Mexico was an aggressive and creative corrupter, offering large payoffs to get what the law otherwise prohibited.*" Transparency International has also confirmed that FDI inflows to developing economies usually involve bribes (Transparency International 2006). Recently, Brazys et al. (2017) have argued that since the interaction between FDI inflows and indigenous capital is complex, studies about FDI activity must consider the specific characteristics of both FDI and local environments. They base their assertion on the seemingly growing evidence that the FDI outcomes differ between poor, developing, and developed economies.

Based on preliminary anecdotal evidence Zhu (2012) and Li et al. (2021) suggest that the impact of FDI on corruption needs further exploration, as the existing literature oversimplifies the consequences of FDI activity on corruption in host countries. He bedrocks his argument on the differentiating characteristics of FDI (compared to other forms of capital inflow). His view is that FDI involves transferring physical assets, human resources, and technology while demanding deep engagement and long-term commitment from parent companies. This could create the incentives and opportunities to exert potent influences on host countries. Bunte et al. (2018) are part of a growing list of scholars that contest, in empirical studies about FDI outcomes, the relevance of sub-nationally geo-referenced investment, outcome, and covariate data and quasi-experimental methods of causal inference (Aragón & Rud, 2013; Aragóon & Rud, 2016; Fafchamps et al., 2017; Knutsen et al., 2017; Zhu, 2017). These authors suggest that since the effects of FDI vary across country and project characteristics, generalising its impact is complex, complicated by the lack of country-specific (or perhaps preference from aggregated regional and/or multi-country data) or even more granular site-specific data that results in imprecise estimates.

Ghana exemplifies many emerging African countries that have engaged in various deliberate and overt policies to attract FDI inflows and are dealing with the emanating in-country tensions therefrom. In recent times, there have been overt tensions and contrary views about the long-term potency of such deliberate policies, such as massive tax waivers and tax holidays and other concessionary measures, usually denied to indigenous businesses. This debate about the value relevance of such FDI inflows is an ongoing debate without consensus. Therefore, this study's findings contribute to this debate through an empirical analysis of the impact of FDI inflows on a variable of international concern within emerging economies, corruption. Suppose the widely held view about the adverse effects of corruption on national economies and the globalised world is accurate as has been widely documented (e.g., Li et al., 2021; Mauro, 1997; Rose-Ackerman, 1975). In that case, the growing dissent within some emerging economies about the impact of FDI inflow on corruption must be empirically investigated. To the authors' best knowledge, the literature about this relationship is scant, with only one paper directly exploring this relationship with data from

selected provinces in China (Zhu, 2017). Other studies, albeit few, have examined the impact of multinational corporations (MNCs) on corruption (Kwok & Tadesse, 2006; Li et al., 2021). Still, the findings of these studies do not comprehensively address the direct impact of FDI inflows because (a) not all investments by MNCs result from an inflow of foreign capital and (b) there are other categorisations of FDI inflows that are not related to MNC investments, as is the case in Ghana.

Besides, a substantial portion of studies about the impact of MNCs on corruption have used aggregated data across many regional blocs and economies (Kwok & Tadesse, 2006; Leal et al., 2021), relying on an often untested and unconfirmed hypothesis of substantive structural, cultural, and systematic homogeneity within economic and geographical blocs (Nsor-Ambala & Coffie, 2021). Recent evidence dispels this assumption of contrived homogeneity between African countries, confirming the need for studies about cultural and behavioural phenomena (such as corruption) to bear relevant contextual considerations (Nsor-Ambala & Coffie, 2021). Even if we accept the argument of substantial homogeneity across African economies (or regional blocs therein), it will be dubious to contest the wide variation in cultural, social, and behavioural attributes. Based on this and granted that acts of corruption can be cultural, social, behavioural, and systematic (Stathopoulou et al., 2021), an empirical basis exists to unravel studies bed-rocked on aggregated datasets into country-specific studies. Zander (2021) confirms that corruption has *"complex country-specific effects"* regarding adopting varying policies.

Moreover, recent data on FDI flows and corruption has improved, making new studies relevant. Therefore, the study seeks to confirm if and how FDI inflows impact corruption by answering the question:

What is the relationship between FDI inflow, Corruption, and Economic Growth in Ghana?

This study answers the numerous calls, such as by Otusanya et al. (2012) and Leal et al. (2021), for rigorous studies about the impact of FDI inflow on corruption in African countries. The rest of the paper is organised as follows. The following section outlines the relevant literature. After that, the methodology is discussed, followed by an empirical analysis, a discussion, and a conclusion.

2. Literature review

Tiwari and Mutascu (2011) and Blonigen (2005) are among a plethora of studies that confirm that for developing nations (Johnson, 2006), FDI inflows exert a positive impact and hence enhance economic growth. Wijeweera et al. (2010) attribute this to positive externalities through technological spillovers and/or diffusion, and trade openness that often accompany FDI inflows. They caution that this "taken-for-granted" outcome can be impacted by the host country's characteristics, such as the quantum of skilled labour (Leal et al., 2021; De Mello, 1999). Their study also confirms that corruption has a negative impact on economic growth. Balasubramanyam et al. (1996) had earlier provided evidence that enhances economic growth in host countries that adopt export promoting policies relative to import substitution policies. Choe (2003) asserts, however, that even though FDI inflow Granger-causes economic growth, and vice versa, the effects are more apparent from growth to FDI than from FDI to growth. Choe (2003) relies on Lim's (1983) assertion that a rapidly growing economy is attractive to FDI because it offers more profit prospects, and on Feldstein and Bacchetta (1991) argument that growth engenders higher rate of capital formation, hence an attraction to FDI. Mauro (1995) analyses a dataset consisting of indices of corruption and confirms that corruption lowers investment and therefore adversely impacts economic growth. Aidt et al. (2008) treat corruption as an endogenous variable in a threshold model to estimate the impact of corruption on growth. They confirm that generally corruption negatively impacts economic growth, averring that corruption reduces the funds available for product investments and capital formation necessary for economic growth. Considering that one of the drivers of corruption is poverty and low welfare, it is not far-fetched to appreciate that growing economies reduce the attractiveness of corruption (Aidt et al., 2008).

Corruption is pernicious, with evidence suggesting that increases in corruption reduce growth and aggravate income inequality's perversion (Gyimah-Brempong, 2002; Li et al., 2021; Ugur, 2014). Although corruption has been internationally categorised as an egregious anti-social

activity, it will seem that this argument is premised on ethics and morality attributes than it is based on consensual empirical analysis (Krifa-Schneider et al., 2022; Richmond & Alpin, 2013).

Until recently, the consensus has been that globalisation, with its attendant trade openness and free mobility of capital (foreign capital inflows), especially into emerging economies, mitigates public sector corruption (Brazys et al., 2017; Krifa-Schneider et al., 2022). While various hypotheses have been propounded in support of this analogy, Brazys et al. (2017) suggest that the empirical support for this assertion has not been comprehensively tested. Most of these hypotheses, admittedly, are based on sound theoretical modelling. For example, the competition hypothesis proposes that capital mobility through FDI promotes market competition and reduces abnormal profits and economic rents. The reduction of the avenues for economic rent reduces the motivation for businesses within a "trade opened" industry to engage in corruption as the size of the prize from such an action is severely limited. Ades and Di Tella (1999), Sandholtz and Gray (2003), and Treisman (2007), and Krifa-Schneider et al., (20202) support this hypothesis. However, this hypothesis adopts a narrow view of corruption and does not model the rational preference of organisational leaders for short-term gains over longer-term survival (Otusanya et al., 2012).

The desire for short-term gains can heighten the motivation for corruption in competitive spaces. For example, recently, there is evidence of MNCs leveraging regulatory capture to force competitors out of business or out of the market (Dunning, 1992). Brazys et al. (2017) argue that FDI inflows may instead increase economic rent rather than reduce it. This occurs when FDI inflows enter markets with high entry barriers that act as deterrents to indigenous businesses. Caves (1996) and Dunning (1992) suggest that a significant attraction of FDI into developing countries is high entry barriers. Because of entry barriers and consequent lack of competition, potential rents in these markets are high, increasing the motivation to engage in corrupt acts to maintain the status quo. Robertson and Watson (2004) find that a rapid increase or decrease in FDI leads to a high level of perceived corruption. Leveraging a list survey experiment in Vietnam, Malesky et al. (2015) also confirm that foreign businesses are more likely than local firms to pay bribes in restricted sectors that yield higher rents.

Even when entry barriers are minimal, FDI inflows can crowd out indigenous business, increase market concentration and rent, especially in developing countries where indigenous businesses are usually small-sized, lack adequate capital, appropriate technology, or specialist personnel. There is evidence that FDI inflows and the presence of MNCs can increase market concentration and result in imperfect competition in developing countries, hence high rents and consequently a higher motivation for corruption.[2] Blomström (1986), Lall (1979), Li and Resnick (2003), and Newfarmer (1979) also confirm that MNCs often take deliberate actions to pursue monopolistic or oligopolistic positions in host countries. Besides, most FDI inflows in emerging economies are targeted at natural resource exploitation. Luu et al. (2022), Ades and Di Tella (1999), and Rose-Ackerman (1999) confirm that rents accruing from natural resources exploitation or a lack of competition foster corruption. High rents improve firms' ability to internalise the cost of corruption and increase public officials' incentive to demand bribes. In this instance, public officials, who exert some level of control over FDIs, are mainly motivated by the fact that high rents increase the value of their control rights, and therefore the rational consequence of an upweighted willingness to exchange their control rights for bribes (Ades & Di Tella, 1999). Considering that FDI inflows usually result in vertical, horizontal, forward, backward, and ancillary linkages with indigenous entities, the susceptibility of high rent to rent-seeking behaviour (Fuller, 2013; Javorcik, 2004) widens the benefits of rents to include a wide range indigenous agents and hence consequently, corrupt activities may increase due to FDI inflow.

A second argument, proposed by scholars such as Gerring and Thacker (2005), Kwok and Tadesse (2006), and Sandholtz and Gray (2003), is that the emanating economic integration from globalisation that allows free capital mobility leads to the transfer of "noble capitalist norms" such as economic neoliberalism, the rule of law, democratic governance, and property rights protection, all of which supposedly help reduce corruption (Brazys et al., 2017).

Kwok and Tadesse (2006) use the framework of institutional theory to propose three avenues through which FDI inflows can impact its host institutions: regulatory pressure effect, demonstration effect, and professionalization effect. In discussing the regulatory effects, Kwok and Tadesse (2006) argue that FDIs need for external legitimacy through adopting a host country's corrupt business practice is often at tension with internal legitimacy from the parent company and international business community. They assert that if the MNC has enough bargaining power, they can opt for internal and international legitimacy over host country's legitimacy. Their argument is flawed on many fronts, including their admittance that "*the U.S. Foreign Corrupt Practices Act, enacted in 1977, was prompted by a series of scandals involving questionable payments by U.S. firms to overseas government official*." While this suggestion is plausible, it remains normative because of their admittance of the pervasive corrupt acts by MNCs. Kwok and Tadesse (2006) also argue that there may also be a spillover or demonstration effect on corruption (Oliver, 1997). Dealings with MNCs can expose corrupt public officials to how business decisions and allocations are made within the MNCs (Eden et al., 1997). Local officials and indigenous business can then mimic such practices to enhance the country's international reputation and attract more business. Impliedly, local businesses and public officials may imbibe "noble" practices of MNCs gradually. The professional effect asserts that local professionals will adapt their ways to enhance their chances of being recruited by FDIs.

While these arguments are plausible, they ignore the empirical evidence that MNCs as "open systems" adapt the business practice, including entry strategies to fit different markets and national characteristics. Even Kwok and Tadesse (2006), while arguing that FDI inflows can be agents of corruption mitigation, accept that, more often than not, institutional setting shapes the behaviour of MNCs to gain legitimacy. MNCs actively adjust their entry mode and market strategy to local environments (Henisz, 2000; Li et al., 2021; Rodriguez et al., 2005). Brazys et al. (2017) highlights how US companies operating in China, rather than diffuse ethical business practices, adopt the common Chinese business practice of bribery to secure business deals. Indeed, Transparency International (2006); Hellman et al. (2000), (2002), and Søreide (2006) provide evidence that most often MNCs have an equal tendency and marked tendency to engage in corrupt acts, especially in emerging economies and LDCs.

Thirdly, FDIs, especially inflows into emerging countries, often have the backing of the powerful governments of their home country and, in addition, may leverage their bargaining power and market size for favourable outcomes (such as policy and institutional changes) rather than engage in corrupt acts (Kwok & Tadesse, 2006; Malesky, 2004; Wang, 2015). Recent evidence has challenged this assertion, confirming that a substantial number of MNC consciously exploit their power to overcome imperfections in arm's-length markets (Caves, 1996; Dunning, 1992).

The enumerated analysis will seem that the taken-for-granted belief that FDI inflows mitigate corruption must be re-examined. There is compelling evidence, in recent times, that the adaptive business practices of MNCs could encourage corrupt acts by MNCs in poor and emerging countries. Brazys et al. (2017) argue that an analysis of the impact of FDI inflows on corruptions must bear in mind that the distinctive characteristics of MNCs determine their market strategies in different host countries and the consequences of their conduct on corrupt activity. Balasubramanyam et al. (1996) and Lall (1979) confirm that MNCs adopt different strategies between developed and developing countries.

3. Methodology

3.1. Data sources and variables description

The variables' definition and data sources are listed in Table 1. The study uses data spanning from 1960 to 2019. The data set ended in 2019 because some of the variables used in the study did not have observations beyond 2019. The foreign direct investment and economic growth variables were sourced from the World Development indicators database, while the estimate of corruption was obtained from the World Governance Indicators as shown in the table.

3.2. Estimation technique

The causal links among corruption, foreign direct investment, and economic growth will be examined using Vector Autoregression (VAR) approach. The statistical software used for the analysis is Eviews 10. The VAR approach is used in this paper because it tackles endogeneity issues, which are a major hurdle in time series data analysis when it comes to econometric modelling. The impulse response and decomposition of the forecast error variance of the variables can also be generated using the VAR approach. The VAR technique provides a more flexible framework in which all variables in the system of equations are considered endogenous, making it suitable for the study.

Holtz-Eakin et al. (1988) pioneered the VAR methodology, which is now widely utilized in economic and financial research all over the world (Love & Ariss, 2014; Love & Zicchino, 2006). This study adds to the body of knowledge by examining the endogenous relationship among corruption, foreign direct investment, and economic growth in Ghana using the VAR estimating technique. The following is the general model for VAR:

$$Y_t = \sum_{k=1}^{p} \alpha_t Y_{t-k} + u_t \tag{3.1}$$

where Y_t is a vector containing K endogenous variables, $t = 1 \ldots T$ time periods while Y_t is specified as

$$Y_t = \begin{bmatrix} CORR_t \\ FDI_t \\ LNGDPPC_t \end{bmatrix} \tag{3.2}$$

Table 1 presents the variables definition and sources.

Y_{t-k} stands for the lagged estimates of the endogenous variables and U_t is a $K \times I$ vector of random errors, and it is specified as

$$U_t = \left[U_{1t}, U_{2t,} \ldots\ldots U_{Nt}\right] \tilde{iid}(0, \delta) \tag{3.3}$$

α_t is allowed to be dependent cross-sectional. In cases where there exist exogenous variables, equation (3.1) will become

$$Y_t = \sum_{k=1}^{p} \alpha_t Y_{t-k} + D_{ij} R_t + U_t \tag{3.4}$$

where *Dij* are $K \times M$ matrices for each lag $j = 1, \ldots..p$, and R_t is an $M \times 1$ vector of exogenous covariates similar to all countries i.

Table 1. Data source and variable description

Variable	Notation	Description	Data source
Foreign direct investment	FDI	Foreign direct investment (% of GDP)	WGI
Economic Growth	LNGDPPC	Natural log of GDP per capita (current US$)	WDI
Corruption	CORR	Control of Corruption: Estimate	WGI

Note: *WDI = World Development Indicators: WGI = World Governance Indicators*

In the same way, VAR can also be specified in a reduced form according to (Love & Zicchino, 2006) as follows:

$$Y_t = \sum_{k=1}^{p} \alpha_t Y_{t-k} + \tau_2 R_t + \lambda_i + \gamma_t + e_t \tag{3.5}$$

If exogenous variables (R_{it}) are included, it makes Eq. (3.5) different from Love and Zicchino (2006) specification. Where Y_{t-k} is a three-variables vector $[CORR, FDI, LNGDPPC]$. R_t represent the exogenous variables if they exist. Also, λ_i is fixed effect which is country specific and it is an embodiment of the time-invariant factors that are not observable, γ_t is time dummies which takes into consideration world economic shocks and e_t is the disturbance term.

3.3. Empirical model specification

From equations (3.4) and (3.5), this section presents the empirical equations for corruption, FDI, and economic growth. The VAR framework is made up of three empirical equations, which are described below. Corruption, FDI, and economic growth are all modeled using own lags and exogenous variable lags, with time-specific effects and country-specific fixed effects taken into account. The models are specified below as follows:

$$CORR_t = \partial_1 + \sum_{j=1}^{p} \delta_{1j} CORR_{t-j} + \sum_{j=1}^{p} \delta_{2j} FDI_{t-j} + \sum_{j=1}^{p} \delta_{3j} LNGDPPC_{t-j} + \lambda_i + \gamma_t + \varepsilon_t \tag{3.6}$$

$$FDI_t = \partial_2 + \sum_{j=1}^{p} \delta_{1j} FDI_{t-j} + \sum_{j=1}^{p} \delta_{2j} CORR_{t-j} + \sum_{j=1}^{p} \delta_{3j} LNGDPPC_{t-j} + \lambda_i + \gamma_t + \varepsilon_t \tag{3.7}$$

$$LNGDPPC_t = \partial_3 + \sum_{j=1}^{p} \delta_{1j} GDPPC_{t-j} + \sum_{j=1}^{p} \delta_{2j} CORR_{t-j} + \sum_{j=1}^{p} \delta_{3j} FDI_{t-j} + \lambda_i + \gamma_t + \varepsilon_t \tag{3.8}$$

$CORR_t$ is corruption estimate for Ghana at any time t; FDI_t is foreign direct investment at time t; $LNGDPPC_t$ is economic growth (GDP per capita) at time t; $CORR_{t-j}$ is the lag of corruption estimate; FDI_{t-j} is the lag of foreign direct investment; $LNGDPPC_{t-j}$ is the lag of economic growth measured by the natural log of GDP per capita. The study logged the GDP per capita to normalise it with the other variables because its figures are so large. FDI which is a foreign direct investment as a percentage of GDP and corruption estimate was not logged.

After computing the VAR coefficients, the forecast error variance decompositions (FEVD) and impulse response functions (IRFs) are produced using the generalized Cholesky decomposition method. The impulse response functions enable us to have an understanding of how over time, the endogenous variables respond to a shock in another variable in the system, while the decomposition of the forecast-error variance indicates each shock contribution to the source of variation of each endogenous variable at any given forecast period.

4. Results and discussion

4.1. Descriptive statistics

The variables used in this study descriptive statistics are presented in Table 2. We use the median as a measure of central tendency in our discussions since the mean is susceptible to outliers. The results show that the median for Ghana's corruption estimate is −0.255. Control of Corruption encapsulates popular perceptions of the amount to which public power is used for private gain, encompassing petty and grand corruption, as well as state takeover by elites and private interests. The corruption estimate is the country's score on the aggregate indicator which is expressed in standard normal distribution units ranging from −2.5 to 2.5 with −2.5 showing the highest corruption estimate and 2.5 the lowest corruption estimate. The median foreign direct investment net inflow as a percentage of GDP in Ghana is 1.496%,

showing that Ghana needs to do a lot more to attract FDIs into the country. Economic growth which is measured by GDP per capita (current US$) has a median value of $11.43

4.2. Granger causality test

The study used a Granger causality test to see if we could model the variables in a VAR framework. Th Granger causality test results are reported in Table 3. Except for corruption and economic growth and also corruption and FDI, which have a one-way relationship, the data show that the variables Granger-cause each other at the standard significant thresholds of 1%, 5%, and 10%. This means that a VAR framework can be used to model the variables.

4.3. Lag order selection criteria

The lag order estimate and selection were decided utilizing the Hannan-Quinn information criterion (HQ), Schwarz information criterion (SC), and Akaike information criterion (AIC) once the study used a time series VAR model. These information criteria were chosen because the findings they generate are far stronger and more resilient (Qu & Perron, 2007). Table 4 shows the results of the lag order selection. The preferable VAR framework is the first order. The first order was chosen since it had the smallest criteria value as indicated in Table 4 following Andrews and Lu (2001). As a result, the first-order VAR is used in the study

4.4. Results of unit root test

It is very important that the variables must be stationary in time series data analysis. The stationarity test is required because the order of integration of the variables will aid in the selection of the right model for the parameter estimation and will prevent spurious regression. The Augmented Dickey fuller (ADF) and Phillips–Perron (PP) tests were used in this study. Table 5 summarises the findings of the time series unit root test. Table 5 shows that all variables are integrated of order zero, or at level I(0), as well as integrated of order one, or first difference I(1). The study therefore used the variables at their levels to estimate the VAR model.

4.5. Analysis of the regression results

Table 6 provides evidence that the lag values of CORR predict CORR and FDI. Similarly, the lag values of FDI predict CORR, FDI, and GDPPC. Also, the lag values of GDPPC predict DFI and GDPPC. The results show that there is a reverse causality between CORR and FDI. This suggests that policies aimed at promoting FDI will not compromise the control of corruption and vice versa. All the variables are positively impacted by their past realisations. Bearing in mind that the CORR score is arranged on a scale from −2.5 to 2.5 such that higher scores imply a relative improvement in the control of corruption, the results provide confirmation that past realisations of FDI positively impact the control of corruption such that an increase in FDI inflow reduces corruption and vice

Table 2. Descriptive statistics

	CORR	FDI	GDPPC
Mean	−0.219	2.420	1146.392
Median	−0.255	1.496	11.438
Maximum	0.039	9.467	11,489.320
Minimum	−0.367	−0.660	0.013
Std. Dev.	0.084	2.617	2634.913
Skewness	1.648	1.228	2.590
Kurtosis	4.919	3.404	8.753
Jarque-Bera	36.374	15.500	149.820
Probability	0.000	0.000	0.000
Observations	60.000	60.000	60.000

Table 3. Granger causality test

Excluded	Chi-sq	df	Prob.
Dependent variable: CORR			
FDI	4.054525	1	0.0441
LNGDPPC	1.328722	1	0.2490
All	9.506618	2	0.0086
Dependent variable: DFI			
CORR	16.15448	1	0.0001
LNGDPPC	4.915135	1	0.0266
All	22.16537	2	0.0000
Dependent variable: LNGDPPC			
CORR	0.005064	1	0.9433
FDI	3.971342	1	0.0463
All	7.374436	2	0.0250

Table 4. Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−191.5010	NA	0.236725	7.072762	7.182253	7.115103
1	38.86776	427.2292*	7.56e-05*	−0.977009*	−0.539046*	−0.807645*
2	47.43061	14.94607	7.71e-05	−0.961113	−0.194677	−0.664726
3	52.56499	8.401710	8.94e-05	−0.820545	0.274364	−0.397135
4	62.24753	14.78787	8.86e-05	−0.845365	0.578017	−0.294931
5	65.82422	5.072404	0.000111	−0.648154	1.103701	0.029303

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 5. Unit root test

	FDI	COR	LNGDPPC
Level			
ADF	−4.24***	−2.87**	−4.89***
PP	−4.23***	−2.95**	−4.90***
First difference			
ADF	−7.95***	−7.38***	−6.13***
PP	−27.67***	−8.22***	−32.99***

Source: *Authors estimate from research data;* $P<0.01^{***}$ $P<0.05^{**}$

versa. Brazys et al. (2017) have earlier suggested that the emanating market competition from FDI inflows reduces public sector corruption.

Curiously prior periods FDI inflows negatively impact economic growth. FDI can create foreign capital dependence with adverse consequences on economic growth, especially for developing economies (Kentor & Boswell, 2003). The dependency theory suggests that emerging economies that depend on

Table 6. VAR results

	CORR	FDI	LNGDPPC
CORR(−1)	0.427682***	10.27135***	−0.026034
	(0.13844)	(2.55553)	(0.36583)
	[3.08931]	[4.01926]	[−0.07116]
FDI (−1)	0.009940**	0.554767***	−0.025997**
	(0.00494)	(0.09113)	(0.01305)
	[2.01359]	[6.08767]	[−1.99282]
LNGDPPC(−1)	0.002426	0.086119**	1.014646***
	(0.00210)	(0.03884)	(0.00556)
	[1.15270]	[2.21701]	[182.469]
C	−0.151724***	3.229285***	0.259429**
	(0.03979)	(0.73453)	(0.10515)
	[−3.81298]	[4.39638]	[2.46724]
R-squared	0.596403	0.858732	0.999056
Adj. R-squared	0.574389	0.851027	0.999005
Sum sq. resids	0.167173	56.96515	1.167355
S.E. equation	0.055132	1.017708	0.145687
F-statistic	27.09156	111.4439	19,405.21
Log likelihood	89.33743	−82.68199	32.00514
Akaike AIC	−2.892794	2.938373	−0.949327
Schwarz SC	−2.751944	3.079222	−0.808477
Mean dependent	−0.218131	2.434932	2.157035
S.D. dependent	0.084507	2.636751	4.617756

Note: Standard errors in () and t-statistics in [] and ***, **, * represents significance at 1%, 5%, and 10%, respectively.

foreign capital can reduce their economic productivity with attendant impacts on economic growth in the medium to long term (Vernengo, 2004). Kentor and Boswell (2003) had earlier confirmed that foreign capital dependence promotes income inequality, accelerates population growth, and slows economic growth. However, prior period economic growth positively impacts FDI inflows, in an apparent desire by MNCs to take advantage of the improved purchasing power and market size that accompanies economic growth (Nsor-Ambala and Coffie, 2021). The negative effect of FDI on economic growth could also be because of the resource curse effect (Manzano & Gutiérrez, 2019). This will occur if foreign direct investments are channelled to natural resource sectors at the expense of the manufacturing sector. Resource curse effect has the potential of dampening economic growth.

The evidence that prior realisations of control of corruption positively impact FDI inflows is not new. Nsor-Ambala and Coffie (2021) find similar evidence with a dataset from Ghana, further confirming that while the overall impact of CORR on FDI is positive, the rate of reduction in FDI from an increase in corruption is more significant compared to the rate of increase in FDI from a reduction in corruption (i.e., an increased control of corruption). They explain their findings with the rational expectations theory. Prior levels of control of corruption, however, negatively impact economic growth in apparent support of the "grease in wheel" argument for corruption (Méon & Sekkat, 2005). Grease in the wheel suggests that as a second-best case and under certain circumstances, corruption can positively enhance economic outcomes (i.e. compared to a case where corruption is not possible). Bardhan (1997) clarifies this suggestion with the assertion that:

> in the second-best case [. . .]. It is usually presumed that a given set of distortions are mitigated or circumvented by the effects of corruption; but quite often, these distortions and

Table 7. Variance decomposition of CORR

Period	S.E.	CORR	FDI	LNGDPPC
1	0.055132	100.0000	0.000000	0.000000
2	0.061983	97.61157	2.385644	0.002790
3	0.065432	95.84205	4.147374	0.010573
4	0.067540	94.80021	5.175752	0.024040
5	0.068882	94.20089	5.755716	0.043390
6	0.069743	93.85451	6.076936	0.068554
7	0.070294	93.65285	6.247872	0.099277
8	0.070644	93.53334	6.331480	0.135182
9	0.070866	93.45871	6.365476	0.175811
10	0.071006	93.40640	6.372929	0.220671

Table 8. Variance decomposition of FDI

Period	S.E.	CORR	FDI	LNGDPPC
1	1.017708	8.697080	91.30292	0.000000
2	1.365751	33.88244	66.11031	0.007244
3	1.577034	44.26923	55.70656	0.024203
4	1.705946	49.14902	50.79945	0.051534
5	1.786216	51.77019	48.14006	0.089753
6	1.836823	53.30142	46.55957	0.139009
7	1.868854	54.23742	45.56349	0.199094
8	1.889099	54.81917	44.91133	0.269506
9	1.901848	55.17737	44.47312	0.349509
10	1.909866	55.38875	44.17303	0.438213

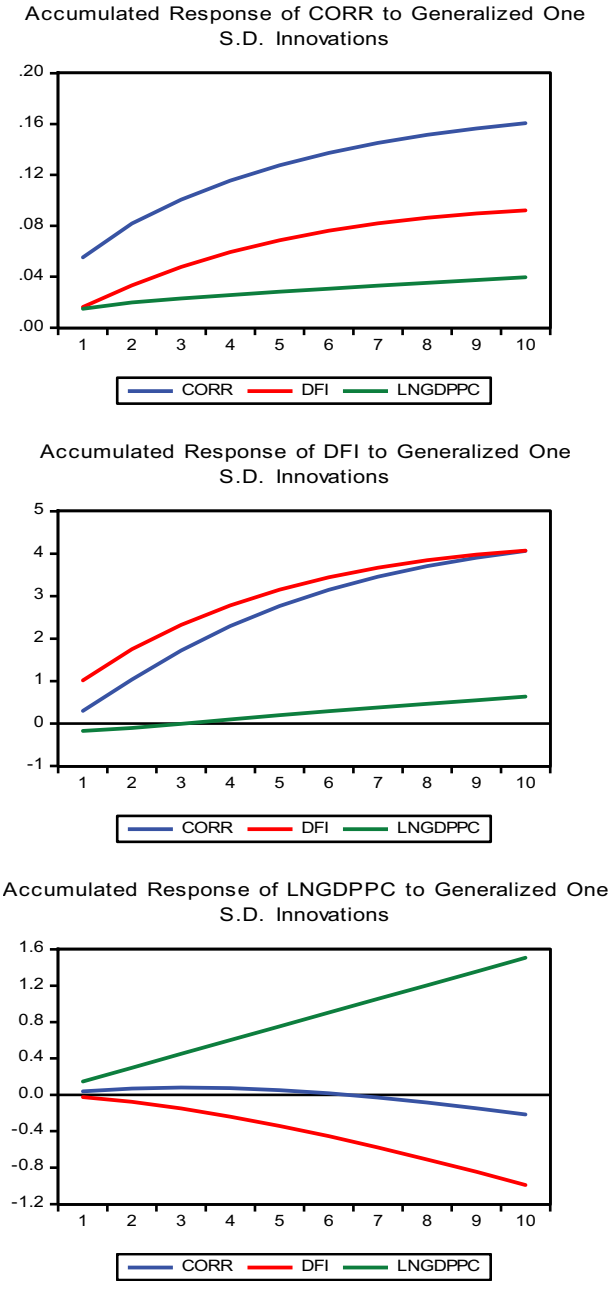
Table 9. Variance decomposition of LNGDPPC

Period	S.E.	CORR	FDI	LNGDPPC
1	0.145687	7.235132	6.926162	85.83871
2	0.212208	5.478945	12.41238	82.10868
3	0.265839	3.666823	16.81037	79.52281
4	0.314012	2.677623	20.42069	76.90169
5	0.359375	2.432851	23.38278	74.18437
6	0.402972	2.701185	25.80379	71.49503
7	0.445229	3.280204	27.78046	68.93934
8	0.486316	4.025253	29.39802	66.57673
9	0.526300	4.841533	30.72811	64.43036
10	0.565212	5.670285	31.82892	62.50079

Cholesky Ordering: CORR DFI LNGDPPC

corruption are caused or at least preserved or aggravated by the same common factors. The distortions are not exogenous to the system and are instead often part of the built-in corrupt practices of a patron-client political system.

Figure 1. Impulse response functions.



4.6. Forecast error variance decomposition

The results of the Cholesky decomposition of the forecast error variance decomposition (FEVD) underlying the VAR framework residual covariance matrix are consistent with our findings. The variance decomposition shows the amount of information each variable contributes to the other variables in the autoregression framework. It indicates how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. The results in Table 7, based on the computed FEVD, reveal that foreign direct investment and economic growth account for 6.37% and 0.22% of the variation in corruption estimate, respectively, in the long run in a period of 10 years based on the results in Table 7. This shows that foreign direct investment, rather than economic growth, explains much of the variation in corruption across time. Corruption explains 55.38% of the variation in foreign direct investment in a period of 10 years, while

Figure 2. Inverse Roots of AR Characteristic Polynomial

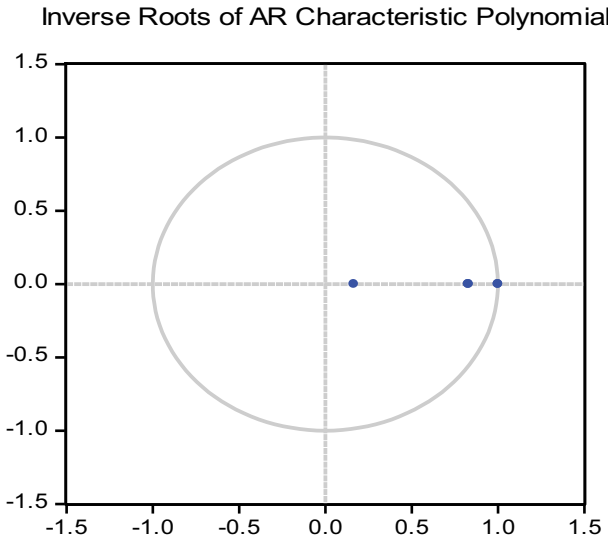


Table 10. Model stability test

Root	Modulus
1.001812	1.001812
0.829954	0.829954
0.165329	0.165329

Warning: At least one root outside the unit circle.
VAR does not satisfy the stability condition.

economic growth explains 0.43% of the variation in foreign direct investment in the long run in a period of 10 years, according to Table 8.

This also means that corruption, rather than economic growth, explains a large portion of the long-run volatility in foreign direct investment. Finally, the variance breakdown of economic growth is in Table 9 which shows that corruption explains 5.67% of the overall variation in economic growth, whereas foreign direct investment explains 31.82% of the long-run variation in economic growth. It follows that improvements in foreign direct investment cause greater variation in economic growth than corruption. The findings suggest that in the long run, the variables explain themselves much better than the other endogenous factors.

4.7. Impulse response functions (IRF)

Figure 1 depicts the IRFs of corruption, foreign direct investment, and economic growth by looking at how shocks in the variables influence each other. In Figure 1, the endogenous variables' VAR framework impulse response functions are shown. The corruption (CORR) has a positive and statistically significant impulse response to foreign direct investment (FDI) shocks, which supports our VAR results in Table 6. In terms of levels, the IRF plot shows that a positive shock in foreign direct investment has a beneficial impact on corruption. Figure 1 depicts the IRFs of banking sector development and financial stability to shocks in the other endogenous variable.

4.8. Model stability test

In our notation, we eliminated the exogenous variables and focused on the VAR's autoregressive setup, as indicated in equation (1). Both Lutkepohl (2005) and Hamilton (1994) propose that a VAR model is stable if all of the companion matrix's moduli are strictly less than unity. In other words, stability indicates that the VAR model has a boundless-order vector moving average (VMA) representation and is invertible,

allowing for known interpretation of impulse-response functions and error variance decompositions. The eigenvalues plot (see, Figure 2), as well as the results in Table 10, shows that the estimations were stable. As a result, at least one eigenvalue lies outside the unit circle.

5. Conclusion and policy implications

Despite the fact that there has been a lot of empirical studies on corruption, foreign direct investment, and economic growth in recent years, the interdependence among corruption, foreign direct investment, and economic growth has been largely ignored in the literature. It is for this reason that this study examines the causal relationship among corruption, foreign direct investment, and economic growth from the Ghanaian perspective. Corruption, foreign direct investment, and economic growth all play important roles in most African economies' development agendas and macroeconomic stability, necessitating the study.

The findings suggest that there is a bi-causal relationship between foreign direct investment and economic growth, implying that the variables mutually reinforce it on each other. This implies that these variables are complements rather than contradict each other. Increased economic growth promotes foreign direct investment, according to the results. The recommendation of the study is that the central government of Ghana and other policymakers can enhance foreign direct investment by establishing and implementing policies that promote economic growth and reduce corruption. Also, central government and policymakers should not consider these variables independently when modelling or formulating economic policies, but rather consider them as complements. This means that pursuing economic growth policies will neither jeopardize nor compromise the goals of reducing corruption and promoting foreign direct investment.

This study is not without limitations. It is limited in scope in terms of wider applicability. Since it is limited only to Ghana, the results cannot be generalised. The study recommends as future direction for research, for other researchers to expand the scope of the study to include more countries or the whole of Africa.

LIST OF ACRONYMS

ADF	The Augmented Dickey Fuller
AIC	Akaike information criterion
CORR	Control of Corruption Estimate
FDI	Foreign direct investment as a percentage of Gross Domestic Product
FEVD	forecast error variance decomposition
FPE	Final prediction error
GDP	Gross Domestic Product
GDPPC	Gross Domestic Product Per Capita
HQ	Hannan-Quinn information criterion
IRF	Impulse Response Functions
LNGDPPC	Natural log of GDP per capita (current US$)
MNC	Multinational Companies
PP	Phillips–Perron test
SC	Schwarz information criterion
SDG	Sustainable Development Goals
VAR	Vector Autoregression
WDI	World Development Indicators
WGI	World Governance Indicators

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Notes
1. David Barstow and Alejandra Xanic von Bertrag, "The Bribery Aisle: How Wal-Mart Used Payoffs to Get Its Way in Mexico," New York Times, 17 December 2012.
2. See for example, Blomström (1986), Balasubramanyam et al. (1996), Lall (1979), and Newfarmer (1979); Willmore (1989)

Data availability statement
The data that support the findings of this study are available within the World Governance Indicators and World Development Indicators at https://databank.worldbank.org/source/worldwide-governance-indicators; and https://databank.worldbank.org/source/world-development-indicators; available in the public domain.

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