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Abstract

This study complements the extant literature by assessing the role of governance dynamics in food security in Ghana for the period 1980-2019. The empirical evidence is based on the Fully Modified Ordinary Least Squares (FMOLS) technique and governance is categorized into: political (entailing political stability and voice & accountability), economic (consisting of regulatory quality and government effectiveness) and institutional (entailing corruption-control and the rule of law) governance dynamics. The study finds that the engaged governance dynamics improve food security in Ghana. Policy implications are discussed with specific emphasis on the sustainable development goals.

Keywords: Governance; Vulnerability; Food security; Sustainable development
JEL Classification: I38; Q12; R20; O20; O55

Introduction

Food security, which constitutes availability, accessibility, and use of food and the underlining stability, has received significant attention in global development discourse and debates in recent times(FAO, IFAD, UNICEF, WFP, & WHO, 2017). Although the concept of food security is not entirely new, the 2007/2008 global food crisis has been a major factor for the internalization of food security, as international development agencies such as the World Bank and the United Nations, among others, and national governments heightened their commitment to improve agriculture, food security and nutrition, especially in developing and vulnerable regions (Candel, 2014; Page, 2013). This commitment equally brought global governance of food security into the limelight, with many actors and competing interests to strengthen global agricultural systems and improve food security(Candel, 2014).

Without doubt, the role of agriculture in food security and green economic growth and recovery post COVID-19 in the world in general and Africa in particular, cannot be understated. Indeed, many African countries including Ghana, rely on agriculture as the engine of economic growth and development. In Ghana, for instance, while the performance of agriculture to gross domestic product has dwindled in recent years, the sector still contributes immensely to foreign exchange earnings, food security, employment and poverty reduction(MOFA, 2016). Nevertheless, transboundary challenges such as climate change and the recent COVID-19 pandemic, have intensified the 'wicked problem' of food insecurity across the globe with adverse impact in developing, poor and vulnerable countries(Niles et al., 2020; Adjognon, Bloem, & Sanoh, 2021). Studies contend that the pandemic in particular has massively disrupted agricultural systems (Ataguba, 2020; Lugo-Morin, 2020), with ripping effects such as rising food prices (World Bank, 2021) and household poverty (Diop & Asongu, 2021; Vos, Martin, & Laborde, 2020).

This creates the urgent need for concerted global efforts and governance mechanism to address food insecurity issues, especially in vulnerable economies in Africa. But to what extent does existing governance mechanisms and frameworks at different spatial scales significantly address food insecurity? According to Vos (2015), governments' polices are inadequate in addressing critical problems such as food insecurity, and driving transformative change in society. Candel(2014) also posits that existing food security and governance studies at global levels are characterized by fragmented and inconclusive results, which greatly affect clarity of food

security and weaken policy recommendations. With food insecurity and the underlining vulnerabilities largely differentiated at national and subnational levels, the author recommends further studies on state governance and food security. This contends with Paarlberg's(2002)argument that state governments and institutions continue to play a dominant role in food security, particularly in poor and vulnerable countries, amidst globalization.

The literature shows that governance directly and indirectly influences food security. From a political economy perspective, Wiggins & Leturque (2011) note that Ghana's agricultural performance under the Millennium Development Goals contributed immensely to halving hunger and poverty in the country. This achievement is largely due to formulation and implementation of policies and programmes that promote sustainable agriculture and human capital development(MOFA, 2016). Indeed, as stipulated by Adger et al. (2004), an enabling policy environment is essential to achieving food security and minimizing climate and environmental change impacts. As such, the policy frameworks of the Government of Ghana are influenced by its governance mechanism and the commitment to enhance the provision and protection of food as a public good(MOFA, 2017; Sarpong & Anyidoho, 2012).

Food security as a public good is guaranteed when governance mechanisms create strong institutions, allocate resource, build capacities, and implementation of effective policies for sustainable agriculture and productivity(Food and Business Knowledge Platform, 2021; Page, 2013). In Bangladesh, Kashem & Faroque (2013) report that strides in eradicating poverty and improving food security are largely rooted in the government's priority to achieve food self-sufficiency and the accompanying policies and programmes. This contends with findings from Latin American countries where governments' policy regimes and programmes and the supporting legal frameworks for food and nutrition security have improved access to food among the poor and minimized poverty(FAO, 2017). Nevertheless, regime shift and the corresponding poor harmonization of policies negatively affect food security (Vos, 2015). For instance, Sahley, Groelsema, Marchione, & Nelson (2005) note that lack of policy harmonization and coherence and the underlining politicization of food security have rendered many Malawians food insecure.

Surprisingly, there is scarcity of information on food security and governance nexus in Ghana. Sarpong & Anyidoho (2012) opine that Ghana's agriculture policy environment is not inclusive and favourable, as key stakeholders particularly farmers are often sidelined in policy formulation

and implementation, although these farmers in their vulnerable and poor conditions contribute significantly to the country's food production (Asare-Nuamah & Mandaza, 2020). Such a disposition makes it difficult for policymakers to achieve transformative economic change in the lives of the poor and vulnerable population(Andrews et al., 2021). Again, about 1.2 million Ghanaians are food insecure and 2 million more are likely to face food insecurity(WFP, 2009). This is problematic as the country seeks to increase agricultural productivity, improve food security and achieve food self-sufficiency amidst declining agricultural output(MOFA, 2017). Being one of the most democratic countries in Africa, Ghana can leverage on its governance mechanism to cushion agricultural performance and achieve food security. To what extent therefore does governance in Ghana influence food security? This study fills the identified gap by investigating the relationship between food security and governance in Ghana, thereby contributing to achieving zero hunger, sustainable agriculture and food security as well as strong institutions in the country, as stipulated in Goals 2 and 16, respectively, of the sustainable development goals (SDGs).

Literature review

Conceptual review

Governance

The concept of governance has been widely and differently applied by scholars and institutions (Peters, 2012), leading to the plurality of its definitions and characteristics (Candel, 2014). This, according to Windsor (2009) and reiterated by Katsamunska (2016), has resulted in controversy and confusion of the concept. Nevertheless, Ruhanen, Scott, Ritchie, & Tkaczynski (2010) identify a common ground and centrality in the definition and application of governance across different academic disciplines and organizations. For Eagleton-Pierce (2014), governance is interpreted as either a process or structure, where the former deals with steering or directing policymaking process while the latter emphasizes the institution of guidelines, rules and procedures. Termeer et al. (2011) define governance as the interactive collaboration between state entities and the private sector with the prior objective of achieving collective goals. This definition sidelines the crucial participation of citizens as stakeholders in governance, as the

World Bank (2012) emphasizes citizens' voices and participation as critical dimensions of governance.

Shleifer & Vishny (1997) denote that governance mechanism simply constitutes legal and economic institutions that are subjected to politics and the political process of states. Governance, however, differs from government, which constitutes the bureaucratic, hierarchical and state-centric institutions that define, formulate and implement policies, programmes and actions for achieving collective goals (Eagleton-Pierce, 2014). Governance embraces coordination and a multi-stakeholder approach, also known as policy network (Katsamunska, 2016), which introduces and activates interests, power and structure of actors (Ruhanen et al., 2010). Governance involves people and institutions (Candel, 2014), whose capacities are critical to governance quality and its outcomes in the lives of the governed. Termeer, Dewulf, Breeman, & Stiller (2015) contend that governance across the globe requires capabilities to aggressively deal with wicked problems, such as food insecurity. Transparency and accountability are equally important dimensions of governance commonly used in the literature, as they ensure efficiency, uphold citizen participation, strengthen auditing, and check corrupt practices (Katsamunska, 2016). Nevertheless, be it a democratic or an authoritarian governance system, the realization of goals by addressing complex and wicked challenges such as food insecurity, and the provision and protection of public goods such as food security, characterize all forms of governance (Paarlberg, 2002).

Consistent with contemporary African governance literature (Andrés, Asongu, & Amavilah, 2015; Tchamyou, 2021; Tchamyou, 2017), the conception and definition of governance are also articulated by World Governance Indicators of the World Bank into political, economic and institutional dimensions: *"(i) political governance (measured with political stability/no violence and "voice & accountability") is the election and replacement of political leaders; (ii) economic governance (entailing government effectiveness and regulation quality) is the formulation and implementation of policies that deliver public goods and services, and (iii) institutional governance (proxied by corruption-control and the rule of law) is the respect of citizens and the State, of institutions that govern interactions between them*" (Asongu & Odhiambo, 2021:447).

Food security

Food security is defined as 'when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their food preference and dietary needs, for an active and healthy living'(FAO, 2013, 2015a). The concept of food security has evolved from the initial notion of food on the market(FANTA, 2003) to a broader term that recognizes changes in global food system, climate and environmental change, changing global demography dynamics and human rights, to its current constituents of availability, accessibility, and use of food and the underlining stability (Ericksen, 2008; FAO, 2008, 2017). The traditional notion of food security as the availability of food on the market was problematic as mere availability does not guarantee access to food, especially among the poor and vulnerable (Akudugu & Alhassan, 2013). Similarly, nutrition, health and the associated conditions especially in developing countries, also gained attention in global food security and development debates (FAO, 2017; Vos, 2015).

Food availability constitutes production, distribution and exchange of food while affordability, allocation and preference are the dimensions of food accessibility. In addition, food utilization is a function of nutritional and social values, food safety and stability. Availability of food focuses primarily on the supply side of food by considering the quantity, quality and type of food available to a unit, household or community (FAO, 2013; FAO et al., 2017). Contrary, food accessibility looks at the ability of people to have access to their required quantity, quality and type of food. It is concerned with people's capacity to convert their assets (such as financial and political) into food, thus the purchasing power of people and the associated inequalities. Food accessibility is a great concern in developing economies, as poverty, conflict and climate change intensify poor access to food and malnutrition (WFP & FAO, 2015). Furthermore, food utilization centers on the consumption of food, and the associated nutritional and social values, and safety. It aims at ensuring that people consume food that offer them the required nutritional value, and is devoid of any danger while recognizing social practices, norms and values attached to food consumption. Critical to food security is food stability, which emphasizes the continuity of food availability, accessibility and utilization over time without any form of political or economic distortion that hinders people's access to their preferred food in the right quantity and quality (FAO, 2017).

From the foregoing discussion, it is evident that food security is a multi-dimensional and complex concept with strong linkage with many development issues (Candel, 2014; Vos, 2015). Crucial to this debate is the role of agriculture in addressing food insecurity. Consequently, SDG2 seeks to promote sustainable agriculture and achieve food security. Closely linked to the preceding argument is the influence of policies and for that matter governance in food security. Food security governance, therefore offers an opportunity to address food insecurity through a holistic, coordinated, collaborative and multi-stakeholder approach (FAO, 2017). Food and Business Knowledge Platform (2021) equally emphasizes the need to address technical aspects of food security while for FAO (2017), economic, social and political dimensions of food security cannot be overlooked. As indicated by Ericksen (2008)and reiterated by Candel (2014), a holistic look at the food security system and associated external factors will be instrumental in improving agriculture and food security.

Empirical review of governance and food security

The literature presents two main perspectives of the nexus between governance and food security. While one school of thought considers governance as a driver of food insecurity, another rather presents an optimistic view of governance as a mechanism to solve the problem of food insecurity (Candel, 2014). Implicitly, governance has direct and indirect as well as positive and negative relationships with food security. The strategic advantage of governance to strengthen and improve food security lies in its ability to formulate and implement policies and programmes that tackle critical social and economic challenges(Committee on World Food Security, 2017; FAO, 2017). For instance, in South Africa, improvement in food security has been linked to inclusive and collaborative stakeholders' involvement in adaptive corporate governance(Pereira, 2013; Pereira & Ruysenaar, 2012), which is consistent with studies that showed that improved governance in South Africa and Brazil consequently strengthened food systems and food security (Haddad, 2011; Pereira, 2012). Such improvement in governance, according to Page (2013) hinges on reconciliation of competing interests from multiple stakeholders and maximization of their specific but collective capacities. The capacities of policy makers are critical to engendering effective and strong policy environments necessary to address complex and wicked challenges such as food insecurity (Termeer et al., 2015). Conversely, low

capacity of policy makers contribute to worsen food security, as reported in Malawi (Sahley et al., 2005).

A study in Bangladesh indicates that government interventions for agriculture such as the National Food Policy intensified crop and livestock production, increased per capita food availability and food sufficiency status of the country, thereby minimizing food insecurity among households. This contends with the position of Wiggins & Leturque's (2011) that Ghana's sustained agricultural growth which contributed immensely to halving hunger and poverty under the Millennium Development Goals (MDGs) was spearheaded by enabling and improved policies for agriculture, health and education. Sarpong & Anyidoho (2012) concur that Ghana's agricultural policies have been instrumental in minimizing climate change impact on the agriculture sector and increasing food security. In China, robust economic transformation policies have contributed directly and indirectly to immense improvement in food security (Paarlberg, 2002).

Indeed, governance mechanism and the underlying policies and programmes indirectly influence agriculture and food security(Committee on World Food Security, 2017; FAO, 2017) through economic growth and transformation, infrastructure development and technology (Carraro & Karfakis, 2018; Godfray et al., 2010; Mensah, Adu, Amoah, Abrokwa, & Adu, 2016). For instance, Bah & Kpognon (2020) posit that governance in general and rule of law and political stability in particular, within the Economic Community of West African States, stimulates public investment and economic growth. Studies also recommend the need for policies in developing African countries to aggressively tackle carbon emission, energy and environmental pollution (Adewuyi & Awodumi, 2020) as well as infrastructural gaps (Jiya, Sama, & Ouedraogo, 2020), which hamper agriculture, food security and sustainable economic growth. Thus, governance has the potential to cushion livelihood, reduce poverty and increase agriculture activities among the poor (Ataguba, 2020; Diop & Asongu, 2021), thereby addressing food insecurity.

Without doubt, while governance can relay tremendous positive effect on food security, it can equally serve as a driver of food insecurity or contribute indirectly to deteriorating food security, particularly in developing regions. The case of Malawi provides a classic example of governance as a driver and contributor to food insecurity (Sahley et al., 2005). Poor governance in particular has been identified as a major driver of food insecurity, especially in poor, vulnerable and

developing regions(Boyd & Wang, 2011; Sahley et al., 2005). Typical of poor governance is its inability to address many challenges including conflict, food insecurity and poverty among others. Weak institutional capacity coupled with poor governance system have been problematic which further weakens the ability to formulate and implement progressive and transformative policies (Committee on World Food Security, 2017). Pereira & Ruysenaar (2012) also associate limited resources of governments as hindrance to their capacity to address critical socioeconomic challenges. However, in many African countries, high corruption and the associated nepotism, prebandlism and despotic politics negatively affect effective governance (Lewis, 1996; Mo Ibrahim Foundation, 2017), thereby hindering it as a driver of socioeconomic and political transformation. Evidently, governance is a two-edged sword with the potential to transform economies or hinder progress to development: thus, it has the potential to serve as a solution mechanism or a driver of socioeconomic problems.

Materials and Methods

The main objective of this study is to estimate the nexus between institutional quality and food security in Ghana. Premised on the governance theory (Stoker,1998; 2018) and institutional theory (Zucker, 1977; 1987),we argue in line with the position of Rossignoli and Balestri (2018), that governance is associated with food security. To estimate this relationship, we follow Amoah et al. (2021), Asiama and Amoah (2019), Kwablah et al. (2014) and apply the Fully Modified Ordinary Least Squares. The choice of estimator depends on its robustness in small samples, as well as its inherent strength in addressing endogeneity and serial correlation identification issues. The main econometric model is specified as follows:

$$FS_t = \alpha_0 + \alpha_1 I_t + \alpha_1 \boldsymbol{Z}_t + u_t \qquad (1)$$

where the outcome variable, 'FS_t'represents food security measured over time, the variable of interest,'I_t' is a proxy for institutional quality measured over time. This is proxied by reconstructed governance indices (i.e., economic governance index, political governance index and institutional governance index). Data on governance was accessed from the Worldwide Governance Indicators (WGI, 2020). Generally, the WGI dataset provides six measures of governance. Following Kaufmann et al. (2010) and Asongu & Odhiambo(2021), we re-construct

three unique measures of governance from the standard six measures. This is done to better appreciate the extent to which similar measures put together explain governance. So, we construct institutional governance index (i.e., average measure of corruption and rule of law), political governance index (i.e., average measure of political stability and voice) and economic governance index (i.e., average measure of government effectiveness and regulatory quality). A vector of 'Z' is introduced into the model as a measure of growth fundamental controls. This includes Gross fixed capital formation (GFCF % of GDP) as measure of capital and secondary education enrolment (SCH) a measure of skilled labour.

The aforementioned variables are macroeconomic variables that rely on time-series data spanning the period 1980 to 2019. Data on FS, GFCF and SCH were accessed from the World Development Indicators (WDI) of the World Bank (2021) while data on 'I' was obtained from the Worldwide Governance Indicators (WGI, 2021). In Table A1 (see supplementary Tables in Appendix), we present the variables used for the regression estimation, the definitions and associated verifiable sources.

Endogeneity, serial correlation and sample size concerns

The concern for addressing endogeneity issues in regression-based research has been widely discussed in empirical literature (Amoah et al., 2021; Korle et al., 2020; Asongu and Nwachukwu, 2014). Three possible channels exist by which the problem of endogeneity occurs, and this includes missing variable bias, reverse causality and measurement error (Amoah et al., 2021). Given that countries are endogenously endowed with quality institutions, we argue that our measure of institutional quality is endogenous. This argument is not new in the literature as earlier studies have shared in this position (see Buhanan et al., 2012; Owusu-Nantwi 2019). To address this issue of endogeneity, studies have used estimators such as Autoregressive Distributed Lags (ARDL),Vector Autoregression (VAR), Vector Error-Correction (VECM), Generalised Methods of Moments (GMM), Dynamic ordinary least squares (DOLS), FMOLS, and instrumental variable (IV) approach. The latter has been preferred in the presence of a good instrument. However, for want of a good instrument, the other dynamic models have been used in time-series studies. In fact, finding a good instrument for the present study has been a daunting task hence the study relies on the cointegrating FMOLS.

The FMOLS was originally developed by Phillip and Hansen (1990). This is a semi-parametric dynamic estimation technique which exhibits good performance in the presence of endogeneity, serial correlation, small samples and in the absence of co-integration (Adom and Bekoe, 2013; Wang and Phillips, 2016; Amoah et al., 2020). In addition, Amoah et al. (2021) have recently observed that the FMOLS estimator provides optimal estimates in cointegrating regression and produces robust estimates given nonstationary and endogenous regressors.

As earlier observed, the variable of interest -institutional quality is endogenous, however, in the absence of a valid instrument, we resort to the FMOLS estimator to determine the long-run relationship between institutional quality and food security. From the afore-discussed evidence, the FMOLS is considered an appropriate technique in addressing the possible identification challenges associated with our model. Using the same notations as Wang and Wu (2012), the FMOLS estimator and associated covariance are specified as equation 2:

$$\hat{\theta} = \begin{bmatrix} \hat{\beta} \\ \hat{\gamma}_1 \end{bmatrix} = \left[\sum_{t=1}^{T} \boldsymbol{z}_t \boldsymbol{z}_t'\right]\left[\sum_{t=1}^{T} z_t y_t^{+} - T\begin{pmatrix} \hat{\lambda}_{12}^{+\prime} \\ 0 \end{pmatrix}\right]$$

$$\mathrm{Var}(\hat{\theta}) = \hat{\omega}_{1,2}[\textstyle\sum_{t=1}^{T} \boldsymbol{z}_t \boldsymbol{z}_t'], \hat{\omega}_{1,2} = \hat{\omega}_{11} - \hat{\omega}_{12}\hat{\Omega}_{22}^{-1}\hat{\omega}_{2,1} \qquad (2)$$

where $\hat{\lambda}_{12}^{+} = \hat{\lambda}_{12} - \hat{\omega}_{12}\hat{\Omega}_{22}^{-1}\hat{\Lambda}_{22}$, are the terms for correcting the endogeneity and serial correlation (bias) in the specified model. Also, conditional on $\boldsymbol{u}_{2t}, z_t = (x_t', d'_{1t})'$. $\hat{\omega}_{1,2}$ is presented as the estimate of the long-run covariance of u_{1t}.

Findings and discussion

Table 1: Descriptive Statistics

Statistics	fpi	lnfpi	gfcf	sec	lnsec	Institution	Political	Economic
Mean	56.93	3.90	17.94	1,367,102	14.02	0.38	0.54	0.37
Median	51.93	3.95	19.18	1,056,963	13.87	0.35	0.45	0.33
sd	29.01	0.55	7.17	686,488.5	0.47	0.09	0.18	0.09
Skewness	0.37	-0.19	-0.14	0.81	0.47	0.21	0.28	0.80
Kurtosis	1.83	1.75	1.91	2.15	1.74	1.82	1.40	2.69
Minimum	19.36	2.96	3.76	659,950	13.40	0.21	0.28	0.20
Maximum	111.87	4.72	29.25	2,851,160	14.86	0.54	0.84	0.55
Observations	40	40	40	40	40	40	40	40

*sd is Standard Deviation.

Table 1 presents the descriptive statistics of all variables in their raw and transformed forms used in the model. Food security as proxied by food production index has a mean value of 56.93 on a scale of 0-100. From figure A1 (Appendix), it is observed that from 1980-2019 *fpi* in Ghana has been rising with a minimum value of 19.36 and a maximum value of 111.87. However, the average value for Ghana over the same period is far less than the 96.23 *fpi* value for the United Kingdom[1]. Since 2016, the *fpi* value for Ghana has exceeded that of the United Kingdom and could be described as one of the best performing countries in Africa. A policy driver that may have sustained the rise in *fpi* could perhaps be attributed to Ghana's Planting for Food and Jobs (PFJ) initiative. However, with reference to figure 1, we observe a sharp decline in the 2019 *fpi* value for Ghana which raises a legitimate concern regarding the role of quality institutions in sustaining the growth over the years.

The mean value of *gfcf* is 17.94 percent that lies between a minimum value of 3.76 percent and a maximum value of 29.25 percent. This reflects the low *gfcf* values for most countries on the continent of Africa due to low investments in capital expenditure. Also, the number of secondary school enrollment has a mean value of 1,367,102 with a minimum value of 659,950 and a maximum value of 2,851,160. The spike in secondary education enrollment could be attributed to the Free Senior High School (SHS) educational policy which was implemented by the government in 2017.

Again, the economic governance index has a mean value of 0.37 which is relatively lower than the institutional governance index of 0.38 which is also relatively lower than the political governance index of 0.54. This suggests that, comparatively, the average economic governance value is the lowest with a minimum value of 0.20 and a maximum value of 0.55, while political governance index is the highest with a minimum value of 0.28 and a maximum value of 0.84.

It is important to acknowledge that due to the high volatility in *fpi* and sec, both variables were linearized by transforming them into natural logarithm forms before they were plugged into the model for estimation. For the three governance variables of interest, all of them exhibited low volatility as the standard deviations are quite low relative to the mean values.

[1] Food security data for United Kingdom was obtained from WDI of the World Bank (2021)

Table 2: Unit Root Test Results

	ADF		Phillips-Perron	
Variable	**Intercept**	**Intercept and Trend**	**Intercept**	**Intercept and Trend**
fpi	-0.87	-4.26***	-1.19	-4.44***
dfpi	-6.50***	-7.27***	-13.43***	-23.73***
gfcf	-2.14	-2.29	-2.11	-2.38
dgfcf	-5.95***	-5.94***	-6.10***	-6.40***
sec	0.69	-1.66	0.73	-1.68
dsec	-6.94***	-6.97***	-6.72***	-6.94***
Inst	-3.01**	-5.42***	-3.00**	-5.42***
dlnst	-7.54***	-7.43***	-14.75***	-16.07***
Pol	0.26	-1.82	-1.27	-4.77***
dpol	-20.59***	-20.66***	-19.51***	-20.66***
Eco	-2.56	-2.73	-2.59	-2.80
dEco	-6.57***	-6.49***	-6.62***	-6.54***

*** p<0.01, ** p<0.05

To avoid spurious and unpredictable regression results in time series analysis, we first investigate the unit root properties to ensure stationarity of the series. For robustness purposes, two main tests are used namely the Augmented Dickey–Fuller test (ADF) and Phillip–Perron test (PP). The former is used because it allows for higher-order autoregressive process which is usually not the case for Dickey-Fuller test (DF). The PP test is robust to general forms of heteroskedasticity in the error term u_t, and a user need not to specify lag length for the test regression unlike the ADF. Given the unique strengths of the tests, they are presented together to ensure robustness of the evidence. The null hypothesis for both tests is that the data have unit root or are non-stationary. This is rejected provided the p-value is less that 5 percent or less. From the test results as shown in Table 2, we show an overwhelming evidence of stationarity at first difference.

Another requirement in time series analysis is to test the long-run equilibrium of the series. To achieve this, we employed the the Johansen co-integration approach. The evidence from the trace test for the different test types suggest that there is a long-run relationship between food security and the associated covariates as earlier specified. Once this evidence has been established, it implies that we can proceed to estimate the regression using the co-integration FMOLS.

Table 3: Johansen Co-integration Test Results

Data Trend	None	None	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept
Test Type	No Trend	No Trend	Trend	Trend
Trace (Model- Eco. Index)	2	1	1	1
Trace(Model- Pol. Index)	2	2	1	1
Trace (Model- lnst. Index)	2	2	1	1

Table 3: Co-integration Fully Modified Ordinary Least Squares Regression (FMOLS)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FMOLS	FMOLS	FMOLS	FMOLS	FMOLS	FMOLS
Governance Variables of Interest						
Economic Governance Index	4.0939***			0.5457**		
	(0.658)			(0.254)		
Political Governance Index		2.7999***			0.4819*	
		(0.211)			(0.259)	
Institutional Governance Index			6.0424***			0.7380**
			(0.831)			(0.346)
Controls						
Gross fixed capital formation (% of GDP) (Capital)				0.0260***	0.0240***	0.0246***
				(0.003)	(0.003)	(0.003)
Secondary Education (Skilled Labour)				0.8531***	0.7502***	0.8100***
				(0.058)	(0.107)	(0.074)
Constant	2.4194***	2.3534***	1.6139***	-8.7216***	-7.3028***	-8.1738***
	(0.296)	(0.136)	(0.329)	(0.736)	(1.362)	(0.915)
Observations	39	39	39	39	39	39
R-squared	0.339	0.296	0.168	0.959	0.958	0.957

Dep Variable: Food Production Index (ln)
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This section provides empirical results of the study. Results of the FMOLS regression are reported in Table 4. Models 1, 2 and 3 indicate results of the univariate analysis of influence of economic, political and institutional governance on food security, respectively. Similarly, models 4, 5 and 6 also indicate results of the multivariate analysis of influence of economic, political and institutional governance, respectively on food security, in addition to the control variables. It is indicative that all the governance indicators in both the univariate and multivariate results positively and significantly influence food security in Ghana. Implicitly, improving political, economic and institutional governance in Ghana will invariably contribute to improving the country's food security.

In model 1, economic governance (government effectiveness and regulatory quality) has a positive relationship with food security. The study shows that an increase in one unit of economic governance increases food security by 4.0939%. Thus, by increasing government effectiveness and regulation quality, food security will improve. The findings connote that economic governance has the potential to improve food security in Ghana. With many African economies, including Ghana, threatened by Covid-19 and climate change, and the associated rising hardship and poverty on the continent, economic governance is urgently needed than ever (Chiwona-Karltun et al., 2021; Diop & Asongu, 2021). Chiwona-Karltun et al.(2021) in particular emphasized that the onset of the pandemic has intensified food security challenges in Africa, which can be remedied through effective governance. This is largely due to the fact through economic governance, trade, employment, manufacturing and production are likely to increase (Asongu & Odhiambo, 2021; Azam, 2021; Jiya et al., 2020), which further increases the income of households. In agricultural economies like Ghana, rising household incomes corresponds to rising investment in agriculture inputs by farmers, which increases agricultural yields and productivity. In addition, government investment for the sectors of the economy including agriculture, is likely to increase in a booming economy (Bah & Kpognon, 2020).

The positive relationship between political governance (political stability/no violence, and voice and accountability) and food security from model 2 indicates that as political governance increases by one unit, there is about 2.7999% increase in Ghana's food security. Conflicts and violence deteriorate the ability of governments to spearhead economic transformation, build robust agricultural systems and strong institutions. For instance, a study in the Democratic

Republic of Congo noted that continued political conflicts and violence hinder economic growth and increase food insecurity and poverty, especially among the poor and vulnerable communities(Kossele & Shan, 2018). Implicitly, stability in government offers the conducive environment to build institutions and enhance inclusive development. It equally strengthens good and inclusive governance as citizens have the chance to participate in the governing process through voice and accountability. The 1992 constitution, which ushered Ghana into a democratic state, has been instrumental in promoting citizens voice and accountability, and consolidating political stability in the country. Thus, agricultural transformation which drives national and global food security cannot thrive in an unstable political environment. However, consistent with the proposition of Asongu, Kossele & Nnanna, (2021), not all forms of political governance necessary translate into positive outcomes. For instance, the authors found a negative relationship between political governance and trade in Sub-Saharan Africa. Hence, striving for good governance is very critical for development in the continent.

In model 3, institutional governance, which constitutes corruption control and rule of law, has a strong positive relationship with food security. Intuitively, an increase in a unit of institutional governance increases national food security by 6.0424%. The role of institutions in development, including food security is paramount(Andrés et al., 2015). Achieving food security in Ghana will require the establishment of strong institutions to formulate and implement feasible policies. According to Asongu & Odhiambo (2021), such institutions which are collectively established by governments and citizens, interact with multiple sectors of the economy to enhance development. In Ghana, for instance, the Ministry of Food and Agriculture (MOFA) and its allied institutions such as extension services (Asare-Nuamah, Botchway, & Onumah, 2019), and the Council for Scientific and Industrial Research (CSIR) among others, are strategic institutions that can be strengthened to spearhead agricultural transformation necessary for Ghana's food security. In consonance with Sarpong & Anyidoho (2012), weak institutions in the agriculture sector negatively affect effective agricultural policies and transformation in Ghana. This may be partly due to ill-equipped or corrupt institutions, which affect resource allocation and cost(Candel, 2014; Page, 2013; Sahley et al., 2005). In effect, controlling corruption will enhance the effective use of scarce resources and maximize their outputs or impacts, thereby influencing agricultural sector productivity, yields and food security. In consonance with the Mo Ibrahim Foundation (2017), the effective application of the rule of law has implications on

effective implementation of policies and programmes, as nepotism, corruption, prebendalism and clientelism are checked by law.

In model 4, increasing a unit of economic governance increases food security by 0.5457%. Similarly, increasing capital by 1% increases food security by 0.0260% while increasing enrolment (labour) by 1 equally increases food security by 0.8531%. Again, the results in model 5 show that food security increases by 0.4819% when political governance improves or increases. In the same model, both capital and labour increase food security by 0.0240% and 0.7502%, respectively. These results are also consistent in model 6, where an increase in institutional governance increases food security by 0.7380% while capital and labour also improve food security by 0.0246% and 0.8100%, respectively. The positive effect of labour and capital on food security corroborates the findings from previous studies in Ghana (Akudugu, 2012, 2016) and elsewhere (Mahmood, Khalid, & Kouser, 2009). Indeed, smallholder farmers in Ghana and many other African countries suffer from poor access to credit (capital), which greatly affects their productivity. Increasing credit to farmers is therefore essential to improving agricultural productivity and food security. Access to credit increases the uptake of innovations and technologies for higher agricultural production(Forum for Agricultural Research in Africa, 2006). Similarly, increasing credit to farmers also intensifies agricultural mechanization, which is critical for enhanced productivity.

In the case of labour, while many African smallholder farmers have low levels of education, increasing farmers' capacity through education has a positive impact on agricultural productivity. Through education, farmers gain advanced knowledge and skills necessary to improving their farming practices and productivity. For instance, increasing agricultural knowledge and skills helps farmers to make important decisions such as when to plant, what seed to plant, how to manage crops and best storage practices. These are all critical to increasing the overall productivity of the agriculture sector. Therefore, providing farmers with the requisite agricultural knowledge and skills through direct and indirect education including extension(Asare-Nuamah et al., 2019), will invariably enhance labour and agricultural productivity, thereby improving food security. Kpognon, Atangana Ondoa, Bah, & Asare-Nuamah (2021) argued that institutional quality has a crucial role in ensuring labour productivity. Interestingly, while all the governance indicators have positive influence on food security, economic governance, with a variation

margin of 33.9%, exerts the greatest impact on food security, followed by political (29.6%) and institutional governance (16.8%), respectively. Thus, economic governance is the greatest predictor of food security. Without doubt, economic governance has the greatest propensity to spearhead economic transformation with spillover effect on agricultural transformation, improved productivity and food security.

Conclusion and recommendations

This study sought to examine the effect of governance (political, economic and institutional) on food security in Ghana. The result from the study provides interesting insights into the governance-food security nexus. Indeed, achieving food security in Ghana is highly dependent on the governance system in the country. Implicitly, improving political governance which constitutes voice and accountability, and political stability significantly boosts food security in the country. In addition, addressing corruption and the effective application of the rule of law, which are the constituents of institutional governance, has the potential to positively enhance Ghana's food security. Similarly, economic governance (government effectiveness and regulatory quality) equally has a positive effect on food security. Without doubt, economic governance exerts the greatest impact on food security. The result further shows that capital and labour positively influence Ghana's drive to achieve food security.

On the basis of the result, the study recommends the need for governance system in Ghana to embrace the ethics and practices of good governance. Good governance minimizes corruption, promotes transparency, accountable and the rule of law. Again, the practice of good governance boosts the implementation of policies and programmes capable of promoting sustainable development. This stems from the fact that good governance ensures the establishment of strong, competent, well-resourced and equipped institutions capable of supporting and implementing development agenda of governments. In such environment, resources are used for optimum outputs. With Ghana's quest for economic transformation, good governance offers the potential to drive economic growth and development, necessary to boost agricultural production and food security. It is therefore crucial that economic governance in Ghana is strengthened, in addition to political and institutional governance, to put the country on its path to sustainable development. There is also the urgent need to intensify access to credit for smallholder farmers who usually

have challenges in accessing credit for agricultural commercialization and transformation. Access to credit should be complemented with avenues for smallholder farmers to acquire and improve their agricultural knowledge and skills through education and extension services. Improving the level of knowledge of farmers has the potential to increase the adoption and application of best and emerging agricultural practices, innovations and technologies, which is necessary to boost agricultural productivity and food security in Ghana.

This study obviously leaves room for improvement, especially as it pertains to extending the study to other African countries, particularly in fragile and post-conflict countries. Moreover, understanding the role other macroeconomic indicators beyond the remit of the engaged governance measurements is worthwhile.

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Appendix

Table 1: Description of variables

Variables	Measures	Data Sources
Governance indicators		
Voice and accountability	Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom	Worldwide Governance Indicators
Political Stability and Absence of Violence/Terrorism	Measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism	Worldwide Governance Indicators
Government effectiveness	Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	Worldwide Governance Indicators
Regulatory quality	Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	Worldwide Governance Indicators
Rule of law	Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	Worldwide Governance Indicators
Corruption control	Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	Worldwide Governance Indicators
Food production index	Food production index (2004-2006 = 100)	Word Development Indicators
Capital	Gross capital formation (% of GDP)	Word Development Indicators
Skilled labour	Secondary education, general pupils	Word Development Indicators

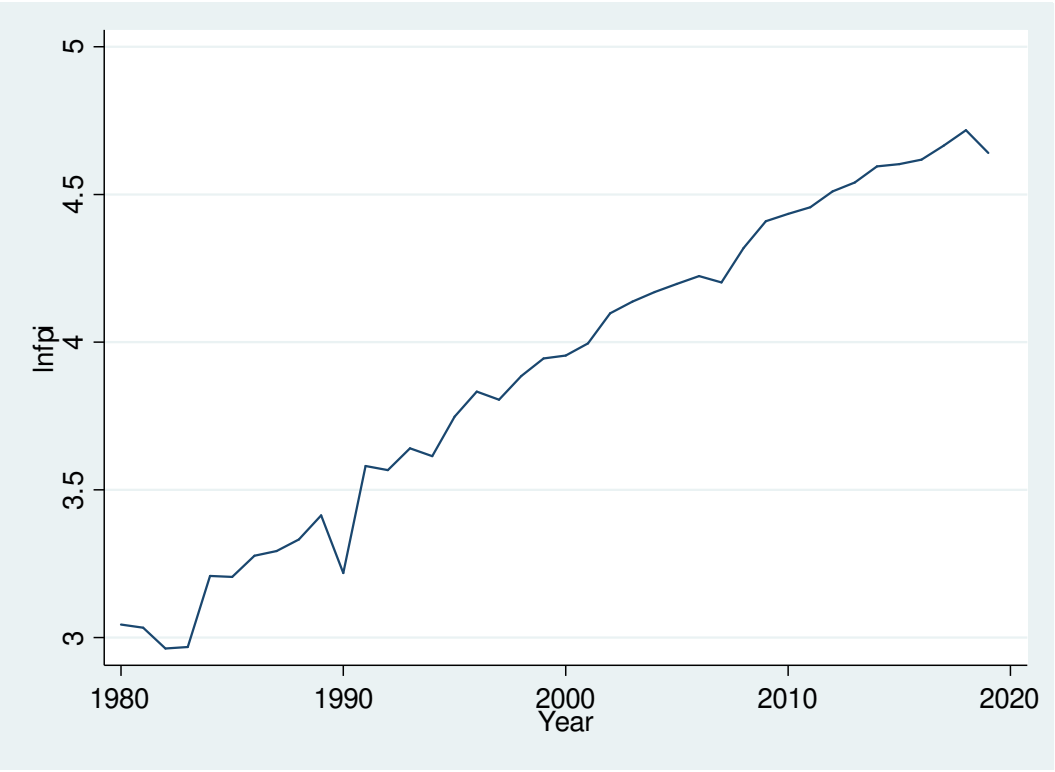

Figure 1: Line graph of food production index from 1980-2019