The Impact of the Political Environment (Stability/Instability) and Food Security/Insecurity on the Economic Growth Performance of African Countries: A panel Study

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ABSTRACT: This empirical study aims to examine the impact of the political environment and nutritional status on the economic growth of low and middle-income African countries, as well as their interactions. Using a panel analytic estimation methodology on a sample of 37 countries over the 2003-2016 period, the study finds that political stability, measured by the absence of violence/terrorism, democratization score, and durability of political regimes, has a statistically significant positive effect on the per capita real GDP growth. The study also constructs indices for food security and insecurity using various covariates, and finds that adequate nutrition, including food availability, accessibility, sustainability and utilization, have a statistically positive impact on economic growth. Additionally, the study highlights the coexistence effect of the political environment and nutrition indicators, which could either magnify or restrain their independent effects on the per capita real GDP growth rate. The study's findings provide insights into the importance of political stability and adequate nutrition in promoting economic growth in low and middle-income African countries.

Key words: Political Environment (stability/instability), nutrition, food security/insecurity, Economic growth, African countries, dynamic GMM.

***JEL Classification*: I15, O10, O43, O55, P16**

تهدف الدراسة إلى تحديد إلى أي مدى أثرت كل من البيئة السياسية المحيطة وأبعاد الأمن الغذائي المختلفة على النمو الاقتصادي للدول الإفريقية المنخفضة والمتوسطة الدخل. وفي سبيل تحقيق ذلك؛ وبالتطبيق على ٣٧ دولة إفريقية منخفضة ومتوسطة الدخل خلال الفترة (٢٠٠٣ – ٢٠١٦)، عمدت الدراسة إلى توظيف نموذج سولو المعدل من أجل بناء نموذج كمي لقياس أثر عدد من المؤشرات الدالة على البيئة السياسية، وكذلك مجموعة من المؤشرات المعبرة عن أبعاد الأمن الغذائي على نمو نصيب الفرد من الناتج المحلي الإجمالي الحقيقي. وقد توصلت الدراسة إلى أن مؤشرات استقرار البيئة السياسية – والتي اشتملت على مؤشر غياب العنف والإرهاب، وكذلك الرقم القياسي لتوافر نظام ديمقراطي – لها تأثير إيجابي ذي دلالة إحصائية على نمو نصيب الفرد من الناتج المحلي الإجمالي الحقيقي، مما يؤكد على أن الدول ذات النظم السياسية الديمقراطية والمستقرة سياسياً عادة ما تشهد معدلات مرتفعة من النمو الاقتصادي. وعلى الجانب الأخر وفيما يتعلق بتأثير أبعاد الأمن الغذائي المختلفة على النمو الاقتصادي، تكشف نتائج الدراسة أن أبعاد الأمن الغذائي الأربع والتي تتمثل في توافر إمدادات كافية من الغذاء، وثبات تلك الإمدادات، بالإضافة إلى إمكانية الوصول الآمن إلى قدر كافي من تلك الإمدادات الغذائية، وكذلك الاستفادة منها لها تأثير إيجابي ذي دلالة إحصائية على نمو نصيب الفرد من الناتج المحلي الإجمالي الحقيقي. علاوة على ذلك، فقد أظهرت نتائج الدراسة أن التأثير المشترك للبيئة السياسية ومؤشرات الأمن الغذائي ذي دلالة إحصائية على نمو نصيب الفرد من الناتج المحلي الإجمالي الحقيقي.

1. Introduction

Achieving sustained economic development is a pivotal policy concern, in specific for Africa whose countries have experienced continued challenges of either lack of democracy, protests, conflicts, or civil wars. For example, in the new Millennium, five out of six regions, that the UN peacekeeping personnel have been deployed in, are African regions.[1] Additionally, achieving food security is one of the most daunting challenges to sustainable development in Africa. A FAO report points out that Africa still has the most prevalence of undernourishment, hitting almost 21% of the population.[2] In general, previous studies argue that countries have experienced challenges with respect to their nutritional needs, have been the countries characterized by political instability.[3] Hence, the existence of politically stable institutions is a necessary condition in order to draw a long-run strategy for domestic food production, imported food supplies, or food aid programs (Deaton and Lipka, 2015). Consequently, the unstoppable recurring cycles of the political unstable events in the African countries are likely to preclude the development process and worsen the living conditions.[4] So far, however, there has been little attention paid to the coexistence effects of both political environment and nutrition status on economic growth in the African countries. In this paper, we investigate the economic growth effects of both the *political environment* and the *nutrition status* for African countries within the framework of the augmented Solow model.

The economic growth connection with the political environment has long been recognized by researchers in both economics and political science fields. Olson (1991), Alesina and et al. (1992), McGuire and Olson (1996), and DeHaan and Siermann (1996) theoretically exhibit explicit debates on the economic growth effect of the political environment. In these studies, the physical and human capital effect of uncertainty through capital flight and

[1] See http://www.un.org/en/sections/issues-depth/peace-and-security/index.html accessed March 17, 2019.

[2] See the State of Food Security and Nutrition in the World: Building Climate Resilience for Food Security and Nutrition. Food and Agriculture Organization of the United Nations, Rome, 2018. http://www.fao.org/3/I9553EN/i9553en.pdf Accessed March 17, 2019.

[3] As Central African Republic, Kenya, Swaziland, and Uganda.

[4] See https://www.un.org/africarenewal/magazine/august-2014/political-stability-remains-challenge accessed March 17, 2019.

brain drain have been the main channels through which political instability hinders economic growth. Nevertheless, while these and others in the literature propound that political instability retards economic growth, there are no conclusive evidence in the empirical literature for the relationship between the two variables. In general, the empirical controversies have been derived from twofold. The first has been the endogeneity between economic growth and the political instability variables while the other pertains to the channels through which economic growth affected by political instability.

Barro (1991) originally applies the neoclassical growth models as the theoretical foundation to empirically examine economic growth effect of political instability proxied by frequencies of revolutions, coups, and political assassinations, and concludes that it retards economic growth. In addition, Fosu (1992) and Jong-A-Pin (2009) show negative correlation between political instability and economic growth. While the finding of Fosu (1992) is derived by using proxies for frequencies of coups and plots to overthrow existing governments, Jong-A-Pin (2009) conclude that civil protest and the political instability of political regime rather than politically motivated aggression and political instability within political regime, have robust negative effect on economic growth. However, the literature has not introduced a conclusive empirical evidence on the correlation of the political environment and economic growth. For instance, Campos and Nugent (2002) reveal that there is no evidence for a long-run correlation of moderate, or severe political instability as proxied by frequencies of revolutions, coups, and political assassinations, and economic growth in their full sample, whilst the negative correlation is confined to the moderate political instability for the sub-sample of Sub-Saharan African countries. Furthermore, Benhabib and Spiegel (1992) and Ali (2001) find that political instability as proxied by changes in government and regulations, assassinations, and border and civil wars, do not have a statistically significant effect on economic growth.

While the above empirical works focus on the economic growth effect of political environment, others have broadened these efforts to involve the possible endogeneity between the two variables. In this context, while Blomberg (1996), Feng (1997), Gupta et al. (1998), Gyimah-

Brempong and Traynor (1999), Balan (2015) examine the causality between political instability and economic growth, Shabbir et al. (2016), Okafor (2017), Williams (2017), and Kaplan and Akçoraoğlu (2017) focus on economic growth effect of the political environment, and use estimating techniques to address the endogeneity issue of these variables in the growth equation. Blomberg (1996) shows that probability of coups as proxy for political instability has a statistically significant negative effect on economic growth; moreover, economic growth adversely affects political instability. By using different types of government changes as proxy for political instability, Feng (1997) finds mixed results. While an irregular government change has a robust negative effect, a major government change has statistically significant positive effect on the economic growth. Feng (1997) states that the negative effect may be explained by the interruption of political regime, while the constitutional change of the political regime may explain the positive sign. In addition, Feng (1997) concludes that economic growth has a robust negative effect on irregular government change and positive effect on the minor government change. Similarly, Gupta et al. (1998) reveal that democracy positively affects economic growth and economic growth has a statistically significant negative effect on frequency of deaths as proxy for political instability. Using a constructed index of 12 politically unstable events as proxy for political instability, Gyimah-Brempong and Traynor (1999) conclude that political instability adversely affects economic growth directly or indirectly through capital accumulation and economic growth has a statistically significant negative effect on political instability. Balan (2015) suggests that defense spending is the key channel for the causality between economic growth and political stability. However, the empirical evidence on the causality of political instability and economic growth has not been conclusive. Using a different dataset, Alesina et al. (1992) and Gurgul and Lach (2013) indicate that the propensity of government collapse as proxy for political instability has statistically negative effect on economic growth; however, they reveal that there is no reverse causality. Furthermore, Zureiqat (2005) concludes the same results by using *polityIV* democratization score as proxy for political instability.[5]

[5] The democratization score *polityIV* is a constructed measure ranges from +10 (for absolute institutionalized democracy) to -10 (for absolute autocracy) (see, Marshall et al., 2018).

On other hand, Shabbir et al. (2016) address endogeneity issue of the growth equation and confirm that physical investment is the channel for the positive correlation between political stability and economic growth. Likewise, Okafor (2017) concludes that frequency of terrorist incidents, poor governance, corruption, and social unrest used as proxies for political instability have statistically significant negative effect on economic growth. An inconclusive result reported by Williams (2017) shows that regime instability rather than protest and violence has a profound negative effect on economic growth. Similarly, Kaplan and Akçoraoğlu (2017) suggest that government instability, corruption, and conflicts rather than quality of bureaucracy, accountability, and internal tensions have negative impact on economic growth.

While the above empirical literature tackles the issue of endogeneity by investigating both the causality of economic growth/political environment and endogeneity of explanatory variables of the growth equation, others particularly focus on endogeneity of political environment and the human capital. Gyimah-Brempong and De Camacho (1998), Fosu (2002b, 2004), and Aisen and Veiga (2011) pivot the correlation of human capital and political instability. Gyimah-Brempong and De Camacho (1998) indicate that political instability as proxied by the weighted index of 12 politically unstable events has a statistically significant negative effect on both the human capital accumulation and economic growth. Fosu (2002b) examines the effect of political instability on human development and finds that the frequencies of successful coups have negative spillover effects on human development channeled through their negative effect on economic growth. Fosu (2004) reemphasizes that the frequencies of both successful coups and abortive coups have negative impact on human development. Aisen and Veiga (2011) use different indices to measure political instability including cabinet change, ethnic homogeneity, polity score, and economic freedom and find that both physical and human capital accumulation play the key role in the negative correlation of political instability and economic growth. However, studies on the subject have been mostly restricted to the role of education and health as human capital measures. For example, human capital accumulation measured by school enrollment in Gyimah-Brempong and De Camacho (1998) and in Aisen and Veiga (2011), while measured by life expectancy and adult literacy at Fosu (2002b, 2004).

The earlier studies that have examined this relationship (for African countries) include Fosu (1992, 2002b, and 2004), and Gyimah-Brempong and Traynor (1999), each focusing on elite political instability rather than any other political environment indicators for Sub-Saharan African countries. In addition, Okafor (2017) examines the effect of four different proxies of political instability on economic growth for West African countries. Conversely, our paper investigates the correlation between political environment and economic growth of 37 low- and middle-income African countries focusing on the endogeneity of political environment and nutrition status measured by food security/insecurity indicators. There has been little empirical evidence on this issue of the endogeniety. In this context, previous literature that has explored this correlation include Timmer (2005a), Olofin et al. (2015), Pourreza et al. (2018). Both the Timmer (2005a) and Pourreza et al. (2018) studies have been descriptive in nature. While Timmer (2005a) suggests that political stability is one of the most important determinants of food security, Pourreza et al. (2018) focuses on human capital negative effect of food insecurity and generalizes his discussion by including the use of resources efficiency as a driver of food security. Furthermore, Olofin et al. (2015) empirically examines the food availability effect of government effectiveness and income growth in the West African countries and finds that income growth rather than government effectiveness has a statistically significant positive effect on food availability.

This paper aims to contribute to this growing area of research in different respects. First, this paper addresses the endogeneity between political environment (politically stable/unstable events) and nutrition status (food security/insecurity indicators) in the economic growth equation. To the best of our knowledge, no previous empirical study has investigated this relationship for the augmented Solow-growth model before. Second, what is not yet clear is the coexistence effects of both political environment and nutrition status on economic growth. Our empirical model assesses these effects for the five different proxies of the political stability/instability and for the eight different proxies of food security/insecurity. Third, none of the empirical studies mentioned focus on examination of the economic growth effect of the overall food security/insecurity in the African countries and in particular the proxies for the four dimensions of food security/insecurity

(availability, access, stability, and utilization) in assessing the effect of nutrition status on economic growth. Moreover, our empirical research is based on more recent panel data of 37 cross-section units (a sample of low and middle-income African countries)[6] covering the 2003 to 2016 period.

The rest of this paper is organized as follows. Section II discusses the augmented Solow model as our theoretical framework; section III provides the data and methodology; section IV presents our empirical estimates; section V provides our conclusions; and section VI provides our policy implications and further recommendations.

2. **The Theoretical framework**

It has been suggested that the political environment has a profound correlation with the economic growth (Gupta et al., 1998; Zureiqat, 2005; Hussain, 2014). Political unrest may stem from unbearable economic conditions emanating from business cycle issues of joblessness and/or run-away inflation. In addition, political unrest and government changes may have a detrimental effect on both the physical and human capital and hinder the process of economic development. On the other hand, the lack of food security strategy may have a deleterious effect on the stock of human capital (Pourreza et al., 2018). Furthermore, although domestic food production, imported food supplies, and food aid programs are considered to be the traditional sources of food security strategy, the effectiveness of these sources fundamentally necessitates a stable and effective presence of both political and economic institutions (Deaton and Lipka, 2015). Consequently, our empirical analysis applies the augmented Solow growth model developed by Mankiw et al. (1992) to examine the role of both political instability and food security in economic growth. Following Mankiw et al. (l992), Islam (l995), and Glewwe et al. (2014), we initially specify augmented Solow model given by equation (3.1), assuming constant return to scale and diminishing marginal productivity as follows.

[6] See Table (1).

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} \left[A(t) L(t) \right]^{1-\alpha-\beta} \tag{3.1}$$

Defining $Y(t)$ as output at period t, $K(t)$ as the stock of physical capital at period t, $H(t)$ as the stock of human capital at period t, $A(t)$ as the level of technology or total factor productivity at period t, and $L(t)$ as the level of labor at period t. We assume that the level of technology and labor grow exogenously at a rate g for technology and n for labor where the output per effective labor is determined by equation (3.2).

$$y(t) = k(t)^{\alpha} h(t)^{\beta} \tag{3.2}$$

Mankiw et al. (1992) argue that economic evolution would occur through both physical and human capital by assuming that there are constant fractions of output invested in physical capital S_k and in human capital S_h as follows,

$$\begin{aligned} \dot{k}(t) &= S_k y(t) - (n + g + \delta) k(t) \ , \\ \dot{h}(t) &= S_h y(t) - (n + g + \delta) h(t) \end{aligned} \tag{3.3}$$

Where both the physical and the human capital depreciate at the same constant rate of depreciation δ. By definition, both $\dot{k}(t)$ and $\dot{h}(t)$ approach zero denoting that $\frac{y(t)}{n+g+\delta} = \frac{k(t)}{S_k} = \frac{h(t)}{S_h}$ in the case of convergence to their steady state values. Therefore, the steady state values of the physical and the human capital per effective labor are governed by,

$$k(t) = \frac{S_k y(t)}{(n + g + \delta)} \quad , \quad h(t) = \frac{S_h y(t)}{(n + g + \delta)} \tag{3.4}$$

Therefore, the steady state values of the physical and the human capital per effective labor are governed by,

$$k^{*} = \left[\frac{S_k^{\,1-\beta} S_h^{\,\beta}}{n + g + \delta} \right]^{\frac{1}{1-\alpha-\beta}} \quad , \quad h^{*} = \left[\frac{S_k^{\,\alpha} S_h^{\,1-\alpha}}{n + g + \delta} \right]^{\frac{1}{1-\alpha-\beta}} \tag{3.5}$$

Upon substituting the steady state levels of physical and human capital per effective labor into the logarithmic form of equation (3.2), Mankiw et al. (1992) determine the steady state level of per capita output as follows,

$$\ln\frac{Y(t)}{L(t)} = \ln A_0 + gt + \frac{\alpha}{(1-\alpha-\beta)}\ln S_k + \frac{\beta}{(1-\alpha-\beta)}\ln S_h - \left[\frac{(\alpha+\beta)}{(1-\alpha-\beta)}\right]\ln(n+g+\delta) \qquad (3.6)$$

The pace of convergence to steady state formula which relies on the steady state level of output per effective worker y^* (derived from equation (3.6) as $\ln y^* = \ln\left(\frac{Y(t)}{A(t)L(t)}\right)$) and the actual level of output per effective worker y, is used by Mankiw et al. (1992) and others as a preliminary step for exploring the dynamic growth of per capita output,

$$\frac{d\ln y(t)}{dt} = \lambda\left[\ln y^* - \ln y(t)\right] \qquad (3.7)$$

Where the rate of convergence $\lambda = (n+g+\delta)(1-\alpha-\beta)$. The general solution of the differential formula presented in (3.7) implies the following dynamic model,

$$\ln y(t_2) = (1-e^{-\lambda\tau})\ln y^* + e^{-\lambda\tau}\ln y(t_1) \qquad (3.8)$$

Where $y(t_2)$ is the level of output per effective labor at the current period, $y(t_1)$ is the level of output per effective labor at the previous period, and τ is the difference between the two periods of time. Then, by subtracting $\ln y(t_1)$ from both sides and substituting for $\ln y^*$ from equation (3.6), the growth of output equation is given as,

$$\begin{aligned}\ln y(t_2) - \ln y(t_1) = {} & \left[1-e^{-\lambda\tau}\right]\frac{\alpha}{1-\alpha-\beta}\ln S_k + \left[1-e^{-\lambda\tau}\right]\frac{\beta}{(1-\alpha-\beta)}\ln S_h \\ & - \left[1-e^{-\lambda\tau}\right]\frac{\alpha+\beta}{(1-\alpha-\beta)}\ln(n+g+\delta) - \left[1-e^{-\lambda\tau}\right]\ln y(t_1)\end{aligned} \qquad (3.9)$$

Reformulating equation (3.9) to stand for per capita output rather than the output per effective labor and representing it in terms of the stock of human capital rather than the growth rate of human capital yield,

$$\ln y(t_2) = \left[1-e^{-\lambda\tau}\right]\ln A_0 + g(t_2 - e^{-\lambda\tau}t_1) + \left[1-e^{-\lambda\tau}\right]\frac{\alpha}{1-\alpha}\ln s_k + \left[1-e^{-\lambda\tau}\right]\frac{\beta}{1-\alpha}\ln h_{t_2} - \left[1-e^{-\lambda\tau}\right]\frac{\alpha}{1-\alpha}\ln(n+g+\delta) + e^{-\lambda\tau}\ln y(t_1) \quad (3.10)$$

Equation (3.10) reveals the dynamic panel data model presented by Mankiw et al. (1992), Islam (1995), Glewwe et al. (2014), and others as a theoretical explanation for the leading determinants of the economic growth, where the term $\left[1-e^{-\lambda\tau}\right]\ln A_0$ refers to the time-invariant individual fixed effect, and $g(t_2 - e^{-\lambda\tau}t_1)$ denotes the time-varying effect. However, several empirical attempts have been carried out after Mankiw et al. (1992) based on including additional determinants for economic growth in the previous dynamic model. Therefore, following Jong-A-Pin (2009) and Aisen and Veiga (2011), we estimate the following dynamic panel data model,

$$\ln y_{it} = \gamma_1 \ln y_{it-1} + \gamma_2 x_{it} + \gamma_3 p_{it} - \gamma_4 \ln\left(n_{it} + g + \delta\right) + \mu_i + \nu_t + \varepsilon_{it} \quad (3.11)$$

Where y_{it} denotes per capita output at the current period of time, y_{it-1} denotes per capita output at some initial point of time, x_{it} is a vector for the economic determinants of economic growth (including the stock of human capital and the rate of physical capital growth), p_{it} is a vector of the political environment and food security proxies, n_{it} is the rate of population growth, g and δ are constants as reported earlier, μ_i is the time-invariant country fixed effect, ν_t is the time-varying effect, and ε_{it} represents the error term of our equation.

3. Methodology and Data

The hypothesis of our empirical analysis is that both the political environment and food security/insecurity have effect on economic growth. We examine the validity of the hypothesis using a dynamic panel data model of thirty-seven developing countries over the 2003 to 2016 period. The general equation for the estimation of a dynamic panel data model is governed as $y_{it} = \gamma y_{it-1} + \beta' x_{it} + \omega_{it}$, where $i = 1,...,N$, $t = 1,...,T$, y is a vector of the dependent variable, x is a matrix of the explanatory covariates of interest including the conventional control variables, γ and β are vectors

of the parameters supposed to be estimated for the lagged dependent variable and the explanatory covariates, respectively and $\omega_{it} = \mu_i + \nu_t + \varepsilon_{it}$ denoting the compiled error term consisting of the unobservable time-invariant unit-fixed effect μ_i, the time-varying effect ν_t, and the white noise ε_{it}.

A major problem with the dynamic panel data estimation technique emerges from the violation of the orthogonality assumption between the explanatory variables and the time-invariant unit-fixed-effect. This strict violation is generated from the dynamic nature of the growth equation (identified by the lagged dependent variable on the right-hand side) and the use of the estimators as pooled least squares, fixed effect, or random effect might be biased and inconsistent, particularly when our panel dataset consists of small number of the time-dimensions relative to the cross-sections. Moreover, most likely the regressors in the economic growth equation (both economic and political environment variables) are jointly determined, resulting in joint endogeneity in the panel data model (Carmignani, 2003).

According to the procedures suggested by Arellano and bond (1991), the generalized method of moments (GMM) dynamic estimator is employed to test our theoretical model. In case of applying the regularity conditions of the GMM, it is expected to be asymptotically normal and consistent estimator (Hayakawa and Pesaran, 2015). In this context, applying the first-difference technique removes the unobservable individual heterogeneity and using lagged values as instruments for both the pre-determined and the endogenous variables allows to account for the joint endogeneity implied in our empirical model. In order to overcome the most likely presence of our cross-sectional heteroscedasticity, we use the White-test method of standard error adjustment. In addition, we apply the Hansen J-test to examine the validity of the lagged level variables used as instruments.

This study employs panel dataset consisting of 37 African countries over the 2003-2016 period. The natural logarithm of real per capita GDP ($\log(R\_GDP)$) is used as a measure for our dependent variable. This measure is derived as $\frac{NGDP_i}{P_i \times Population_i}$, where $(NGDP_i)$ denotes nominal GDP for country (i), (P_i) represents GDP deflator for country (i), and

$(Population_i)$ stands for total population for country (i). The choice of the explanatory covariates, is guided by Mankiw et al. (1992), Gyimah-Brempong and Traynor (1999), Aisen and Veiga (2011), and others. We employ the foreign direct investment (FDI) as a share of GDP and a measure for the rate of physical capital growth (Inv/GDP). This study also uses enrollment in secondary education as a measure for the stock of human capital formation $(Education)$. The population is measured forthrightly in terms of the total population $(Population)$. We measure trade policy strictly by using the trade openness index $(Openness)$ which is derived as $\frac{x_i - m_i}{NGDP_i}$, where (x_i) and (m_i) denote total export and total import for country (i), respectively and $(NGDP_i)$ represents nominal GDP for country (i). Our empirical analysis uses several political and institutional indicators to examine their impact on economic growth. For the institutional index $(Institutional)$, we use proxies for the rule of law, government effectiveness, regulatory quality, voice and accountability, and the score of economic freedom. In addition, political environment is measured by using the indices for political stability and absence of violence/terrorism $(P\_Stability)$, *polity2* score $(PolityIV)$, the durability of the political regimes $(Durable)$, the aggregate numbers of successful or attempted coups d'état and coup plots $(Coup\_Tot)$, and the aggregate numbers of civil, or ethnic violence and war (Civ_Total). In order to account for the impact of nutrition status on economic growth, several proxies are used to address the four dimensions of food security/insecurity including the availability of sufficient supplies of food measured by the average value of food production $(Avaliability1)$ and the average dietary energy supply adequacy $(Avaliability2)$. Likewise, we measure the accessibility to sufficient, safe, and nutritious food by using the depth of food deficit $(Access1)$ and the ratio of prevalence of undernourishment to population $(Access2)$. The stability dimension is measured by the ratio of the value of food imports to total merchandise exports $(Stability1)$ and per capita food production variability $(Stability2)$. In addition, we measure utilization by the prevalence of

obesity in adults 18 years old, or more (*Utilization*1) and the prevalence of anemia among women of reproductive ages 15 to 49 years old (*Utilization*2)

Table 2 exhibits the descriptive statistics associated with per capita real GDP, secondary school enrollment, total population, trade openness, political stability/instability proxies, nutrition status proxies and institutional indicators for the 37 African countries. The sample constituted a diversified cross-section of countries that varied in the profundity of political environment and nutrition status as reflected by the considerable magnitude of the standard deviation relative to the mean of their proxies.

Insert Table 2 Here.

The dataset for the nominal GDP, GDP deflator, total population, and foreign direct investment are from the World Development Indicator database of the World Bank (**https://databank.worldbank.org/reports.aspx?source=world-development-indicators**). Enrollment in secondary education is from the World Bank education statistics (**https://databank.worldbank.org/reports.aspx?source=education-statistics-~-all-indicators**). The institutional variables are obtained from the Worldwide Governance Indicators of the World Bank (**https://databank.worldbank.org/source/worldwide-governance-indicators**). The score of economic freedom is from the Heritage foundation statistics (**https://www.heritage.org/index/explore?view=by-region-country-year&u=637195523003609517**). All the variables used to stand for the political instability are from the integrated network for societal conflict research statistics of the center for systemic peace (INSCR) (**http://www.systemicpeace.org/inscrdata.html**). The political stability and absence of violence/terrorism is obtained from the Worldwide Governance Indicators of the World Bank. Our dataset for the proxies of food security are from the food and agriculture organization (FAO) statistics division (**http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/#.Xmm6Xy2ZPOQ**).

4. Results and Discussion

The main objective of our empirical analysis is to unravel the effects of both the political environment (political stability/instability) and nutrition status (food security/insecurity) and their interactions on the economic growth of low- and middle-income African countries. The key research hypothesis of this study is that both the political environment and nutrition status have a significant impact on economic growth of the countries in the sample. Moreover, the endogeneity between the political environment and nutrition status rather than mere the political environment or nutrition status is expected to magnify their effects on economic growth. Since the political environment, nutrition status, and institutional structure are multidimensional concepts, our empirical analysis uses the factor analysis method to construct a single composite (weighted) index which captures the essence of the variables representing each these broad variable.[7] The covariates employed to construct the index of political stability are the political stability and absence of violence/terrorism, the durability of political regimes, and the democratization score *polity2*. Likewise, we use the frequencies of successful or attempted coups d'état, the officially reported coup plots, and the frequencies of civil, or ethnic violence and war in the construction of political instability index. The covariates used to create the index of food security are the average value of food production, the average dietary energy supply adequacy, the value of food imports to total merchandise exports ratio, and the per capita food production variability. Alternatively, the depth of food deficit, the prevalence of undernourishment to population ratio, the prevalence of obesity in adults, and the prevalence of anemia among women of reproductive ages are employed to construct the index of food insecurity. In addition, we construct a single weighted index for the institutional effect of the rule of law, government effectiveness, regulatory quality, voice and accountability, and the score of economic freedom index.

[7] The factor analysis method is based on examining whether a number of observed covariates are linearly described by some unobserved factors and an individual error term. It relies on the principal components method/technique widely used to estimate the parameters of the linear combination. By examining the matrix of these covariates, the technique is used to construct a single composite index with the most unbiased predictions for the unobserved factors (see, Tryfos, 1997 and Wansbeek and Meijer, 2000).

Four sets of empirical results are presented for our discussion. The first set provides evidence of the impact of political environment on economic growth using several proxies of politically stable/unstable events as measures for the political environment (see, Table 3). The second set of regressions examine the effect of nutrition status on economic growth using eight different proxies for the four dimensions of food security/insecurity including availability, access, utilization, and food stability (See, Table 4). The third set of analysis re-estimates the economic growth effect of both political stability/instability and food security/insecurity using their weighted indices, respectively (see, Table 5). The fourth set of analysis focuses on examining the interaction effects of the weighted indices of both the political environment and nutrition status indicators on economic growth (see, Table 6).

The GMM dynamic panel is applied in estimating the parameters of our empirical model. We use the one period lagged values of both the explanatory variables and the pre-determined variables as instrumental variables. In addition, we employ the first-difference technique to deal with the unobservable individual heterogeneity and the White-Huber standard errors method of adjustment to overcome the cross-sectional heteroscedasticity problem and compute the asymptotic t-statistics. We now turn to the discussions of the results presented in Tables 3-6 representing the impact of the political stability/instability variables, the food security/insecurity variables, the institutional quality variables, the composite indices of political stability and food security/insecurity and their interaction on the economic growth of African countries. The P-values for the Hansen J-test in our regressions indicate that there is no evidence to reject the null hypothesis that the instrumental variables used to account for endogeneity are relevant, implying that all lagged values used in our regressions as instruments are valid. Asymptotic t-statistics (presented in parentheses) are computed from the heteroscedastic consistent standard errors.

1. *Empirical evidence of the effect of the political environment indicators on economic growth*

Table 3 initially provides the results obtained from the preliminary estimation of the measure of economic growth as a function of the

explanatory variables including total population, physical capital (gross capital formation), education (human capital), trade openness, institutions, the lagged values of the regressors, and the control variables. As reported in column 1, the estimated coefficients for total population, enrolment in secondary education, investment to GDP ratio, trade openness, and the institutional index have the expected signs and statistically significant at the 1% level. Respectively, a 1% increase in the above regressors will result in an 8.7% decrease and 1.8%, 0.9%, 1.5%, and 0.9% increase on the economic growth of African countries. Our results are consistent with the findings of Mankiw et al. (1992) and Islam (l995). The estimated coefficients of the extended regressions which include proxies for the political stability/instability are given in columns 2 to 6 of Table 3. The results in column 2 include political stability and absence of violence/terrorism as an additional control variable to the model. The corresponding estimates reveal that the coefficients of the fundamental model are robust estimates in direction and statistical significance adding validity for the inclusion of this political proxy. In addition, the estimated coefficient (0.02) for the proxy of political stability has a statistically significant positive effect on economic growth at the 1% significance level.

Insert Table 3 Here.

The model in column 3 exhibits the results after using the democratization score (*PolityIV*) rather than political stability and absence of violence/terrorism as a proxy for political stability. Similarly, the coefficient estimates remain robust both in direction and statistical significance and yield close magnitude to those in the fundamental model. The estimated coefficient of *PolityIV* (0.0098) has a statistically significant positive effect on economic growth (at the 1% significance level). Column 4 rather exhibits the effect of the durability of political regimes as a proxy of political stability on economic growth. The estimated coefficient of the political durability variable (0.001) is positive and statistically significant (at the 1% significance level). Besides, the robustness of our fundamental results is affirmed in terms of direction and statistical significance. The regression in column 5 employs the frequencies of civil or ethnic violence and war as a proxy for political instability. It has a negative and statistically significant effect on economic growth (at the 5% significance level). Its

estimated coefficient of -0.011 suggests that a 1% increase in the frequencies of civil, or ethnic violence and war will result in a decrease in economic growth by 1.1%. The regression estimates affirm the robustness of the results of our fundamental model in terms of direction and statistical significance with respect to the total population, enrolment in secondary education, trade openness, and the index of institutional quality.

The frequencies of successful, or attempted coups d'état and the officially reported coup plots proxy is included in column 6 to account for the effect of political instability on economic growth. It has a statistically significant (at the 1% significance level) negative coefficient of -0.05 which implies that a 1% increase in this proxy results in a 0.5% reduction in the economic growth of countries in the sample. Overall, the regression results affirm the robustness of the estimates of the fundamental regression in term of direction and statistical significance.

The correlation between political stability/instability and economic growth is consistent with others studies on the African countries by Fosu (1992, 2002b, and 2004), Gyimah-Brempong and Traynor (1999), and Okafor (2017). In addition, it is consistent with more general studies by Barro (1991), Blomberg (1996), Gupta et al. (1998), Zureiqat (2005), Aisen and Veiga (2011), Balan (2015), Shabbir et al. (2016), and Kaplan and Akçoraoğlu (2017) who argue that democracy and political stability positively affect economic growth, while politically unstable events as terrorist incidents, coups, and civil wars retard economic growth. However, our findings do not corroborate with the Benhabib and Spiegel (1992), Ali (2001), and Williams (2017) studies which indicate that politically unstable events such as border and civil war, protests, and violence do not affect economic growth significantly.

2. Empirical evidence of the effect of nutrition status indicators on economic growth

The empirical results in Table 4 focus on the relation between economic growth and the nutrition status in the low- and middle-income African countries as measured by eight different proxies representing the four dimensions of food security/insecurity (availability, access, stability,

and food utilization). Columns 1 and 2 of Table 4 report the coefficient estimates of our fundamental regression after adding proxies that measure the impact of the availability of sufficient supplies of food. The empirical results in columns 1 and 2 show that the estimated coefficients and associated with the variables of food availability as measured by the average value of food production (0.001) and as measured by the average dietary energy supply adequacy (0.009) are statistically significant at the 1% significance level. The remaining estimates of columns 1 and 2 are statistically significant with their expected sign implying the robustness of our fundamental model estimates, with the main difference that investment to GDP ratio was only statistically significant at the 5% level in column 2.

The impact of the access to sufficient, safe, and nutritious food is estimated in columns 3 and 4. The estimated parameter associated with the variables of food accessibility is -0.0006 for the depth of food deficit (presented in column 3) and -0.005 for the ratio of prevalence of undernourishment to population (presented in column 4). Both statistically are significant at the 1% significance level. All other coefficient estimates have their expected signs and statistically significant at the 1% significance level, with the exception that both the investment to GDP ratio and trade openness are significant at the 10% (in column 3) and are significant at the 5% (in column 4).

Columns 5 and 6 provide the coefficient estimates associated with the stability dimension of food security. Both the value of food imports to total merchandise exports ratio (presented in column 5) and the per capita food production variability (in column 6) have a statistically significant positive impact with estimated coefficients of 0.0004 and 0.004 (at the 1% significance level), respectively. The remaining estimates of the other explanatory variables have the expected signs. The coefficient of the investment to GDP ratio (in regression 5) is statistically significant at the 5% significance level.

In Table 4, columns 7 and 8 capture the impact of the food utilization dimension. The estimated coefficient of (-0.01) for the prevalence of obesity in adults (in column 7) has statistically significant negative impact at the 10% significance level. Likewise, the prevalence of anemia among women during the reproductive ages (in column 8) has a statistically significant

negative impact (with the estimated coefficient of -0.01) at the 1% significance level. The estimates of the other control variables, they have their expected sign and statistically significant at the 1% significance level. The estimated parameter of the investment to GDP ratio has a statistically significant positive impact at the 10% significance level (in column 7) and at the 5% significance level (in column 8).

Notwithstanding the lack of empirical studies for the effect of the different dimensions of food security/insecurity on the economic growth of African countries, our findings appear to be consistent with the previous studies in this field for the African countries as in the study by Agboola (2014) who has asserts that food availability is one of the major determinants of economic growth in Sub-Saharan African countries. This also accords with Timmer (2005a) who has demonstrated that the positive relation between food security and rapid economic growth stemming from government policies and interventions.

Insert Table 4 Here.

3. Empirical evidence of the impact of the composite indices of political environment and nutrition status on economic growth

Table 5 exhibits the empirical results of the political *stability/instability* and food *security/insecurity* on the economic growth as measured by four different composite indices of the political environment and nutrition status. Column 1 in Table 5 focuses on the impact of the food security index (*F_Security_Index*) on economic growth. The estimated coefficient of the food security index (0.16) is positive statistically significant at the 1% significance level, implying that a 1% increase in food security increases the economic growth African countries by 1.6%. Column 2 provides estimates for the effect of the food insecurity index (*F_Insecurity_Index*). The empirical results show that the estimated coefficient of food insecurity index (-0.07) has negative and statistically significant impact on economic growth at the 1% significance level, implying that a 1% increase in the food insecurity index reduces the economic growth of African countries in the sample by 0.7%.

The estimated coefficient of total population in table 5, column 1 is -1.02 implying that a 1% increase in the total population is expected to

reduce economic growth by 10.2%. The coefficient of enrollment in secondary education is positive and statistically significant at the 1% level of significance in all the regressions. In addition, the results show that the coefficients of the investment to GDP ratio have the expected positive signs and are statistically significant at the 10% significance level in column 1 and are statistically significant at the 1% level of significance in column 2. The coefficient of trade openness is 0.08 is positive and statistically significant at the 1% significance level in Table 5, column 1, implying that a 1% increase in trade openness results in a 0.8% increase in economic growth. The coefficient of the institution index of institutional quality is also positive and statistically significant at the 5% significance level in column 1 and at 1% significance level in the rest of the regressions in columns 2-4. Interestingly, these findings in Table 5 are comparable to those presented in Table 4 supporting the theory that an adequate availability and access to sufficient, safe, and nutritious food supplies and an adequate biological utilization of food along with stability in achieving those three elements tend propel the per capita economic growth.

Columns 3 and 4 of Table 5 show that the estimated parameters associated with the political *stability* (P_Stability_Index of 0.05) and political *instability* (P_Instability_Index of -0.08) have the expected sign and are statistically significant at the 1% significance level. The results of the remaining control variables show that the coefficients have the expected sign and are statistically significant.

These findings in Table 5 are similar to other studies which have used comparable proxies for the political environment focusing on African countries as in Fosu (1992), Gyimah-Brempong and Traynor (1999), Fosu (2004) and the results are also consistent with those of Barro (1991), Alesina (1992), Blomberg (1996), Feng (1997), Gyimah-Brempong and De Camacho (1998), and Aisen and Veiga (2011). However, they differ from those of Campos and Nugent (2002), Jong-A-Pin (2009), and Williams (2017) studies that do not provide a conclusive evidence for the relation between their constructed composite of political indices and economic growth.

Insert Table 5 Here.

4. Empirical evidence of the effect of the interaction of the political environment and nutrition status

In the regressions whose estimates are reported in Table 6, we use four interaction terms to account for the interaction effects of both political environment (political stability/instability) and nutrition status (food security/insecurity) on economic growth. Table 6 allows for the indices of the political stability/instability interaction with the indices of food security/insecurity rather than each used independently. The independent effect of both of them is not restricted in our regressions. The results in column 1 show a positive and statistically significant relation between the interaction term (of both political *stability* and food *security*) and economic growth at the 1% significance level. This finding suggests that political stability is expected to propel economic growth when society is food secure. The independent effect of political stability and food security is similar to those in columns 1 and 3 of Table 5. The estimated coefficient of political stability index (0.05) is statistically significant at the 5% significance level. The coefficient of food security index (0.13) is statistically significant at the 1% significance level. Regarding the other control variables, the coefficients of total population, enrollment in secondary education, and trade openness are statistically significant at the 1% significance level with estimated parameters -1.04, 0.16, and 0.09, respectively. The estimated coefficient of the investment to GDP ratio is 0.13 and statistically significant at the 5% significance level. The coefficient associated with the institutional quality index is not statistically significant.

In Table 6 Column 2, the coefficient of the interaction between political *stability* and food *insecurity* (-0.07) is negative and statistically significant at the 1% significance level, implying that the coexistence of political stability and food insecurity results in the downturn of economic growth by 0.7% for every 1% increase in the interaction of both variables. This finding is in agreement with the result of column 1 suggesting that political stability is expected to be less effective in boosting economic growth when society is food insecure. The independent impact of both political stability and food insecurity in Table 6 are still comparable to those in Table 5 columns 2 and 3. The estimated coefficients of all the control

variables are according to expectation and are statistically significant at the 1% level.

In the Table 6 Column 3, the mutual effect of the interaction term between political *instability* and food *security* is negative and statistically significant at the 1% significance level, implying that political instability has greater negative impact on economic growth even in the presence of food security. The estimated coefficients of the other covariates do not vary appreciably in magnitude, direction, and statistically significance. The coefficients of total population, enrollment in secondary education are statistically significant at the 1% significance level, while the coefficients of the investment to GDP ratio, trade openness, and institutional index are statistically significant at the 5% significance level.

The coefficient estimate (0.02) of the interaction term between political *instability* and food *insecurity* in Table 6 column 4 is positive, but only marginally significant at the 10% significance level. This finding still supports the idea that the negative effect of political instability on economic growth is expected to be magnified when society is also food insecure. As expected, both political instability and food insecurity independently precipitate a negative blow to the economic growth of African countries in the sample. Again, all the control variables in Table 6 Column 4 have the expected sign and are statistically significant impact on the measure of economic growth at the 10% significance level.

Insert Table 6 Here.

Taken together, these results imply that both the political environment and nutrition status can propel or hinder the economic growth in the sample of countries included in our empirical study. Moreover, the findings further suggest that the economic growth effect of both political environment and nutrition status is likely to be conditioned by the endogeneity between the political stability/instability and food security/insecurity. In other words, the mutual effect of the interaction between the political stability/instability and food security/insecurity indicators is likely to magnify, or restrain the independent effect of each of them in the low- and middle-income African countries.

5. Summary and Conclusion

In this paper, we apply the generalized method of moments (GMM) dynamic estimator for panel data framework consisting of 37 low- and middle-income African countries over the 2003 to 2016 period. The present study introduces several noteworthy contributions to the growing area of the political economy literature. First, our empirical analysis examines the effects of *the political environment* using five different proxies (the political stability and absence of violence/terrorism, democratization score polityIV, durability of political regimes, the frequencies of civil, or ethnic violence, war, the frequencies of successful or attempted coups d'état, and the officially reported coup plots) that indicate the political stability/instability and their composite index (that constructed by using the factor analysis methodology) on the economic growth of African countries in the sample. Second, we use eight alternative proxies for *nutrition* as indicators of the four well known dimensions of food security/insecurity including: 1) availability, 2) access; 3) utilization, and 4) stability. Furthermore, the previous empirical literature for the developing countries has primarily focused on only the examination of conventional sources on economic growth, excluding the impact of either the political environment, or nutrition status (adequate/inadequate nutrition). To the best of our knowledge, this is the first study that takes into account the role both political environment and nutrition on the economic growth of developing countries. Moreover, our empirical study is based on a more recent panel dataset of African countries.

In the augmented Solow model, the individual political stability measures including the absence of violence/terrorism, the democratization score polityIV, and the durability of political regimes have a statistically significant positive effect on the per capita real GDP growth, suggesting that politically stable and democratic regimes are most likely to experience higher rates of the per capita real GDP growth. Likewise, the individual political instability indicators including the frequencies of civil, or ethnic violence, war, the frequencies of successful or attempted coups d'état, and the officially reported coup plots have a statistically significant negative effect on the per capita real GDP growth rate, implying that political instability has a detrimental effect on the per capita real GDP growth rate.

Moreover, the composite weighted indices measuring both the political stability and political instability affirm the latter results.

In terms of the effect of adequate/inadequate nutrition on economic growth, our estimation results reveal that both the availability of sufficient supplies of food (as measured by the average value of food production and the average dietary energy supply adequacy) and the stability dimension (as measured by the value of food imports to total merchandise exports ratio, per capita food production variability) have a statistically positive impact on the per capita real GDP growth rate. Interestingly, the latter results are supported by the significant negative sign of the depth of food deficit and the ratio of prevalence of undernourishment to population (as measures of the accessibility to sufficient, safe, and nutritious food), as well as the statistically significant negative sign of the prevalence of obesity in adults, and the prevalence of anemia among women in the reproductive ages (as measures of the food utilization) and the composite weighted indices of both food security and food insecurity confirm the prior results derived from the effects of the independent measures. Moreover, the empirical results reveal that the endogeneity between the political environment and nutrition indicators could magnify, or restrain the independent effect of each of them on the per capita real GDP growth rate.

6. Policy implication and further recommendation

Our finding reveals that both political environment and nutritional status have a significant impact on the economic growth of African countries. Moreover, the results imply that the endogeneity between the political regime performance and nutrition status is most likely to magnify the effect on the economic growth of the African countries. The finding may have practical relevance to the international development programs, in terms of linking these programs to the democratic transitional process and the political regime performance in the African countries. Accordingly, the performance-based incentives development programs may preclude the deleterious consequences of political instability, which most likely broaden the food insecurity and hinder economic growth. Likewise, the sustainable development strategies of the African governments have to account for the political alongside the economic reform.

The validity of this study is, however, limited in terms of the linear effect of both political stability/instability events and food security/insecurity indicators as well as their interaction effects. Further empirical investigations in this field would be of great help in exploring the causality between the political environment and nutrition alongside the determinants of this relation. Additionally, future research may also be undertaken to account for the nonlinear pattern of this relationship.

Notwithstanding these limitations, however, our finding about the impact of the political environment and nutrition on the economic growth of the African countries sheds some light on the remarkable relation between politics and economics in those countries. Achieving sound performance in the nutritional status could serve as the policy target alongside the political stability to drive sustainable economic development. Consequently, a key policy priority should be to establish a multi-sectoral strategy based on targeting both food security improvements in the main factors of the nutrition availability, access, stability, and utilization, and stable political regime.

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Table 1: List of the low- and middle-income African countries included in the study

Angola	Gambia	Rwanda
Benin	Ghana	Senegal
Burkina Faso	Guinea	Sierra Leone
Burundi	Guinea-Bissau	South Africa
Cabo Verde	Kenya	Sudan
Cameroon	Liberia	Tanzania
Central African Republic	Madagascar	Togo
Chad	Mali	Tunisia
Comoros	Mauritania	Uganda
Cote d'Ivoire	Morocco	Zambia
Democratic Republic of Congo	Mozambique	Zimbabwe
Egypt	Niger	
Ethiopia	Nigeria	

Table 2. Descriptive statistics summary

Variable	Mean	Median	Std. Dev.	Observations
Real GDP Per Capita	6.296	6.133	0.885	403
Secondary School Enrollment	13.392	13.414	1.195	403
(Invest/GDP)	0.046	0.029	0.071	403
Total population	16.489	16.593	1.117	403
Trade Openness	0.684	0.635	0.278	403
Political Stability and absence of violence/terrorism	-0.558	-0.434	0.734	403
Polity IV Score	1.514	0	5.11	403
Durability of political regimes	11.821	11	9.969	403
Total numbers of civil or ethnic violence and war	0.278	0	0.784	403
Total numbers of successful or attempt coups d'état and coup plots	0.094	0	0.325	403
Average value of food production	171.48	160	64.345	403
Average dietary energy supply adequacy	112.58	111	16.14	403
Depth of food deficit	152.12	120	106.15	403
Prevalence of undernourishment to population ratio	21.95	20.5	13.93	403
Food imports to total merchandise exports ratio	54.013	23	110.9	403
Per capita food production variability	9.009	7.4	6.9	403
Prevalence of obesity in adults 18 years old or more	7.757	5.5	6.603	403
Prevalence of anemia among women of reproductive ages 15 to 49 years old	42.251	45.9	11.03	403
Rule of law: Percentile rank	32.728	33.802	17.759	403
government effectiveness: Estimate	-0.639	-0.624	0.495	403
regulatory quality: Estimate	-0.525	-0.474	0.426	403
voice and accountability: Estimate	-0.534	-0.584	0.630	403
economic freedom score	55.744	56.2	5.156	398

Table 3. The Nexus between Political Stability/Instability proxies and Economic Growth

Method: Dynamic Panel GMM

Dependent Variable: Per Capita Real-GDP Growth, $\log(R\_GDP_{it})$

	(1)	(2)	(3)	(4)	(5)	(6)
Log (Population$_{it}$)	-0.8792	-0.8372	-0.915	-0.8636	-0.8967	-0.9083
	(16.639)***	(12.119)***	(14.237)***	(12.334)***	(12.029)***	(11.498)***
Log (Education$_{it}$)	0.1806	0.1668	0.1738	0.1624	0.1831	0.1915
	(10.252)***	(6.757)***	(7.483)***	(5.647)***	(9.309)***	(6.733)***
(Invest/GDP)$_{it}$	0.0949	0.1294	0.1483	0.1326	0.0839	0.1406
	(3.412)***	(2.845)***	(3.119)***	(2.603)***	(2.476)**	(3.029)***
Openness$_{it}$	0.1459	0.1532	0.1386	0.1621	0.1501	0.1312
	(15.014)***	(7.216)***	(5.798)***	(12.139)***	(4.953)***	(15.229)***
Institutional$_{it}$	0.0888	0.0554	0.0745	0.0559	0.0873	0.0829
	(11.432)***	(3.811)***	(7.267)***	(4.473)***	(7.539)***	(7.919)***
P_Stability$_{it}$		0.0211				
		(3.342)***				
PolityIV$_{it}$			0.0098			
			(6.422)***			
Durable$_{it}$				0.0013		
				(2.613)***		
Civ_Tot$_{it}$					-0.0117	
					(2.537)**	
Coup_Tot$_{it}$						-0.0509
						(19.131)***
Log(R_GDP)$_{it-1}$	0.7329	0.7424	0.7469	0.7386	0.7249	0.7492
	(83.883)***	(52.305)***	(59.057)***	(82.251)***	(66.604)***	(59.669)***
Hansen J-Statistic	35.831	33.691	33.234	33.314	34.466	36.552
P-Value	0.252	0.293	0.268	0.265	0.262	0.191
No. of observations	380	380	380	380	380	380

The instrument variables used for estimating the model are the first lag of each explanatory variable, and the second lag for the dynamic factor in the model.
The absolute t-statistic values are in parentheses ( ) below the coefficients of the regressors.
(***, **, *) denote significance level at 1%, 5%, and 10%, respectively.

Table 4. The Nexus between Food Security/Insecurity proxies and Economic Growth
Method: Dynamic Panel GMM
Dependent Variable: Per Capita Real-GDP Growth, log(R_GDP_{it})

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (Population$_{it}$)	-0.9354	-1.0914	-1.0048	-1.0238	-0.8269	-0.8752	-0.7486	-0.988
	(11.947)***	(8.499)***	(14.211)***	(13.598)***	(10.301)***	(13.029)***	(5.884)***	(9.835)***
Log (Education$_{it}$)	0.159	0.1901	0.2039	0.2106	0.1739	0.1755	0.171	0.1447
	(5.868)***	(7.412)***	(12.343)***	(10.832)***	(6.939)***	(7.712)***	(7.854)***	(5.973)***
(Invest/GDP)$_{it}$	0.1234	0.0889	0.0898	0.0978	0.0984	0.1118	0.0772	0.1042
	(2.714)***	(2.181)**	(1.717)*	(2.509)**	(3.489)**	(3.414)***	(1.431)*	(2.464)**
Openness$_{it}$	0.0503	0.0925	0.0607	0.0554	0.1267	0.1169	0.0777	0.0771
	(3.267)***	(3.973)***	(1.877)*	(2.204)**	(3.334)***	(3.549)***	(8.005)***	(8.222)***
Institutional$_{it}$	0.0733	0.037	0.0389	0.0392	0.0997	0.0922	0.0939	0.0759
	(5.914)***	(5.286)***	(5.934)***	(7.927)***	(14.527)***	(9.021)***	(9.146)***	(6.228)***
Avaliability1$_{it}$	0.0013							
	(3.686)***							
Avaliability2$_{it}$		0.0088						
		(5.244)***						
Access1$_{it}$			-0.0006					
			(4.813)***					
Access2$_{it}$				-0.005				
				(4.183)***				
Stability1$_{it}$					0.0004			
					(4.931)***			
Stability2$_{it}$						0.0035		
						(5.796)***		
Utilization1$_{it}$							-0.0104	
							(1.833)*	
Utilization2$_{it}$								-0.0105
								(3.021)***
Log(R_GDP)$_{it-1}$	0.7048	0.7101	0.7149	0.7108	0.7056	0.7081	0.7231	0.7124
	(54.012)***	(39.584)***	(41.333)***	(39.083)***	(67.851)***	(62.396)***	(89.997)***	(64.165)***
Hansen J-Statistic	33.254	32.699	29.663	30.471	31.862	30.953	35.252	33.088
P-Value	0.2676	0.247	0.2818	0.2486	0.3259	0.3676	0.2739	0.2742
No. of observations	373	348	344	344	368	368	380	380

The absolute t-statistic values are in parentheses below the coefficients of the regressors ( ).
(***, **, *) denote significance level at 1%, 5%, and 10%, respectively.
The instrument variables used for estimating the model are the first lag of each explanatory variable, and the second lag for the dynamic factor in the model.

Table 5. The Nexus between Food Security and Political Instability Composite Indices and Economic Growth
Method: Dynamic Panel GMM
Dependent Variable: Per Capita Real-GDP Growth, log(R_GDP_{it})

	(1)	(2)	(3)	(4)
Log (Population$_{it}$)	-1.0177	-0.9903	-2.1185	-0.8892
	(9.503)***	(8.098)***	(18.982)***	(12.629)***
Log (Education$_{it}$)	0.1737	0.1961	0.6597	0.1789
	(6.973)***	(5.776)***	(18.919)***	(6.708)***
(Invest/GDP)$_{it}$	0.0894	0.1223	0.1159	0.1169
	(1.782)*	(2.761)***	(2.792)***	(2.271)**
Openness$_{it}$	0.0841	0.0439	0.0381	0.0673
	(3.034)***	(1.556)*	(2.036)**	(8.338)***
Institutional$_{it}$	0.0288	0.0322	0.0471	0.0738
	(2.079)**	(4.634)***	(4.763)***	(5.186)***
F_Security_Index$_{it}$	0.1595			
	(7.512)***			
F_Insecurity_Index$_{it}$		-0.0734		
		(2.952)***		
P_Stability_Index$_{it}$			0.0518	
			(8.275)***	
P_Instability_Index$_{it}$				-0.0879
				(18.039)***
Log(R_GDP)$_{it-1}$	0.7291	0.714	0.5854	0.7487
	(41.048)***	(32.861)***	(37.573)***	(60.802)***
Hansen J-Statistic	30.481	29.145	33.111	27.777
P-Value	0.2481	0.3539	0.2733	0.5822
No. of observations	344	344	380	380

The absolute t-statistic values are in parentheses below the coefficients of the regressors ( ). (***, **, *) denote significance level at 1%, 5%, and 10%, respectively.
The instrument variables used for estimating the model are the first lag of each explanatory variable, and the second lag for the dynamic factor in the model.

Table 6. The Nexus between Food Security and Political Instability Composite Indices and Economic Growth
Method: Dynamic Panel GMM
Dependent Variable: Per Capita Real-GDP Growth, log(R_GDP_{it})

	(1)	(2)	(3)	(4)
Log (Population$_{it}$)	-1.0383	-1.0905	-1.0665	-1.0835
	(8.555)***	(7.609)***	(4.920)***	(9.989)***
Log (Education$_{it}$)	0.1624	0.2084	0.1935	0.2136
	(5.051)***	(5.996)***	(3.883)***	(6.589)***
(Invest/GDP)$_{it}$	0.1348	0.1132	0.0875	0.1267
	(2.138)**	(3.688)***	(2.437)**	(1.674)*
Openness$_{it}$	0.0999	0.0903	0.0856	0.0456
	(2.927)***	(2.688)***	(2.558)**	(1.021)
Institutional$_{it}$	0.0153	0.0322	0.0775	0.0357
	(0.576)	(4.634)***	(2.424)**	(1.870)*
P_Stability_Index$_{it}$	0.0512	0.0626		
	(2.128)**	(4.077)***		
P_Instability_Index$_{it}$			-0.1561	-0.1653
			(10.477)***	(11.993)***
F_Security_Index$_{it}$	0.1306		0.1352	
	(3.084)***		(2.815)***	
F_Insecurity_Index$_{it}$		-0.0749		-0.1022
		(2.073)**		(3.683)***
P_Stability_Index$_{it}$×F_Security_Index$_{it}$	0.0786			
	(3.847)***			
P_Stability_Index$_{it}$×F_Insecurity_Index$_{it}$		-0.0662		
		(6.043)***		
P_Instability_Index$_{it}$×F_Security_Index$_{it}$			-0.0411	
			(2.248)**	
P_Instability_Index$_{it}$×F_Insecurity_Index$_{it}$				0.0207
				(1.698)*
Log(R_GDP)$_{it-1}$	0.7433	0.6854	0.7749	0.7933
	(30.487)***	(44.791)***	(30.711)***	(26.689)***
Hansen J-Statistic	31.371	29.584	26.614	30.216
P-Value	0.177	0.1989	0.3754	0.1777
No. of observations	344	344	344	344

The absolute t-statistic values are in parentheses below the coefficients of the regressors ( ).
(***, **, *) denote significance level at 1%, 5%, and 10%, respectively.
The instrumental variables used for estimating the dynamic model are the first and second lags of each explanatory variable.