Economic Shocks and the Growth of the Ghanaian Cocoa Industry from 1975 to 2019

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Abstract

In this study, we sought to identify some economic shocks that have affected the Ghanaian cocoa industry and the effects of these shocks based on available annual data over the 45-year period from 1975 to 2019. The analysis was conducted using a simple autoregressive model of the cocoa industry. The results of the analysis indicated that the major economic shocks affecting the cocoa industry in Ghana were political instability arising from military coups, producer price shock linked to very high producer prices, the La Cote d'Ivoire civil wars between 2002 to 2007, and 2010 to 2011, which resulted in large-scale smuggling of cocoa beans across the border to Ghana for sale, and the El Nino weather shock characterized by severe droughts and very low amounts of rainfall, which dampened the production of cocoa beans in Ghana. The negative shocks were the El Nino weather phenomenon and political instability. The positive shocks were the very high producer prices and La Cote d'Ivoire civil war. We suggest some recommendations. These include increased resourcing of the Ghana Meteorological Agency to improve its prediction of extreme weather effects whose occurrence affect the production of crops such as cocoa, the establishment of bigger price stabilization funds by the Ghana Cocoa Board to support the cocoa industry, and research studies to analyse the apparent link between dramatic drop in cocoa production and explosive depreciation of the Ghanaian currency, the Ghana cedi.

Keywords: cocoa industry, economic growth, economic shocks, El Nino weather phenomenon, environmental impacts.

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Introduction

Cocoa is one of the major commodities which have dominated export-based agriculture in Africa since the beginning of the 20th Century. Cocoa is of particular relevance to specific portions of West Africa as well as the world chocolate-making businesses, based in Western countries such as The Netherlands and the United States. Though cocoa is a crop developed by the indigenous people of South America, such as the Aztecs, Incas and Mayans, over four thousand years ago, West Africa is now the biggest cocoa-producing region in the world accounting for 70% of the world's production (Asante-Poku and Angelucci, 2013; International Cocoa Organization, 2022). Following the end of the 400-year Trans-Atlantic Slave Trade, in the second part of the 19th Century, international trade between West Africa and Western countries changed from one dominated by the exports of human slaves into a system involving the production and export of agricultural raw materials and commodities, such as cocoa, forest logs and oil palm. The first cocoa exports from Ghana to Europe involving 55 kilograms of cocoa beans occurred in 1885 (La-Anyane, 1972). The cocoa industry remains an important component of the Ghanaian economy contributing to the foreign exchange earnings of the country (Ghana Statistical Service, 2020). Cocoa is a major ingredient in the manufacture of chocolate. The beans of the cocoa tree (Theobroma cacao L.) are key ingredients for the manufacture of chocolate and some cosmetic goods such as cocoa butter. The worth of cocoa and its consistency are linked to its distinctive and complex flavors. Aside its good taste, cocoa has several benefits which includes health effect such as build up resistance and fighter against fatigue (Send Ghana, 2019). Cocoa is mostly produced by smallholders in West Africa, based on a low-input farming approach, that takes advantage of the forest soil fertility and natural shade. This simple production process explains why the crop is grown on six million hectares of West African forest land. La Côte d'Ivoire and Ghana are the leading producers. Ghana is the second largest producer of cocoa; its production accounts for 20% of the world output (International Cocoa Organization, 2022). Dutch Christian Missionaries began planting cocoa in the Gold Coast's coastal districts as early as 1815, while Basel missionaries began planting the crop in Aburi in 1857. However, these efforts by Christian Missionaries were not very successful in terms of extension to farmers. Rapid spread of cocoa cultivation in Ghana was due to the establishment of an experimental farm by Tetteh Quarshie at Mampong in the Eastern Region of Ghana. Tetteh Quarshie had travelled and worked in Fernando Po. In 1879, he came back home to Ghana

and developed a farm at Mampong based on the production of Amelonado cocoa pods. The success of his work led to the spread of the seeds to other parts of Ghana, especially in areas that had Swiss-German Basel Christian Missionaries, such as Agona Area in the Central Region (mainly Agona Kwanyako and Agona Nsaba), and then other parts of Eastern Region in the last two decades of the 19th Century. Cocoa production rapidly spread to the other parts of Ghana during the early part of the 20th Century (Send Ghana, 2019). The revenues generated from cocoa exports were a key source of Ghanaian government funding from 1920 to 1990; the reserves built up from cocoa revenues provided the first independent administration with the means to pursue an ambitious infrastructural development programme, including the establishment of over 200 secondary schools, several universities, and thousands of kilometres of modern roads (Send Ghana, 2019). According to Wiah and Twumasi-Ankrah (2017), about 30% of Ghana's overall export earnings are derived from the cocoa industry. This view is also indicated by Monastrynaya et al. (2016) and Anaman (1988). The production of cocoa beans in Ghana is an important economic activity and employs thousands of small scale farmers and ancillary workers. Based on the July 2021 national census data, Ghana Statistical Service (2021, page 81) reported that there were 2,096,384 agricultural workers in the eight main cocoa producing regions of Ghana (Ahafo, Ashanti, Bono, Bono East, Central, Eastern, Western and Western North). The 2017/2018 National Census of Agriculture indicated that the number of cocoa tree crop holders was 619,866 (Ghana Statistical Service, 2019, page 151). This would suggest that over one million workers were employed in the cocoa production industry assuming that each cocoa tree holder employed one person for various activities on his/her farm during the production year (for example, the Send Ghana 2019 cocoa study report indicated that each cocoa farmer employed on average 5.5 additional persons to work on the farm. Income from cocoa farming does not come continuously throughout the year due to the seasonal nature of the harvesting of the crop. Many cocoa farmers have increased financial vulnerability during the off-season periods. From October to March, the major crop is harvested, while the less productive midcrop is harvested from April to September. Few farmers are able to save considerable amounts of money for the off-season period; many farmers do not have economic resilience options in place, such as insurance or alternative sources of income (Bannor et al., 2019; Send Ghana, 2019). Ghana

has one of the fastest growing income inequality in Africa (Ghana Statistical Service, 2018; World Bank, 2021). This inequality is characterized by growing income gap between the rural and urban components of the economy, and is worsened when economic shocks hit the climate-vulnerable agricultural sector including the cocoa industry. Cocoa is of considerable importance to the local economy, as virtually all cocoa export revenues are returned to Ghana through the Central Bank (Bank of Ghana). For the other major export items such as crude oil and gold, contractual arrangements with foreign companies operating in Ghana have resulted in a relatively small amount of export values being returned directly to the Ghanaian economy. For example, the Ghanaian government gets less than 15% of the value of crude exports; much of the total value of crude oil exports is retained overseas by the off-shore oil companies. Given that virtually all cocoa export revenues are directly returned to the Ghanaian economy, cocoa production is critical, not only as a source of foreign exchange earnings, but as an important tool in the stabilization of the value of the Ghanaian currency - the Ghana cedi. A common economic problem in Ghana is the significant depreciation of the value of the Ghana cedi, especially in some periods of the year when foreign reserves are low due to low levels of merchandise exports, high levels of merchandise imports and relatively large amounts of repatriation of profits by foreign-owned companies operating in the country. The weakness of the local currency, specifically its rapid depreciation, is also linked to the volume of the country's exports, especially the level of cocoa sales that are rapidly returned to the economy to finance imports and development needs of the country. Large cocoa exports are therefore critical in the overall balance of the Ghanaian economy and the socio-economic development of the country. Economic shocks, including those related to the cocoa industry, have consistently affected Ghana since political independence in 1957 and during the British colonial rule from 1844 to 1957. The cocoa-linked economic shocks that affected the economy were a big catalyst in the political independence struggle of Ghana led by Dr. Kwame Nkrumah and the Convention People's Party from 1949 to 1957 (Anaman, 1988; Anaman and Bukari, 2021). Economic shocks that hit the Ghanaian cocoa industry included the historically-low cocoa prices over the 1962 to 1965 period. These cocoa-price related shocks were related to international Cold War East-West political tensions and the primary role of Ghana as the then leader of the Pan-African movement. World cocoa prices reached its lowest level ever in July 1965, averaging 211 US dollars per tonne (International Cocoa

Organization, 2021), seven months before the first military coup in Ghana on 24 February 1966. These very low world cocoa prices, combined with the severe 1962/63 El Nino weather-related shock, led to a temporary balance of payments crisis in Ghana and directly contributed to the first military coup. During the 1962-1965 period, Ghana was the leading producer of cocoa beans in the world and accounted for about 37.5% of world production in 1965 (International Cocoa Organization, 2021; Kotey et al., 1974). Beyond low world cocoa prices, other factors, which act as economic shocks, have affected the performance of the Ghanaian cocoa industry as measured by its growth. These include the El Nino weather phenomenon commonly associated with severe droughts and very high temperatures (Kotey et al., 1974; Jacobi et al., 2015; Anaman et al., 2017). The 1977/78 and 1982/83 El Nino phenomena were considered to be the worst in the recorded history of Ghana in terms of severe droughts and considerably affected agricultural production. In terms of floods, the 1962/63 El Nino (La Nina) event also severely affected agricultural production in Ghana (Anaman, 2018). Incidentally, the severe 1977/78 El Nino event which affected the entire West African region led to dramatic reduction of world cocoa production leading to the highest recorded cocoa price of 4,361.8 US dollars per tonne in July 1977. Production of cocoa in Ghana has fluctuated over the last five decades (1970 to 2020) with the persistence of low farmer productivity, sometimes linked to poor weather conditions (Oyekale, 2020). Yet, cocoa production in Ghana reached the highest level since production in the country during the recently-completed production year, 2020/2021. Cocoa production exceeded 1.05 million tonnes during the 2020/2021 production year (from October 2020 to September 2021) despite the emergence of the coronavirus Covid-19 pandemic which slowed down production throughout the world (Ghana Cocoa Board, 2021). Ghana produced a record cocoa production level of over one million tonnes in the 2020/2021 production year and yet the country was expected to record the lowest cocoa production in 12 years in the 2021/2022 production year of only 685,000 tonnes in the 2021/2022 production year (Ghana Web Business News, 2022), a 34.8% decline of about 365,000 tonnes within one production year; a decline apparently linked to economic shocks. The large fluctuations of aggregate cocoa production over the last four decades, could be linked to both negative and positive economic shocks, which could include events occurring in the neighbouring country of La Cote d'Ivoire, currently the world's largest producer of cocoa beans. The

economic shocks need to be analyzed to provide more enhanced information to policy makers. This will enable them to undertake targeted measures to ensure steady and consistent development of the cocoa industry that best serves the interest of cocoa farmers and society in general. The impacts of economic shocks on economies have been extensively researched (for some excellent recent reviews, refer to Botzen et al., 2020; Shang et al.; 2021). However, the emphasis of many studies is placed on the identification and impacts from shocks which impose negative outcomes on economies. There are relatively limited studies on the simultaneous identification and assessment of both negative and positive impacts arising from economic shocks on economies. Studies which focus on the positive impacts of economic shocks on economies of developing countries such as Ghana are even more limited. The study reported in this paper focuses on Ghana and puts emphasis on the assessment of various economic shocks which impose both negative and positive impacts on the cocoa industry in Ghana. Given the background presented, the identification of major economic shocks and their effects on the Ghanaian cocoa industry were the objectives of this study. The remainder of this article is organized as follows: the next section is the literature review linked to the study which includes a discussion of economic shocks, the theoretical framework and empirical applications of assessment of economic shocks on various economic sectors. The methodology employed for the study is presented next followed by the presentation of the results and their discussion. Finally, the conclusions and some policy recommendations are reported.

Literature Review
Definition and Importance of Economic Shocks

An event or an occurrence that brings severe impacts, either negative or positive, can be referred to as an economic shock (Anaman and Egyir, 2019). Economic shocks vary based on their underlying causes; however, they can be classified into two main groups. The first group is made up of economic shocks that are caused or induced by natural hazards or events linked to nature. The second group is made up of shocks linked to human-made events such as terrorist activities undertaken by militant groups, major accidents (for example, nuclear explosions), road and airline traffic accidents due to human errors, and civil wars and conflicts. The first group of economic shocks caused by natural hazards, can be classified into three groups. These are: (1) natural shocks linked to the atmosphere

and hydrosphere, such as floods and tidal waves arising from under-sea earthquakes, (2) natural shocks linked to movements in the lithosphere, such as avalanches, dust storms, earthquakes, landslides and tornados, and (3) natural shocks linked to the biosphere, originating from bacteria and viruses such as coronaviruses and avian flu, and Ebola, and wildfires (Anaman et al., 2017; Anaman, 2018). For example, flooding caused by the La Nina weather event (the opposite of the El Nino weather event) makes it difficult to undertake continuous outdoor building work over a long period. In 1962 and 1963, a La Nina-linked natural event occurred in Ghana, which resulted in a negative growth of the economy (Anaman, 2018). A similar event occurred in 1968, which is a distinguishable year due to it being the wettest year on record when an average of 142.53 centimetres of rainfall was recorded in Ghana. The second group of economic shocks arise from the fluctuations and weaknesses of human-created systems, including financial systems. An example is very low world cocoa prices during the 1962 to 1965 period (Anaman, 2018), a price shock due to substantial price changes in world commodity prices. Shocks related to commodity prices have considerable impact on growth of developing countries (Fernandez et al., 2017). The collapse of commodity prices has directly created difficulties in repaying debts by African countries, as was the case with Zambia defaulting international loan payments in 2020. Unprecedented increases or declines in commodity prices create uncertainty, which can accentuate the effects of price decreases when compared to gains, resulting in an uneven response in real GDP growth. Further, adverse expressions of trade shocks can cause substantial decreases in growth rates and economic problems, which could instigate political conflict (Kilian, 2014).

When a big share of a nation's economy is based on international trade, international commodity price swings have an important influence on the domestic economy. Changes in terms of trade, or the ratio of the export price index to the corresponding import price index, are frequently used to quantify fluctuations in the net barter terms trade index. When a country's trade terms improve, its exports become more valuable and its imports less expensive. Major changes in terms of trade in weak economies lead to conflicts by worsening social strife, shifting political and economic power balances, and raising predatory incentives for elites (Elbadawi & Hegre, 2007).

Theoretical Framework for Analysing Economic Shocks

Shocks to the economic systems are frequently considered as extrinsic. It must be noted that economic shocks can have either negative or positive impacts, even though the term is often associated with its negative impacts. Negative economic shocks, which affect the economy and its constituent industries adversely, are often due to the disruptive effects of these shocks. On the other hand, positive economic shocks influence the economy in a positive manner, sometimes through the stimulation of economic growth arising from governments hosting international events such as Olympics Games. These events require major construction activities being undertaken that have multiplier and secondary effects on other industries in the local economy. From a macro-economic perspective, the aggregate supply and aggregate demand curves can be affected by shocks. In a negative sense, economic shocks affect aggregate supply through reduction of aggregate output and its related effect in increasing overall level of price in the economy. This effect of economic shocks is related to impact on the aggregate supply curve when purchases of inputs and materials become difficult or impossible due to blockades of international shipping lanes and routes, arising from wars. A common disturbance to aggregate supply comes from prolonged strikes by workers in critical industries (Anaman and Egyir, 2019). The impacts of shocks on aggregate supply is illustrated in Figure 1. The straight-line curve, S_1S_1, shows the aggregate supply curve in the absence of a negative shock. The related overall price level of the economy is indicated as P_1. A negative economic shock is represented in Figure 1 as the parallel shift leftward of the aggregate supply curve of the economy from S_1S_1 to S_2S_2. This leftward parallel shift of the economy, resulting from a negative economic shock, results in the overall price level rising from P_1 to P_2. This increase in the price level is observed as rises in consumer price and producer price inflation; these are measured by various indices in Ghana by the Ghana Statistical Service. This simple illustration assumes that the aggregate demand curve of the economy remains constant as D_1D_1.

As indicated earlier, economic shocks can also negatively or positively affect the aggregate demand of an economy. Aggregate demand of an economy is made up of expenditures related to household consumption, business investment by both private and publicly owned firms and businesses, government recurrent expenditures, and net trade made up of exports minus

imports. An example of a negative aggregate demand shock is the reduction of expenditures by householders and government arising from pandemics such as the 2020/2021 coronavirus Covid-19 pandemic and the 2008 global financial crisis. Pandemics such as Covid-19 restrict the movements of human beings, and thus, lower the demand for products and services that require interactions of humans, such as those in the tourism industry. Figure 2 shows the impact of negative shock on aggregate demand whose initial level is indicated by D3D3. Due to the decreased spending or expenditures by consumers arising from an economic shock such as the Covid-19 pandemic, the aggregate demand curve shifts downwards to the new curve D4D4. This downward shift of the aggregate demand curve then leads to the lowering of the general price level of the economy from P3 downwards to P4. Note that this illustration assumes that the aggregate supply curve remains unchanged at S3S3. Since industries and markets are linked together in a modern economy, major shocks to either demand or supply in an industry within a local economy do often generate extensive impacts throughout the economy. The most classic case of economic shock is a prolonged civil war which leads to substantial breakdown in law and order and disrupts market-based activities leading to reduction of outputs in various industries. However, wars occurring outside a country could have impacts on the domestic economy if these wars are taking place in neighbouring countries with push human refugees across the border to the local economy. Refugees coming to a country from neighbouring countries bring both good and bad effects. The good effects include the smuggling of large amounts of export commodities to the recipient country which improves the balance of trade position. The bad effects include pressure on existing social services and facilities of the recipient country which sometimes lead to resentment by local citizens.

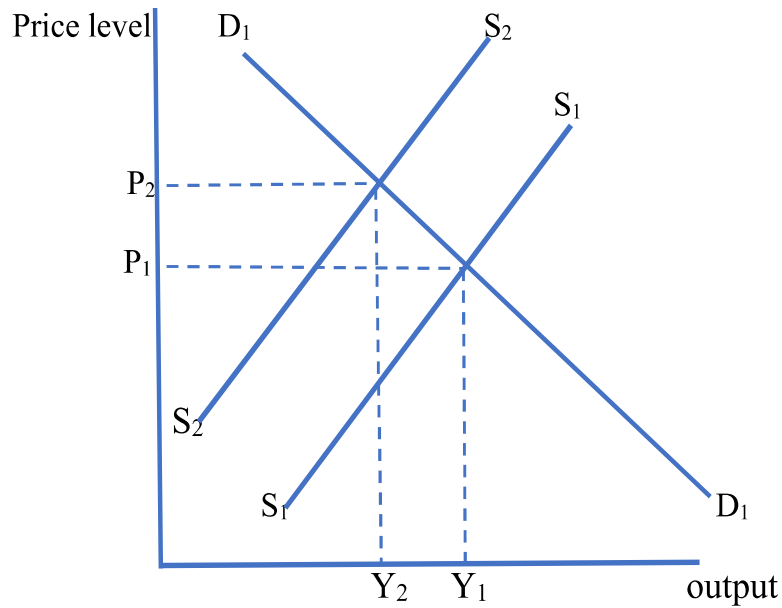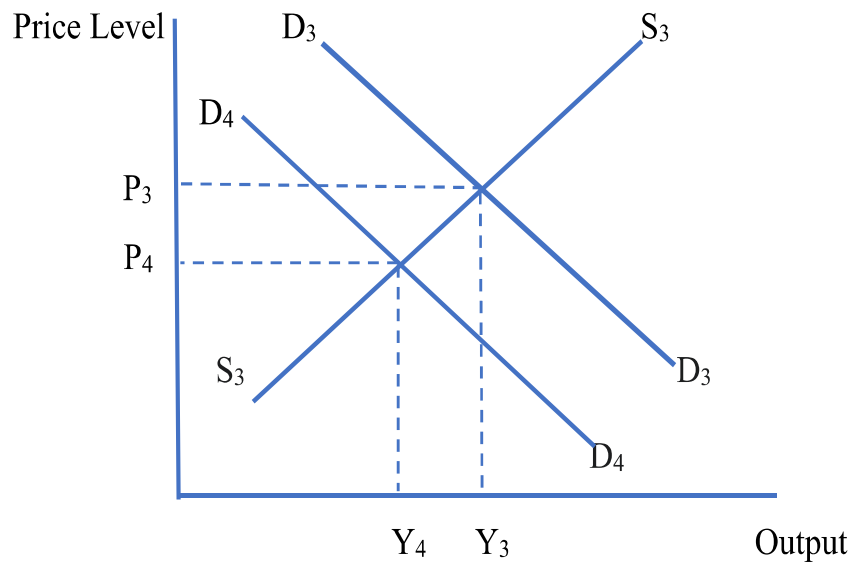**Figure 1: Illustration of the impacts of shocks on aggregate supply**

Figure 2: Illustration of the impacts of shocks on aggregate demand

Review of Empirical Works

Developments in the Ghanaian Cocoa Industry

Ghana is the only major cocoa-producing country in Africa that has retained a semi-liberalized marketing and pricing regime with considerable State management control, despite the late 1980s neoliberal structural reforms

pushed by major international organizations. Its cocoa beans command a high-quality premium on the international market due to stringent quality controls. As compared to other cocoa-producing countries, Ghana's cocoa value chain is special. The Ghanaian government is involved at all stages of production and export illustrating the importance of public-private partnerships in strategic industries (Essegbey and Ofori-Gyamfi, 2012; Send Ghana, 2019). Ghana Cocoa Board, Ghana's state-run marketing board, monitors cocoa quality and supervises the export of Ghana's cocoa beans. Licensed Buying Companies buy the beans from farmers and then sell them to Ghana Cocoa Board at a set price. The Ghana Cocoa Board's wholly-owned subsidiary, has the sole responsibility to market and export cocoa beans to local and foreign buyers, local processors and local retailers. The Ghana Cocoa Board also supervises operations on the domestic side of the chain. Its quality control division manages quality control measures at all stages of the supply. The private sector manages the bulk of input supply. The Ghana Cocoa Board undertakes input distribution programmes to cocoa farmers; however the costs of the input distribution programmes are directly borne by the farmers through a reduction in the gross producer price of cocoa and not subsidized by the Board (Bannor et al., 2019; Send Ghana, 2019). Several factors affect farmers' productivity and their incomes. These include declining productivity due to aging population and very old farms beyond 30 years (Dormon et al., 2004; Kroeger et al., 2017; Oyekale, 2020). Labour shortage affects the industry's long-term survival, owing to younger generations' reluctance to follow their forefathers' footsteps (Kyei et al, 2011; De Leicht, 2017). The importance of the environment is implied in conventional discussions about cocoa sustainability. The cocoa tree's viability is clearly threatened by a slew of environmental issues. In the quest to enhance yields from accessible plants and lands for example, there has been a rise in environmentally-destructive production activities (Shapiro and Rosenquist, 2004). Other factors that have influenced cocoa production in Ghana include extensive deforestation resulting in the depletion of accessible arable land and the incursion of the cocoa frontier into previously forested areas (Ntiamoah and Afranie, 2008; Quaye et al., 2015). Many farmers find it difficult to grow their cocoa crops as a result of changing climate which has resulted in uncertain seasonal swings ranging from extreme dryness to abundant rainfall (Maclean, 2017). The revival of the Ghanaian cocoa industry in the 21st Century was

due to increased efforts to boost yields from accessible plants, increased use of fertilizers and pesticides, and land expansion through deforestation. Smuggling of cocoa from La Cote d'Ivoire to Ghana also helped to boost local cocoa exports caused by the conflicts and wars and relatively lower producer prices in certain years in La Cote d'Ivoire. The uncertainty in La Cote d'Ivoire following the 2010–2011 post-election conflict pushed many farmers in that country to sell their cocoa beans in Ghana.

Economic Shocks and the Ghanaian Cocoa Industry

Ghanaian cocoa production is characterized by smallholder farming, which frequently employs entire families as workers. Production is exposed to a substantial risk of drought and is more and more influenced by extreme temperatures reaching the crop's physiological tolerance limit (Schroth et al., 2017). Further, the Ghanaian cocoa landscape is beset by ecological issues such as declining soil fertility, high pest and disease incidence, and high exposure to droughts and temperature extremes, all of which are exacerbated by poor agricultural practices and insufficient farm upkeep by typically elderly farmers. From the viewpoint of the external market environment, high market demand, more processing factories, government programs, and a market for high-quality specialty beans were among the variables considered prospects for the Ghanaian cocoa industry. On the other hand, threats to the industry came from the increasing production from new producing countries, climate change, alternative products becoming more popular, environmental deterioration, variation in price and changing global market requirements (Laode and Saediman, 2019). Shocks such as heavy rains and price reductions are common and severely affect many small-scale farmers in developing countries. The majority of the world's farming households still rely on agriculture for a living, and this could be jeopardized by adverse events, either directly or indirectly. The Ghanaian cocoa industry, like all other industries, is affected by the prices paid to producers of the commodity. Figure 3 illustrates the historical trend in Ghana cocoa production in tonnes from 1975 to 2019, the period of this study. The level of production was steadily falling from 1975 to 1984. From 1984 to 2002, production fluctuated though there was an increasing trend. Production jumped sharply from 2002 to 2007; thereafter the fluctuating production pattern returned from 2008 to 2019. However, over the latter period, cocoa production in Ghana was consistently above 600,000 metric tonnes each year. A primary driver

of increased production of cocoa during the first decade of the 21st Century was the relatively high prices of the commodity at the international market driven by high international demand during the decade of high commodities prices (refer to Fernandez et al., 2017). The big jumps in cocoa production in Ghana from 2002 to 2007, and 2010 to 2012, were apparently linked to increased smuggling of cocoa beans from La Cote d'Ivoire to Ghana, as a result of the civil wars in the former country from 2002 to 2007, and 2010 to 2011.

Figure 3: Illustration of historical cocoa production in tonnes in Ghana from 1975 to 2019
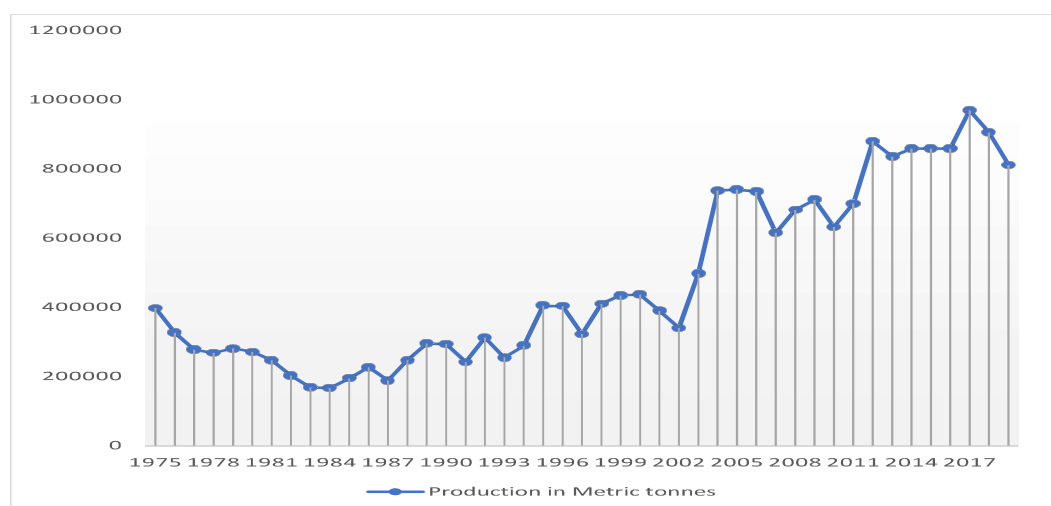
Source: Authors' illustration based on data from Faostat, 2021.

Methodology

Statistical Analysis of Cocoa Industry's Growth

An autoregressive model of the cocoa industry was the statistical procedure in this study. An autoregressive model is a statistical time series model that predicts the future based on past events (Meek et al., 2002; Anaman, 2003). As established by Gujarati (2003, page 176), the first difference of the natural logarithm of a variable is equivalent to the growth rate of the variable at its level. The growth of the value of the cocoa production in time t is equivalent to the first difference of the natural logarithm of the value of cocoa production. If the natural logged value of cocoa production is integrated of the order 1 (I(1)), then its first difference is stationary or I(0).

The model used in this study was constructed was to analyse determinants of the growth of the Ghanaian cocoa industry from 1975 to 2019. The model is indicated in Equation 1.

$$GoI_t = B_0 + B_1\, GoI_{t-1} + B_2\, GoE_{t-1} + B_3\, EL_t + B_4\, PS_t + B_5\, IWS_t + B_6\, PPS_t + U_t \tag{1}$$

Where GoI_t is the growth of the industry in year t (current year) based on the value added to the gross domestic product (GDP) by the cocoa industry; GoI_{t-1} is the lagged growth of the industry in the previous year (t-1); GoE_{t-1} is the lagged annual growth of the whole Ghanaian economy from the change in the GDP in the previous year (t-1) and PS_t is a dichotomous variable denoting political instability with a value of 1 for political instability (1978, 1979, 1981 and 1982); this value represents years of coups or attempted coups (the value of zero denotes years of political stability, all other years). EL_t is a dummy or dichotomous variable for years of low rainfall or droughts associated with the severe occurrences of the El Nino weather phenomenon in Ghana; the value of 1 denotes occurrences of El Nino weather phenomena in 1977, 1978, 1982, 1983, 1990, 1999, 2007 and 2015. The value of zero is designated for years of non-occurrence of severe El Nino phenomenon; IWS_t is a dichotomous variable with 1 for years when there was civil war in La Cote d'Ivoire, and zero when there was no civil war.

The first Ivorian civil war occurred from 19 September 2002 to 4 March 2007. The second Ivorian civil war occurred from 28 November 2010 to 11 April 2011 (Wikipedia, 2022). The years, 2003, 2004, 2005, 2006, and 2011 were years of intense conflict and were assigned the value of 1. It was assumed that large amounts of cocoa produced in La Cote d'Ivoire were diverted across the border to Ghana due to insecurity. Finally, PPS_t is a dichotomous variable with 1 for very high international cocoa prices which translated to very high local cocoa producer prices, and zero for an otherwise situation. The years, 1976 and 2010 were assigned to be years of very high cocoa prices. The high international cocoa prices reflected in high local producer prices. U_t is the error term in the equation. A normally-distributed error term would imply that the ordinary least squares statistical procedure could be used for the estimation of the parameters of the model. The parameter estimates for the autoregressive model are *Bi* (where i = 0, 1, 2, 3, 4 and 5).

Data and Data Sources

The data used were secondary data obtained from the Ghana Statistical Service and were compared with those from the Food and Agriculture Organization's FAOSTAT database. Years of occurrence of severe El Nino events were obtained from the Ghana Meteorological Agency, Accra. The output data related to GDP and the value of the various sectors of the GDP provided by the Ghana Statistical Service were made up of four series or structures of the economy. These were (1) 2013 to 2019 series using 2013 as the base year, (2) 2005 to 2016 series using 2006 as the base year, (3) 1993 to 2009 series using 1993 as the base year, and (4) 1975 to 1993 using 1975 as the base year. In order to get consistent set of data from 1975 to 2019, from these four series of data, the backcasting method was employed using the

year 2013 as the base year for all 45 years from 1975 to 2019. The nominal and constant values for the cocoa industry were used to derive specific industry-based deflators.

Result and Discussion

Results

Unit root tests were conducted for the two continuous variables used in the models – growth of cocoa industry and growth of the whole economy. The results of the Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests indicated that both variables were stationary, implying that the OLS method was adequate for model estimation. The null hypothesis of unit root for the growth of cocoa industry variable was rejected based on the computed Type 1 error probability values of 0.042 and 0.005 for the ADF and PP tests, respectively. Further, the null hypothesis of unit root in the growth of the whole economy variable was rejected with computed probability values of 0.004 and 0.003 for both ADF and PP tests, respectively. Table 1 provides the summary of the results of the econometric analysis of the growth of the industry based on the model of autoregressive equation. The power of the model, as measured by the R^2, indicated that 59.2% of the variation in the annual growth of the cocoa industry was explained by the six independent variables. The estimated model was correctly specified with the Ramsey Reset Test p value of 0.762 above the maximum critical p value of 0.10 used in this study. Given the relatively small sample size employed in this study (45 years), an important diagnostic test was the normality of the equation error term. A normal error term would justify the extrapolation of the results from the sample of 45 years to the population of infinite number of years of cocoa production. This would then allow the use of the estimated sample parameter values for discussion and interpretative analysis. The equation error term was established as normally distributed based on the Shapiro-Wilk test (Shapiro and Wilk, 1965). The computed p value of this test was 0.339, this was above the maximum critical p value of 0.10. The model also had no significant heteroscedasticity as measured by the Lagrange Multiplier (LM) test (refer to Silvey, 1959; Breusch and Pagan, 1979 for a discussion of the LM test). The computed p value of 0.878 was above the maximum critical p value of 0.10. The null hypothesis no significant heteroscedasticity (homoscedasticity) was not rejected. The variance inflation factors (VIF) of all the six independent

variables were less than 10.0 (refer to Table 1). The critical threshold for VIF is 10.0 or above for the detection of significant multicollinearity (refer to Hill et al., 2018). Hence, there was no significant multicollinearity in the model. Based on the standardized regression estimates, the El Nino weather phenomenon was the most important factor affecting the growth of the Ghanaian cocoa industry, followed by La Cote d'Ivoire civil war shock, the producer price shock related to the very high real producer prices obtained in two selected years (1976 and 2010), and finally the political instability shock related to military coups and attempted coups (refer to results in Table 1). All four economic shocks significantly affected the economic growth of the Ghanaian cocoa industry. There were two negative economic shocks and two positive economic shocks. The negative economic shocks were the El Nino weather phenomenon and political instability. The positive economic shocks were La Cote d'Ivoire civil war and the very high producer prices. The lagged growth of the whole Ghanaian economy influenced the current growth of the cocoa industry in a positive manner; however, this influence was not significant. The lagged growth of the cocoa industry did not significantly influence the current growth of the industry. The parameter estimate of 0.113 for the Ivorycoastwarshock variable meant that there was an extra positive growth of about 11.3% of the Ghanaian cocoa industry during the war years in La Cote d'Ivoire as compared to years of no war in that country. This growth reflected the increased smuggling of cocoa beans from La Cote d'Ivoire to Ghana. For the continuous period from 2003 to 2006 during the first Ivorian civil war, the annual value (net returns to land and management) of the Ghanaian cocoa industry was about 465 million United States dollars. The impact of cocoa smuggling to the Ghanaian cocoa industry during this period would have been significant.

Table 1: Summary of the results of the analysis of the growth of the Ghanaian cocoa industry related to the influence of various economic shocks, over the period, 1975 to 2019.

Explanatory variable	Unstandardized Regression Coefficients	Standardized Regression Coefficients	Student T-Test Value	Probability Level of Significance	VIF
Intercept	0.026	0.000	1.391	0.173	0.000
Laggedgrowthcocoaindustry	-0.025	-0.027	-0.213	0.833	1.439
Laggedgrowthwholeeconomy	0.277	0.121	0.997	0.325	1.288
ElNinoweathershock	-0.105	-0.388	-3.235	0.003***	1.268
Political instability	-0.072	-0.200	-1.736	0.091*	1.164
Ivorycoastcivilwarshock	0.113	0.344	2.849	0.007***	1.283
Producerpriceshock	0.227	0.325	3.031	0.004***	1.014

Notes:

The dependent variable is the annual growth of the cocoa industry in Ghana in time t

F value	8.655***
R^2	0.591***
Adjusted R^2	0.522***

*** significance of the parameter at the 0.01 level; ** significance of the parameter at the 0.05 level; * significance of the parameter at the 0.10 level.

Discussion

According to Osei et al. (2018), rainfall has a great impact on cocoa production. Cocoa is drought sensitive linking the sequence of its cultivation is linked to rainfall distribution, hence, it thrives with consistent water throughout the year. They indicate that the rainfall regime affects annual changes in cocoa yields more than any other climate variable, and the perfect yearly rainfall pattern for extreme growth and yield is between 1500 mm and 2500 mm. Cocoa grows best in hot, rainy conditions, and cultivation is mainly limited to locations within 20 degrees north or south of the Equator. The best climatic parameters for cocoa growth are mean shade temperature of 27°C,

with day-to-day variations of 8°C and at least 12 cm of evenly distributed rainfall (Kotey et al., 1974). The cocoa industry is impacted by weather-related shocks, for example, those caused by the El Nino weather phenomena in 1962 and 1963, 1977, 1982 and 1983, 1990, 1999, 2007, and 2015 (Anaman et al., 2017; Anaman, 2018). In Ecuador, rural low-input cocoa farms located at the coastal Pacific lowlands are especially vulnerable to climate-related yield deficits, such as those triggered by the El Niño–Southern Oscillation (ENSO) weather anomaly (Cai et al, 2020). The severe El Nino of 2015 triggered a lengthy drought in Ghana's main cocoa crop from 2015 to 2016, resulting in low cocoa yield in decades (Maguire-Rajpaul et al., 2020). These researchers indicate that the El Nino weather phenomenon, characterized by severe droughts and very high temperatures, affected the growth of the Ghanaian cocoa industry. This result is consistent with the finding of our study. Ghana saw the first of five military coups in 1966 on the 24th of February, nearly nine years after political independence. The coup was sparked by a series of economic shocks. The balance of payments crisis in 1965, caused by very low world market prices for cocoa, the country's primary commodity export, and other externally-driven political-economy shocks related to the international East-West Cold War tensions, were also responsible for the first coup staged by some middle-level officers of the Ghana Army (Anaman and Bukari, 2019, 2021). After the first coup, there was a 27-year period of political instability until the Fourth Republican Constitution was promulgated on January 7, 1993. This study has provided results indicating that the political instability related to coups significantly affected the growth of the Ghanaian cocoa industry. High volatility of cocoa prices on the global market was cited as a severe shock to the cocoa value chain's activities (Send Ghana, 2019). The drop in cocoa prices results in financial losses across the whole cocoa value chain. The supply of inputs, internal marketing operations are reliant on the volume of cocoa export revenues; these are affected when world cocoa prices fall. Given significant declines in world cocoa prices, input suppliers and haulers are affected, albeit to a lower amount, because cocoa-related operations account for a relatively small portion of their profits. The cocoa producer price differences between Ghana and La Cote d'Ivoire influence illegal cocoa commerce between the two countries. This illegal commerce is also influenced by political tensions or civil wars in either of these two major cocoa producing countries. As a result, cocoa is smuggled into Ghana

when the producer price in Ghana is greater than the producer price given to farmers in La Cote d'Ivoire, and vice versa when the producer price in La Cote d'Ivoire is higher than the producer price offered to farmers in Ghana.

Conclusions and Recommendations

This study was concerned with examining the effects of economic shocks on the growth of the Ghanaian cocoa industry using annual data covering the period from 1975 to 2019. The analysis was based on an autoregressive model of the cocoa industry which incorporated two lagged growth variables linked to the whole economy and the cocoa industry. The four identified economic shocks were political instability related to military coups in Ghana, droughts linked to the El Nino weather phenomenon, La Cote d'Ivoire civil war during the first decade of the 21st Century, and the very high producer prices during 1976 and 2010. The major conclusion of the study was that economic shocks influenced the economic growth of the Ghanaian cocoa industry. However, these shocks had both negative and positive effects. The negative effects were related to the El Nino weather-related shock and political instability. On the other hand, the Ivorian civil war and the very high producer prices had positive effects on the growth of the Ghanaian cocoa industry. The positive effect of the Ivorian civil war on the Ghanaian cocoa industry, through large-scale cocoa smuggling from La Cote d'Ivoire into Ghana, at the height of the civil conflict, also created secondary economic impacts, for example, increased employment and domestic trade in Ghana. These impacts energized the overall economic growth in Ghana which moved above five percent growth for the first time in 2003, since 1991, and remained above that rate until the El Nino weather shock of 2007, which reduced annual economic growth to 4.3%. Incidentally, 2007 was also the year the first Ivorian civil war ended.

Overall, economic shocks significantly affect the Ghanaian economy and society. As indicated by Anaman (2018), Ghanaian policymakers need to see economic shocks as part and parcel of the fabric of the economy and take pro-active steps to reduce their impacts. The government needs to monitor the occurrences of the El Nino weather phenomenon by resourcing the Ghana Meteorological Agency to improve its prediction of the phenomenon to enhance the country's preparedness for this phenomenon and other weather-related shocks. The Ghana Cocoa Board must work with other State agencies, such as the Forestry Commission and the Environmental Protection Agency,

to organize programmes to educate farmers and individuals on the essence of planting more trees to improve the resilience of the ecosystems in the cocoa-growing areas of Ghana. Finally, the Ghana Cocoa Board needs to establish bigger price stabilization funds in order to cushion and support the cocoa industry whenever there is a drop in international cocoa prices in order to promote consistent and steady growth of the cocoa industry.

Limitations of the Study and Suggestions for Further Research

A limitation of the current study is its scope on only four major economic shocks affecting the cocoa industry. More comprehensive assessment of economic shocks could involve the use of an input-output (IO) analysis of the economy of Ghana arising from the specific shocks on the cocoa industry which is capable of establishing the direct, indirect and induced impacts of economic shocks throughout the 76-industry national economic structure embedded in the 2018 national IO table. This assessment is part of our on-going research study at the University of Ghana using the latest 2018 national IO table and 2021 national census data. Finally, the link between the large depreciation of the Ghanaian currency, the Ghana cedi, and dramatic reductions in cocoa production, arising from economic shocks, need to be explored by academics through research studies. Even though the Ghana cedi is known to be a depreciating currency, characterized largely as a unit-root series, the explosive depreciation of the currency which is very pronounced in certain years, such as 2022, hurts the economy considerably and needs to be more thoroughly analysed.

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References

Addison, T., Ghoshray, A., & Stamatogiannis, M. (2015). Agricultural Commodity Price Shocks and Their Effect on Growth in Sub-Saharan Africa. Journal of Agricultural Economics, 67(1), 47-66. https://doi.org/10.1111/1477-9552.12129

Anaman, K.A. (1988). African Farm Management: Principles and Applications with Examples. Ghana Universities Press.

Anaman, K.A. (2003). Can the Construction Industry Pull the Rest of the Economy out of Recession? Evaluation of the Causality Links Between the Construction and the Rest of the Economy and the Macroeconomy. In Applied Economic Analysis in Brunei Darussalam: Evaluation of Economic Growth and Trade, Microeconomic Efficiency and Analysis of Socio-economic Problems: Bandar Seri Begawan: Universiti Brunei Darussalam.

Anaman, K.A. (2018). Economic Shocks and Growth in Post-Independence Ghana, 1957 to 2017. Institute for Fiscal Studies.

Anaman, K.A., Quaye, R., & Amankwah, E. (2017). Evaluation of the Public Weather Services by Users in the Formal Services Sector in Accra, Ghana. Modern Economy, 8(7), 921-945. https://doi.org/10.4236/me.2017.87065

Anaman, K, A. & Bukari, G. A. (2019). Political Economy Analysis of Voter Participation and Choices in National Elections in Ghana's Fourth Republican Era, Research in World Economy, 10(3), 174-198.

Anaman, K, A. & Egyir, S, I. (2019). Economic Shocks and the Growth of the Construction Industry in Ghana Over the 50-Year Period From 1968 to 2017. Research in World Economy, 10(1), 1-16. https://doi.org/10.5430/rwe.v10n1p1

Anaman, K, A. & Bukari, G. A. (2021). Voter Turnouts in Presidential Elections in Ghana: A Political Economy Analysis Using District-Level Data. Research in World Economy, 8(1), 13-31.

Asante-Poku, A., & Angelucci, F. (2013). Analysis of Incentives and Disincentives for Cocoa in Ghana. Food and Agriculture Organization.

Bannor, R. K., Oppong-Kyeremeh, H., Atewene, S. and Wongnaa, C. A. (2019). Influence of Non-Price Incentives on the Choice of Cocoa Licensed Buying Companies by Farmers in the Western North of Ghana, Journal of Agribusiness in Developing and Emerging Economies, 9(4), 402-418. https://doi.org/10.1108/JADEE-11-2018-0151

Botzen, W.J.W., Deschenes, O. and Sanders, M. (2020). The Economic Impacts of Natural Disasters: A Review of Models and Empirical Studies, Review of Environmental Economics and Policy, 13(2), 167-188.

Breusch, T.S. and Pagan, A.R. (1979). A Simple Test for Heteroscedasticity and Random Coefficient of Variation. Econometrica, 47(5), 1287-1294.

Bryant, C. & Mitchell, M. I. (2021). The political ecology of cocoa in Ghana: Past, present and future challenges. Natural Resources Forum, 45(3), 209-325. . https://doi.org/10.1111/1477-8947.12232

Cai, W., McPhaden, M.J., Grimm, A.M, Rodrigues, R. R., Tashetto, A.S., Garreaud, R.D., Dewitt, B., Poveda, G., Ham. Y., Santoso, A., Benjamin, N., Anderson, W., Wang, G., Geng, T., Jo, H., Marengo, A., Alves, L.M., Osman, M., Li, S., Wu, L., Kapamperidou, C., Takashashi, K., & Vera, C. (2020). Climate impacts of the El Niño–Southern Oscillation on South America. National Review Earth Environment, 1(4), 215–231. https://doi.org/10.1038/s43017-020-0040-3

De Leicht, S.C. (2017). A Roadmap Towards a Sustainable Cocoa Sector in Ghana. International Trade Forum, 2, 34–35.

Dormon, E.N.A., Van Huis.A., Leeuwis C., Obeng-Ofori, D., & Sakyi-Dawson, O. (2004). Causes of Low Productivity of Cocoa in Ghana: Farmers' Perspectives and Insights from Research and the Socio-Political Establishment. Wageningen Journal of Life Sciences, 52(3), 237-259. https://doi.org/10.1016/S1573-5214(04)80016-2

Elbadawi, I., & Hegre, H. (2007). Globalization, Economic Shocks and Internal Armed Conflict. Defence and Peace Economics, 19(1), 37-60. https://doi.org/10.1080/10242690701365160

Essegbey, G., & Ofori-Gyamfi, E. (2012). Ghana Cocoa Industry - An Analysis from the Innovation System Perspective. Technology and Investment, 3(4), 276-286. https://doi.org/10.4236/ti.2012.34038

Fernandez, A., Schmitt-Grohe, S., & Uribe, M. (2017). World Shocks, World Prices, and Business Cycles: An Empirical Investigation. Journal of International Economics, 108(1), 2-14. https://doi.org/10.1016/j.jinteco.2017.01.001

Food and Agriculture Organization (FAO) (2013). Analysis of Incentives and Disincentives for Cocoa in Ghana. Monitoring African Food and Agricultural Policies: Synthesis Report. http://www.fao.org/3/at551e/at551e.pdf

Ghana Cocoa Board (2021). The Ghana Cocoa Story. https://Cocobod.gh/cocoa-story

Ghana Statistical Service (GSS). 2018. Ghana Living Standards Survey Round 7 (GLSS) 7 Poverty Trends in Ghana 2005-2017. Accra: GSS.

Ghana Statistical Service (GSS). (2019) 2017/2018 Ghana Census of Agriculture.

Ghana Statistical Service (GSS) (2020). Rebased 2013-2019 Annual Gross Domestic Product April 2020 Edition.

Ghana Statistical Service (GSS) (2021). 2021 Population and Housing Census General Report Volume 3E Economic Activity.

Ghana Web News (2022). Ghana Set to Record Lowest Cocoa Crop Yield in 12 Years – Report by Bloomberg News. http://www.ghanaweb.com

Glejser, H. (1969). A New Test for Heteroscedasticity. Journal of the American Statistical Association, 64(325), 316-323. https://doi.org/10.1080/01621459.1969.10500976

Gujarati, D.N. (2003). Basic Econometrics. McGraw-Hill.

Hill, R. C., Griffiths, W. E., & Lim, G. C. (2018). Principles of Econometrics. London: John Wiley and Sons.

International Cocoa Organization (ICCO) (2022). Quarterly Bulletin of Cocoa Statistics, Various Issues.

Kilian, L. (2014). Oil Price Shocks: Causes and Consequences. Annual Review of Resource Economics, 6(1), 133–154. https://doi.org/10.1146/annurev-resource-083013-114701

Kolmogorov, A. (1933). Sulla Determinazione Empirica di Una Legge di Distribuzione. G. Ist Ita. Attuari, 4, 83-91.

Kotey, R.A., Okali, C. and Rourke, B.E. (editors; 1974). Economics of Cocoa Production and Marketing. University of Ghana.

Kroeger, A, Koenig S, Thomson A, Streck C, Weiner P-H, & Bakhtary, H. (2017). Forest and Climate Smart Cocoa in Côte d'Ivoire and Ghana, Aligning Stakeholders to Support Smallholders in Deforestation-Free Cocoa. The World Bank.

Kyei, L., Foli, G., & Ankoh, J. (2011). Analysis of Factors Affecting the Technical Efficiency of Cocoa Farmers in the Offinso District-Ashanti Region. American Journal of Social and Management Sciences, 2(2), 208-216. https://doi.org/10.5251/ajsms.2011.2.2.208.216

La-Anyane, S. (1972). The Ghana Cocoa Industry. The Cocoa Growers' Bulletin, 19, 5-9.

Laode, G. & Saediman, H. (2019). Analysis of Factors Affecting Cocoa Development in Southeast Sulawesi. Pakistan Journal of Nutrition, 18(5) 479-490.

Maclean, R. (2017). Chocolate Industry Drives Rainforest Disaster in Ivory Coast. The Guardian. https://www.theguardian.com/environment/2017/sep/13/chocolate-industry-drives-rainforest-disaster-in-ivory-coast

Maguire-Rajpaul, A, V., Khatun, K., & Hirons, A, M. (2020). Agricultural Information's Impact on the Adaptive Capacity of Ghana's Smallholder Cocoa Farmers. Frontiers in Sustainable Food Systems, 4(28), 1-16. https://doi.org/10.3389/fsufs.2020.00028

Meek, C., Chickering, D. M., & Heckerman, D. (2002). Autoregressive Tree Models for Time-Series Analysis. Proceedings of the 2002 SIAM International Conference on Data Mining, 229–244. https://doi.org/10.1137/1.9781611972726.14

Monastryrnaya, E., Joerin, J., Dawoe, E., & Six, J. (2016). Assessing the Resilience of the Cocoa Value Chain in Ghana. Swiss Federal Institute of Technology.

Ntiamoah, A., & Afrane, G. (2008). Environmental Impacts of Cocoa Production and Processing in Ghana: Life Cycle Assessment Approach. Journal of Cleaner Production. 16(16), 1735-1740. https://doi.org/10.1016/j.jclepro.2007.11.004

Osei, M. E., Egyir, I. S., & Gordon, C. (2018). Effects of Rainfall and Temperature Variability on Cocoa Production in the Dormaa West District of the Brong-Ahafo Region, Ghana. Journal of Energy and Natural Resource Management, 1(2), 29-35. https://doi.org/10.26796/jenrm.v1i2.134

Oyekale, A. S. (2021). Climate Change Adaptation and Cocoa Famers Rehabilitation Behaviour Ahafo Ano North District of Ashanti Region, Ghana. Open Agriculture, 6(1), 263-275. https://doi.org/10.1515/opag-2020-0191

Quaye, W., Ampadu, R., Onumah, J., & Titiati, A. (2015). Does the current land tenurial arrangement in Ghana incentivize adoption of environmentally sustainable cocoa production practices? A case study of four selected cocoa growing districts in Ghana. African Journal of Science, Technology, Innovation and Development, 7(4), 265–275. https://doi.org/10.1080/20421338.2015.1082366

Ramsey, J.S. (1969). Tests for Specification Errors in Classical Linear Least Squares Regression. Journal of the Royal Statistical Society, Series B, 31(2), 350-371. https://doi.org/10.1111/j.2517-6161.1969.tb00796.x

Schroth, G., Laderach, P., Martinez-Valle, A.I., & Bunn, C. (2017). From Site-level to Regional Adaptation Planning for Tropical Commodities: Cocoa

in West Africa. Mitigation and Adaptation Strategies for Global Change, 22(6), 903–927. https://doi.org/10.1007/s11027016-9707-y

Send Ghana (2019). Assessing Farm Gate Pricing and Income of Cocoa Farmers: A Case Study of Cocoa Farmers in the Agona East District.

Shang, Y., Li, H. and Zhang, R. (2021). Effects of Pandemic Outbreak on Economies: Evidence from Business History Context, Frontiers in Public Health, 9:632043.

Shapiro, S.S. and Wilk, M.B. (1965). An Analysis of Variance Test for Normality (Complete Samples). Biometrika, 52(3-4), 591-611. https://doi.org/10.1093/biomet/52.3-4.591

Shapiro, H.Y. and Rosenquist, E. M. (2004). Public/private Partnerships in Agroforestry: The Example of Working Together to Improve Cocoa Sustainability. Agroforestry Systems, 61, 453–462. https://doi.org/10.1023/B:AGFO.0000029025.08901.9c

Silvey, S. D. (1959). The Lagrangian Multiplier Test. Annals of Mathematical Statistics, 30(2), 389-407.

Smirnov, N. (1948). Table for Estimating the Goodness of Fit of Empirical Distributions. Annals of Mathematical Statistics, 19(2), 279-281.

Wessel, M. and Quist-Wessel, F. (2015). Cocoa Production in West Africa, A Review and Analysis of Recent Developments. Wageningen Journal of Life Sciences, 74(7), 1-7. https://doi.org/10.1016/j.njas.2015.09.001

Wiah, E. N. and Twumasi-Ankrah, S. (2017). Impact of Climate Change on Cocoa Yield in Ghana Using Vector Autoregressive Model. Ghana Journal of Technology, 1(2), 32-39.

Wikipedia (2022). First Ivorian Civil War. First Ivorian Civil War - Wikipedia, 31 May 2022.

World Bank. 2021. Country Data on Ghana.

https://data.worldbank.org/indicator/SI.POV.GINI?locations=GH