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Title: Foreign Direct Investments in Africa with a focus on Cocoa Production

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Abstract

This paper examines the relationship between foreign direct investment (FDI) and cocoa production in Sub-Saharan Africa (SSA) countries for the period 1997-2017. The fixed effect regression results confirm a positive and strongly significant association between Per capita FDI and cocoa production. The results are robust to many model specifications. The findings suggest the need for FDI expansion in the cocoa sector in Africa which is a major contributor to the economy of cocoa producing countries in Africa. This research advocates the use of disaggregated sectoral FDI inflows as a recommendation for future research to help establish effective policies relevant to the sectors. Further the research recommends that causality in the relationship between cocoa production and FDI be investigated in future.

Key Words - Foreign Direct Investment, Africa, Cocoa Production

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I would like to thank my supervisor Katarina Nordblom for her helpful comments during my thesis work.

TO MY FAMILY

1. Introduction

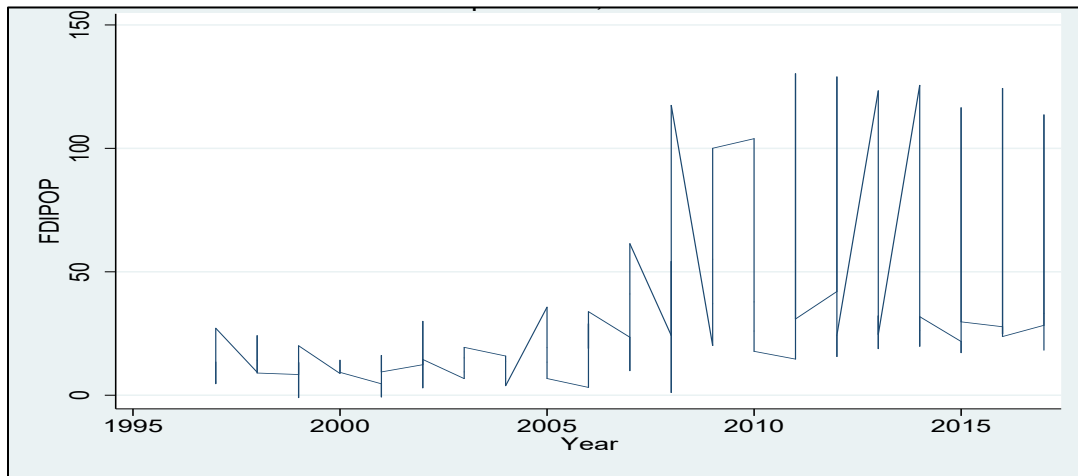
1.1 Foreign Direct Investments in Africa

Globalization of foreign direct investments (FDI) has increased significantly in the past two decades (Figure 1 and Appendix A). According to the Global Development Finance, 2005, FDI is the most stable and largest component of capital flows used in the development finance process. Some of the benefits of FDI inflows to a host country include employment creation (Kobrin, 2005) and improvement of the economy of host countries through funding investment projects, increasing technical progress and transfer of new technology to developing countries (Gohou & Soumare' 2012), pg. 75. Moreover, most African countries are off track in meeting the United Nations' Millennium Declaration of 2000 which aim at human development and poverty reduction. This has created the need for significant amounts of capital investments to redress this situation (Gohou & Soumare' 2012).

In light of the expected benefits of FDI to an economy, many researchers have investigated the relationship between foreign direct investment (FDI) and economic growth assuming a positive correlation between economic growth and welfare(e.g., Alfaro, 2003; Alfaro, Chanda, Kalemli-Ozcan, & Sayek, 2004; Alfaro, Chanda, Kalemli-Ozcan, & Sayek, 2010; Apergis, Lyroudia, & Vamvakidis, 2008; Carkovic & Levine, 2005; Chowdhury and Mavrotas; Hansen & Rand, 2006). However, some researchers have questioned this assumption (e.g., Anand & Sen, 2000), who observe that economic growth with inequality may maintain or increase the level of poverty in a country. However, only a few studies have been conducted with a focus on Sub-Saharan Africa probably due to the relatively small level of foreign direct investment

to Africa, in comparison to other regions, e.g. Latin America and Asia (Ankilo 2004; Adams 2009;). This was confirmed in the UNACTAD's World Investment Report 2018 Appendix A.

Figure 1: Graph of per capita FDI for the period 1997-2017 for cocoa producing countries

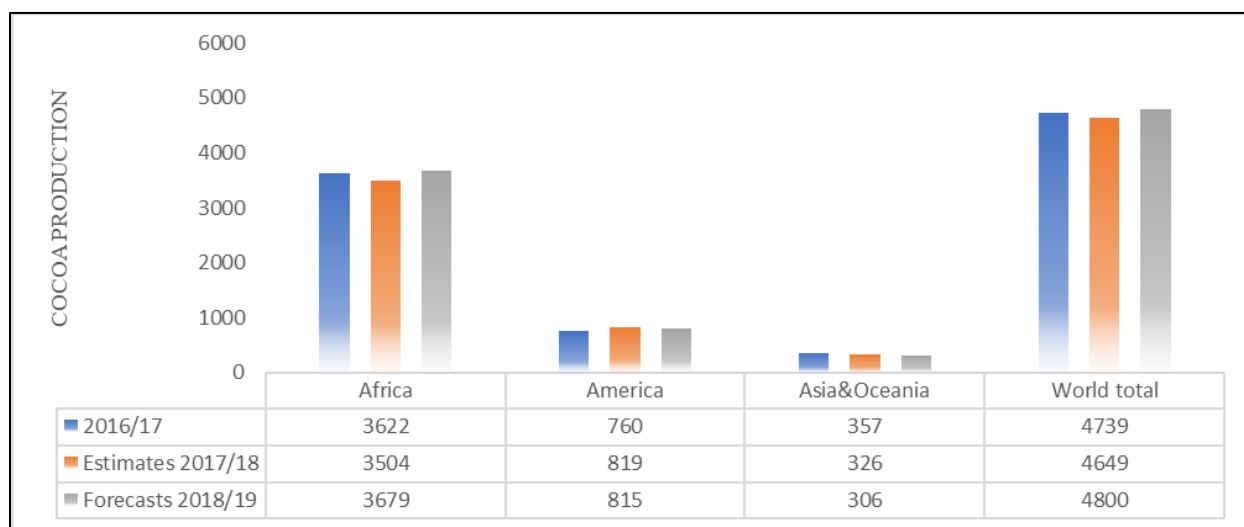


1.2 Cocoa Production in Africa

Agricultural growth has had significant aggregate effects in the reduction of extreme poverty (Bourguignon and Morrison 1998; Gollin, Parente, and Rogerson 2002; Christiaensen, Demery, and Kuhl 2011). Some researchers note that agriculture promotes growth in non-agricultural sectors through structural transformation of rural areas with low productivity to higher productivity urban areas (e.g., Bezemer and Heady 2008; de Janvry and Sadoulet 2009; McArthur and McCord 2017). Cocoa (also known as *theobroma cacao*) production supports the livelihood of around 50 million people globally for their livelihoods while governments rely on earnings from cocoa to finance economic and social development programs. The cocoa industry is estimated to be worth 150 billion dollars with an annual global production of about 4.5 million Tonnes (Fairtrade Foundation 2016). About 80 % of the world's cocoa is produced in Africa with the top producers being Ivory Coast, Ghana, Cameroon, and Nigeria as shown

in figure 2. (UNFAO). Despite having such a great potential on the economy of a country, the future of cocoa production is threatened by a variety of factors such as low income (Vellema et al. 2015) which affects cocoa yield especially in West Africa where the yield gap is high (Wessel & Quint-Wessel, 2015). Other factors include price instabilities relating to supply deficits/surpluses (Pipitone, 2015: Thornton, 2015) or challenges in production as a result of soil erosion or fungal diseases (Rice & Greenberg, 2000). Globally the cocoa-producing countries have similar tropical climate (Olesen et al. 2013). Figure 2 below summarizes global cocoa production with data extracted from the ICCO (2019).

Figure 2: Global Cocoa Production in thousand tonnes



Source; Table generated from data collected from the International Cocoa Organisation Secretariat (ICCOS) and UNFAO

This research contributes to the literature on FDI in two main ways. First, the study examines the relationship between FDI and cocoa production in SSA countries, which to my knowledge has not been done by previous researchers to date. Secondly, the research performed several robustness tests using interaction terms, providing an in-depth understanding of the

relationship among the variables allowing more hypotheses to be tested. However, the study is faced with various challenges. First, there is a limitation of lack of disaggregated FDI inflows data, which makes it difficult to allocate sectorial (in this case agriculture) FDI in the empirical analysis. Moreover, data on key control variables such as *Education* and *Roads* was not available for some of the countries such as Ivory Coast., which happens to be the highest cocoa producer in the sample countries.

Additionally, the research does not control for child labor, which has had a global negative reputation in the cocoa industry in Africa. According to the World Cocoa Foundation (WCF), child labor is a widespread and challenging issue in African agriculture. It is estimated that about 2.1 million children work on family cocoa farms the Ivory Coast and Ghana (International Labour Organisation). Due to lack of availability of data, the analysis does not control for this thought-provoking variable which has been of global attention in the cocoa industry. Finally, according to the Guardian Global Development Report (2014), there have been reports of some farmers smuggling cocoa from Ghana to the Ivory Coast where cocoa is valued for 50% or more. This research faces the challenge of data limitation once more as this information though not verified, has great potential to impact on cocoa production per country.

The rest of the paper is organized as follows: Section 2 discusses the literature review on the previous studies on the impact of foreign direct investment. Section 3 describes the theoretical framework used in developing the model used in this analysis. Section 4 describes the data and methodology used. Section 5 presents the empirical results and discusses the findings. Section 6 offers managerial and policy implications, suggestions for future research, and concluding

remarks. This paper studies the relationship between FDI and cocoa production in Africa. The main research question for this study is, therefore “*does FDI have a positive association with cocoa production in Africa?*”

2. Literature Review

2.1 Foreign Direct Investment

Several researchers have investigated the impact of FDI on economic growth with the common assumption that FDI improves the welfare of a country. Although most research finds that FDI promotes economic growth, there has been mixed conclusions on the topic with the differences arising from methodological and conceptual factors ranging from missing data, different definitions of FDI and econometric specifications (Gohou & Soumare’ 2012). To overcome these challenges such as missing data, this research makes an addition to literature by investigating the relationship between FDI and cocoa production of which data is readily available on the World Bank and the United Nations (FAO) site.

Gohou & Soumare’ (2012) investigated the impact of FDI on welfare using cross-country data between 1990 to 2007 using FDI per capita and found the impact of FDI on welfare to be positive. A similar approach is used in this research; however, the main difference is that the main dependent variable in this research is cocoa production and not human development index (HDI) and gross development product (GDP) as investigated by Gohou & Soumare’ (2012). This is mainly because HDI is limited in terms of availability of data while GDP has been proven to be unreliable in measurement of welfare (Gohou & Soumare’ 2012; Pg. 78). Another notable difference between this research and Gohou & Soumare’ (2012) is that interaction

terms on the variables of this study were investigated as additional robustness tests to the model. For FDI to be efficient in welfare improvement through job creation, the number of jobs created must be greater than the number of jobs lost as a result of FDI-related activities such as layoffs under mergers & acquisitions and the closing of local firms, etc. FDI in a labor-intensive, pro-poor sector such as agriculture is thus, likely to have the greatest impact on welfare (Gohou & Soumare' 2012). This research, therefore, focuses on the agriculture sector which is the backbone of the economy in countries in Africa (Economic Commission for Africa 2012). To be more specific, the research aims at understanding the association between FDI and cocoa production.

This study focuses on the cocoa sector, thus follows the sectorial analysis approach as used by previous researchers who opted to analyze the link between FDI and specific sectors or regions (Gohou & Soumare' 2012) Pg. 77. Such researchers include Alfaro and Charlton (2007) who focused on the industrial sector through their study on 29 countries between 1985 and 2000 and found positive and significant results after controlling for industry characteristics and time effects. Similarly, Balasubramanyam et al. (1996) focused on the trade sector (exports and imports) and found a positive effect of FDI on growth after analyzing 46 developing countries in the period 1970 to 1980, it was also noted that the effect is more apparent in countries where exports were promoted (Singapore, Malaysia, and Chile) than in countries that implement import substitution policies (Peru and Bangladesh). This research shall therefore include interaction terms on *openness* among others to investigate the effect of *openness* on the impact of FDI on cocoa production.

Alfaro (2003) examined how FDI affected growth in the primary, manufacturing, and services sectors and found a great variance. Using cross-country data between 1981 and 1999, Alfaro's findings suggest that in general, FDI has an ambiguous effect on growth as its effects in the primary sector are negative, its effects in the manufacturing sector are positive, and its effects in the services sector are unclear. Blomstrom (1994) finds the impact of FDI on growth to be positive only when the minimum threshold of wealth per capita is reached, otherwise the effect is negative.

Zhang (2001) investigated 11 emerging economies in East Asia and Latin America and found FDI had a positive impact on economic growth but the effects were dependant on country-specific features such as host countries with liberated trade policies, high education standards and encouragement of export-oriented FDI. Following this approach, this research controls for country and time (year) effects. Some empirical analysis found negative or neutral results on the investigation of the relationship between FDI and Economic growth. Moreover, FDI has been found to have a negative effect on the host country through the crowding-out effect (Razafimahefa et al. 2007, Borensztein et al.1998), where domestic firms exit the local market due to lack resources and organizational skills to compete against foreign firms. If the foreign MNEs are more efficient in the production of goods than the local firms, the crowding-out effect forces the local firms to swap activities or exit the market.

In summary, studies on the relationship between FDI and economic growth have indicated contradicting results using FDI and GDP growth variables. Most studies have assumed that economic growth and welfare are perfectly and positively correlated and have thus used GDP

growth as a proxy for welfare. Several researchers have challenged this assumption by proving that GDP can grow even as poverty is on the rise. To overcome this limitation, a small number of papers have examined the direct relation between FDI and welfare, while others have studied the impact of FDI on specific sectors. This research overcomes this challenge, through investigating the relationship between FDI and cocoa production. The data on cocoa production is also readily available hence it is a reliable main dependant variable. To the best of my knowledge, no such study has been conducted by previous researchers to date.

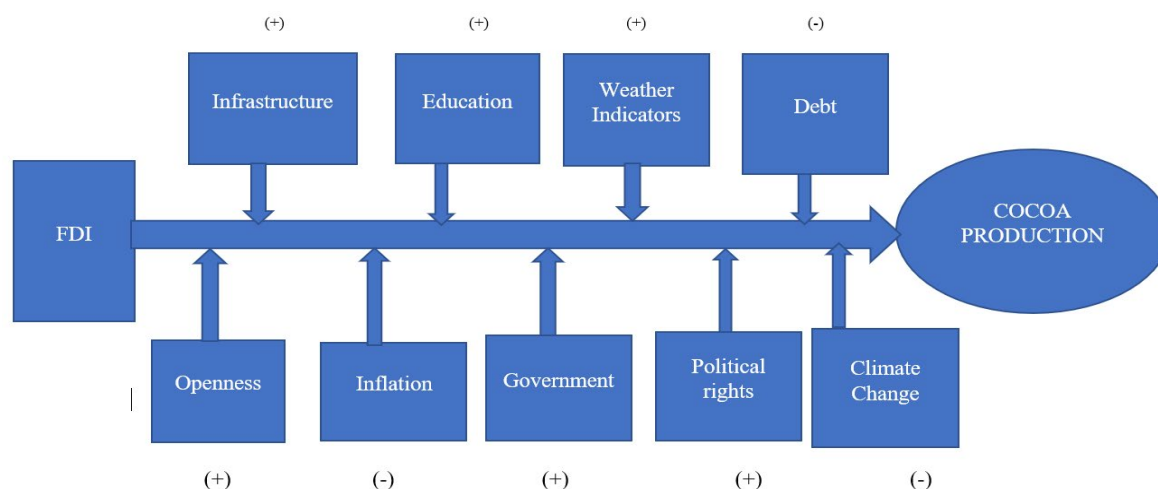
3. Theoretical framework and Research Design

This section presents a theoretical framework which can predict the association between FDI and cocoa production. The main hypothesis H_0 refers to the main research question aimed at testing if FDI has a positive association with cocoa production in Africa. Cocoa production supports the income of about 50 million farmers in Africa (Fairtrade Foundation 2016) and has the potential to help African countries reduce poverty and attain the Millennium Goals (MDG's). Several control variables are introduced to the model: the level of *Openness* of a country, *Infrastructure*, *Government Spending*, *Political Stability*, and *Education* are predicted to have positive associations, while *Inflation Debt* and climate change variable *CO2Emissions* are predicted to have negative associations with cocoa production.

Gohou & Soumare' (2012) re-examined the impact of Foreign Direct Investment (FDI inflows) and poverty reduction in Africa. In their analysis, they used FDI net inflows per capita and HDI as principal variables. Their results confirmed a positive and strongly significant

relationship between FDI net inflows and welfare in Africa. This research replicates the model used by (Gohou & Soumare' 2012) to design the theoretical framework in Figure 3 below.

Figure 3: Framework Model



However, I observe a limitation in their main variable HDI which has a lot of missing data and therefore likely to be biased. To overcome this limitation, my research analyses the association between FDI and cocoa production. However regional differences will not be examined since most of the countries are in the same regional trade area. Following the theoretical framework used by Gohou & Soumare' (2012), the null hypothesis of this research is that *FDI has a positive association with cocoa production in Africa*. Additional robustness tests are performed on various forms of FDI. Moreover, interaction terms are included in the model to study the association of the independent variables. These include *FDI_Openness*, *FDI_Debt*, *FDI_Education*, *FDI_Government*, *FDI_Inflation*, *FDI_Inmobile*, *FDI_Internet* and *FDI_CO2emissions*. The hypothesis is summarized as follows;

H₀: FDI has a positive association with cocoa production in Africa

Several researchers have analysed the overall impact of FDI on economic growth, assuming a perfect positive correlation between economic growth and welfare. However, this assumption has been questioned (e.g., Anand & Sen, 2000). At the same time, the literature has been limited due to the difficulty in measuring welfare and economic development. Therefore, this study shall study the impact of FDI on cocoa production which is measured in Tonnes and is readily available on the UNFAO website. My anticipation is to find a positive relationship between cocoa production and FDI like most previous researchers such as Gohou & Soumare' (2012).

4. Data and Methodology

4.1 Data Collection

The data used for this study comprises of the top 4 sub-Saharan African countries actively involved in cocoa production. The choice of countries and period was determined by the extent to which the data on the selected variables is persistent over time. The countries of choice have a similar social, economic, political, and climate conditions as this safeguards the results against any bias that may result from sample selection. As a result, the countries chosen were as follows: *Ivory Coast (Côte d'Ivoire)*, *Ghana*, *Cameroon*, and *Nigeria*. The study uses panel data for the years 1997-2017 to empirically analyze the relationship between FDI and cocoa production. It is expected that analysis based on these sample countries may provide a preliminary understanding of the association between FDI and cocoa production. To safeguard the consistency of the results in the analysis, I dropped variables with incomplete data before

running panel regressions. Table 1 provides a summary of the details and sources of the data. Following the approach used by (Gohou & Soumare' 2012), data were obtained from the World Bank and the United Nations Development Program (UNDP) database. While data on cocoa production was obtained from UNFAO.

The variables were further categorized into three to improve the empirical analysis; **Economic and policy variables**, **Business Environment variables** and **climate variables**. Where economic and policy variables are measurements that determine how an economy and policies implemented the function. This includes *Debt*; *Government consumption*; *Inflation*; *Phone, Mobile*; *Road*; *Openness*; *Internet*, and *Education*. Business Environment variables include external and internal factors of a country that may affect business, such as political stability, rule of law index (LAW) which measures effectiveness of rule of law for which investors are protected (World Resources Institute), and *CPI*; Corruption Perceptions Index which gauges transparency published by transparency 11 based on expert opinions where a high score implies low risk. Currently, 168 countries are ranked on a scale from 100 (very clean) to 0 (highly corrupt) (World Resources Institute).

Climate variables include variables that capture changes in the weather and climate such as *AvTemperaturec* and *AvRainfallmm*. Additionally, the study includes *CO2Emissions* to control climate change. Details of the variables are provided in Table 1. Below

Table 1: Summary of the variables and sources data

Variable	Description	Source of data
FDI	Foreign Direct Investment Inflows (million US Dollars)	World Development Indicators, African Development Indicators
FDIPOP	Per capita foreign direct investment	World Development Indicators, African Development Indicators
FDIGDP	FDI/GDP	World Development Indicators, African Development Indicators
FDIGCF	FDI/GCF	World Development Indicators, African Development Indicators
CocoaProduction(T)	Average annual cocoa production (Tonnes)	United Nations Food And Agriculture (UNFAO)
		World Development Indicators, African Development Indicators
<i>Welfare measures</i>		
GDP	Per capita Gross Domestic Product (GDP/POP) (USD)	World Development Indicators, African Development Indicators
HDI	Human Development Index	United Nations Development Programme (UNDP)
<i>Control variables</i>		
Openness	Total Imports plus Exports over GDP (USD)	World Development Indicators, African Development Indicators
Debt	Total Debt / GDP (USD)	World Development Indicators, African Development Indicators
Education	Education value-added as a percentage of GDP.	World Development Indicators, African Development Indicators
Government	total government consumption over GDP(USD)	World Development Indicators, African Development Indicators
Inflation	Measured as the %in GDP deflator	World Development Indicators, African Development Indicators
Mobile	Number of mobile subscriptions per 100 people	World Development Indicators, African Development Indicators
Internet	Internet users per 100 inhabitants	World Development Indicators, African Development Indicators
Law	The degree to which investors are protected	World Development Indicators, African Development Indicators
CPIA	Corruption Perceptions Index	World Resources Institute
Political rights	Political stability and absence of violence	World Governance Indicator
AvRainfallmm	Average Rainfall of a country (millimeters)	National Climatic Data Centre (NCCD)
AvTemperaturec	Average Temperature of a country (degree Celsius)	National Climatic Data Centre (NCCD)
CO2Emissions	CO2 emissions (kg per PPP \$ of GDP)	World Development Indicators on climate change

4.2 Dependent and independent variables

The main dependent variable in this study is cocoa production, following the model used by Gohou & Soumare' (2012), the main variables used to explain the association of FDI with cocoa production is the net flow of FDI. FDI is a cross-border investment where a resident in one economy influences the management of an enterprise which is a resident in another economy (OCED, 2008:17). To test this model, additional robustness tests were performed using interaction terms and different FDI variables. For this research three main components of FDI were used: (i) *FDIPOP*: per capita FDI or the ratio of FDI net inflows over total population; (ii) *FDIGDP*: the ratio of FDI net inflows over GDP; and (iii) *FDIGCF*: the ratio of FDI net inflows over gross capital formation (GCF). Cocoa production measured in Tonnes which is the standard unit of measurement of production at FAO and ICCOS.

4.3 Model Specification

This research follows the approach used by Gohou & Soumare' (2012), however, as an alternative approach and test for the model, a *Hausman test* is employed to determine the most suitable model. As shown in Appendix B, the p-value of the test is 0.00 implying that the fixed effects model is most suitable for this analysis. In other words, cross-section fixed effects per country are statistically significant and need to be controlled, while period fixed effects are insignificant. The fixed effect model is therefore used to control the heterogeneity of individual country and yield more precise delivery of results. The following fixed effect model is therefore adopted for the research:

Equation 1: Fixed effect model (with controls)

$$\text{CocoaProduction}_{it} = \alpha + \beta_1 \text{FDI}_{it} + \beta_2 \text{Openness} + \beta_3 \text{Debt}_{it} + \beta_4 \text{Education}_{it} + \beta_5 \text{Government}_{it} + \beta_6 \text{Inflation}_{it} + \beta_7 \text{Mobile}_{it} + \beta_8 \text{Internet}_{it} + \beta_9 \text{LAW}_{it} + \beta_{10} \text{CPIA}_{it} + \beta_{11} \text{Politicalrights}_{it} + \beta_{12} \text{AvRainfallmm}_{it} + \beta_{13} \text{AvTemperature}_{it} + \beta_{14} \text{CO2Emissions}_{it} + u_{it}$$

Where $i = \text{subscript}$ for each country, $t = \text{subscript}$ for time, α is a constant, $\beta_1, 2, \dots, 20$ are the coefficients for the independent variables. The error term u_{it} accounts for any unobserved individual home-country effect that is implicitly included in the regression.

This equation implies that cocoa production in a country is associated with *FDI*, *Openness*, *Debt*, *Education*, *Government spending*, *Inflation*, *Mobile*, *Internet*, *Law*, *CPIA* and *Political Rights* in a country. The main variables have been common in previous research on FDI. Besides, researchers have shown that the cocoa plant thrives in favorable tropical climate (Olesen et al. 2013), therefore the climatic indicators (*Temperature and Rainfall*) were included in the regression model. I set up year dummies Y_{rt} to absorb the potential heterogeneity generated by the annual macroeconomic shocks during the period of study. It is expected that the effect of the independent and control variables on the dependent ones does not occur immediately, but in the following period, thus the variable FDI has also been lagged by one year ($t+1$).

Analyzing the expectations of the association of the control variables, it is expected that government spending will have a positive association with cocoa production in developing countries where citizens' basic needs are predominantly safeguarded by government spending.

Debt is included as a control variable to account for the government's financial constraints, it is expected that the debt ratio will have a negative association with cocoa production as high debt constrains the government's capacity to respond to the basic needs of its population (Gohou & Soumare' 2012).

Inflation is introduced to capture the macroeconomic instability experienced by a country. It is expected that *Inflation* will have a negative association with cocoa production as high inflation increases the price of basic goods and directly impacts the poor. Three main features of Infrastructure were introduced to this model. This include, kilometers of road paved per 100 habitats, the number of internet users per 100 habitants, and the number of fixed and mobile phone users per 100 habitants. Infrastructure is expected to have a positive association with cocoa production because the development of infrastructure contributes to better living conditions (e.g. faster transportation and communication). *Roads* face a high percentage of missing data bias and were not used in this analysis. However, this would make an interesting variable of study in future research as there has been a lot of road network development in recent years enabling the supply of goods and services around the world; rural roads, for example increase and diversify farmers' income by connecting them to markets (World Bank Overview 2018).

Education is included in the model as an indicator of the quality of a country's human capital. A well-educated population is usually connected with a high level of labor productivity. It also implies larger numbers of skilled workers that have the capacity to absorb advanced technology from developed countries (Barro & Lee, 2011). It is therefore expected that *education* will have a positive association with cocoa production. Gohou & Soumare' (2012), pg.85.

Openness defined as the ratio of total exports plus imports over GDP is included in the model as an indicator of the measure of the friendliness of an economy to trade. It is therefore expected to have a positive association with cocoa production. *AvTemperaturec* and *AvRainfallmm* are included in the model as indicators of weather and climate. Cocoa production is most suited in favorable tropical climate (Barrientos & Asenso-Okyere, 2012). Crop yields are influenced by many environmental factors such as moisture and temperature acting with other factors (Waggoner 1983). According to UNDP, 2012a, Changes in weather patterns and the increasing frequency of droughts make certain areas unusable for the rain-fed cocoa agriculture. It is therefore expected that favourable weather conditions will have a positive association with cocoa production. On a closely related note, the effects of climate change are expected to have a negative effect on cocoa production (UNDP, 2012). An indicator of climate change, *CO2Emissions* is included in the model to control for climate change effects, with the expectation of a negative association with cocoa production.

Finally, over the years African countries have been characterized by low levels of institutional efficiency and an underdeveloped business environment, both of which negatively impact foreign direct investments. I control for these effects with variables related to the business environment, the quality of institutions, and the political risks (CPIA and LAW).

Equation 2 – Fixed effect model (with controls and interaction terms)

$$\begin{aligned} \text{CocoaProduction}_{it} = & \alpha + \beta_1 FDI_{it} + \beta_2 \text{Openness} + \beta_3 FDI_Openness + \beta_4 Debt_{it} + \beta_5 FDI_Debt_{it} \\ & + \beta_6 \text{Government}_{it} + \beta_7 FDI_Government + \beta_8 Inflation_{it} + \beta_9 FDI_Inflation_{it} + \beta_{10} \ln Mobile_{it} \\ & + \beta_{11} FDI_lnMobile + \beta_{12} Internet_{it} + \beta_{13} FDI_Internet + \beta_{14} LAW_{it} + \beta_{15} FDI_Law + \beta_{16} CPIA_{it} \end{aligned}$$

$$+ \beta_{17} FDI_CPIA + \beta_{18} AvRainfallmm_{it} + \beta_{19} FDI_AvRainfallmm + \beta_{20} AvTemperaturec_{it} + \beta_{21} FDI_AvTemperaturec + \beta_{22} CO2Emissions_{it} + \beta_{23} FDI_CO2Emissions + u_{it}$$

Equation 2 above is used to examine the association of interaction effects with the impact of FDI on cocoa production. The equation allows more hypothesis to be tested by providing a basis for comparing the direct effect and the true interaction effect of the control variables. Interaction terms in this study were introduced by multiplying the control variables with FDI, that is $FDI_X_i = FDI * X_i$. β_1 is now interpreted as the unique association of FDI on cocoa production only when the control variables=0. $\beta_2, \beta_3, \dots, \beta_n$ represents the association of the control variables with the impact of FDI on cocoa production. The results from Equation 1 and Equation 2 are then analyzed in terms of differences in coefficients and their significance.

5. Results and Analysis

This part consists of four sections. First, summary statistics will be introduced, followed by the correlation matrix in the second section. In the third section, regression results of a panel data model with fixed effect will be presented. In the fourth section, robustness tests are performed through the inclusion of interaction terms in the model. Discussions are presented along with the corresponding results.

5.1 Descriptive Statistics

Table 2 presents the summary statistics based on the top 4 cocoa-producing countries in Africa for the period 1997-2017. The countries used in the study are Ivory Coast (also known as Côte d'Ivoire), Ghana, Cameroon, and Nigeria. All main variables except for weather and climate

change indicators have at least 84 country-year observations. Variables with insufficient data were dropped from the data set before running the regressions to safeguard the consistency of the results. However, *Education* suffers a limitation of missing data with some countries like Ivory Coast having no *Education* data available yet recording the highest cocoa production during the study period. The results indicate considerable differences in the main dependent variable *CocoaProduction* among the sample countries considering the high standard deviation of 48900 an indicator that despite having similar geographical features considering tropical climate and location, some countries produce more cocoa beans than others. FDI per capita has the highest volatility among the three components of FDI used in this analysis with a standard deviation of 34.54. It can also be noted that there exist some negative FDI values in the data set, within *FDIGCF* reporting -0.01 and *FDIGDP* -0.138 as minimum values. This is as a result of including zero and non-positive values of FDI inflows to the data set. According to Frankel et al. (1997), zero-value flow can result from two possibilities, (1) the country has no FDI flow in a given period due to their small size and remoteness or (2) the value is too minute and subject to rounding since the unit is in million dollars. This causes an inevitable bias in interpreting the result based on challenges in determining which possibility results in a specific observation. Negative values indicate a divestment, for example, a multinational selling asset out to locals or other multinationals. Among the economic and policy variables, Roads has the highest standard deviation 42328.5 Km indicating that the data is widely spread from the mean hence less reliable in comparison to the other infrastructure variables Mobile and Internet.

Table 2: Summary Statistics for the top 4 cocoa producing African countries, 1997-2017

Variable	Obs	Mean	Std.Dev.	Min	Max
CocoaYield	84	4248.226	1195.336	2652	7006
CocoaProduction	84	653000	489000	116000	2030000
FDIPOP	84	31.95	34.537	-.999	130.276
FDIGCF	84	1.046	8.047	-.01	73.911
FDIGDP	84	2.473	2.028	-.138	9.517
HDI	84	.146	.243	0	.646
GDP	84	1191.82	695.225	280.239	3487.376
LnGDP	84	6.928	.567	5.636	8.157
Openness	84	63.977	24.084	0	109.807
Debt	84	51.079	48.148	0	189.819
Education	84	1.598	1.79	0	4.482
Government	84	10.046	3.59	.913	15.308
CO2Emissions	72	.149	.045	.083	.266
Inflation	84	9.973	12.272	-2.891	80.755
Mobile	84	41.85	40.826	.013	135.801
LnMobile	84	2.342	2.571	-4.327	4.911
Internet	82	7.662	10.681	.007	43.84
Law	84	-.68	.597	-1.523	.118
CPIA	84	.613	1.306	0	4.5
Civil Liberty	84	.064	.327	0	2.5
Political_rights	84	.094	.573	0	5
AvRainfallmm	76	108.561	17.667	76.599	147.034
AvTemperaturec	76	26.689	1.045	24.686	28.083

5.2 Matrix of correlations

The correlation matrix showed in Table 3 is used to present a rudimentary check for multicollinearity. The first upper left area of the correlation matrix corresponds to correlations between cocoa production, FDI and welfare variables (HDI and real per capita GDP). The highest correlation between FDI and cocoa production is observed with FDIGDP at 11%, with the other FDI variables slightly below 10%. The middle area of the matrix shows correlations between the economic and policy variables. The lower right area displays correlations between business environment variables, institutional quality variables, and political stability variables. A positive correlation of approximately 40% can be noted between the two welfare variables used by previous researchers HDI and real per capita GDP. The 60% loss of correlation supports the claim that economic growth does not entirely translate into better welfare. For the FDI variables, the highest correlation is observed between FDI/GDP and per capita FDI at 89%. A variance inflation factor (VIF) was then used to test for multicollinearity. As per the results in Appendix B, the VIF of *Civil Liberty* and *political stability* variables are above the threshold of 10 and were dropped off the analysis resulting in Table 4.

Table 3: Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
(1) CocoaYield	1.000																						
(2) CocoaProduction	0.863	1.000																					
(3) FDIPOP	0.065	0.095	1.000																				
(4) FDIGCF	-0.086	-0.030	-0.070	1.000																			
(5) FDIGDP	0.107	0.114	0.881	-0.025	1.000																		
(6) HDI	0.010	0.063	0.390	-0.078	0.174	1.000																	
(7) GDP	-0.143	0.026	0.441	-0.091	0.102	0.521	1.000																
(8) LnGDP	-0.009	0.142	0.492	-0.092	0.169	0.501	0.941	1.000															
(9) Openness	0.524	0.594	0.072	-0.012	0.212	-0.059	-0.457	-0.407	1.000														
(10) Debt	0.570	0.480	-0.357	0.049	-0.121	-0.372	-0.601	-0.600	0.543	1.000													
(11) Education	-0.188	-0.351	0.576	-0.091	0.478	0.450	0.295	0.382	-0.254	-0.594	1.000												
(12) Government	0.460	0.467	-0.007	0.048	-0.037	0.141	0.054	0.268	0.117	0.305	0.053	1.000											
(13) CO2Emissions	0.129	0.217	-0.197	0.100	-0.007	-0.386	-0.460	-0.510	0.488	0.459	-0.550	-0.322	1.000										
(14) Inflation	-0.191	-0.067	0.272	0.171	0.292	-0.031	-0.052	-0.086	0.180	-0.092	0.126	-0.255	0.373	1.000									
(15) Mobile	0.131	0.289	0.637	-0.094	0.354	0.727	0.713	0.763	0.040	-0.534	0.469	0.155	-0.444	0.015	1.000								
(16) lnMobile	0.160	0.306	0.481	-0.025	0.247	0.482	0.682	0.816	-0.105	-0.535	0.485	0.339	-0.424	-0.002	0.771	1.000							
(17) Internet	-0.103	0.039	0.546	-0.062	0.214	0.679	0.808	0.751	-0.220	-0.557	0.405	-0.010	-0.382	0.056	0.825	0.614	1.000						
(18) Law	-0.168	-0.112	0.272	0.157	0.396	-0.030	-0.239	-0.263	0.208	0.170	0.124	0.015	0.174	0.444	-0.052	-0.276	-0.015	1.000					
(19) CPIA	-0.050	-0.006	0.238	-0.060	0.268	-0.351	0.172	0.273	-0.141	-0.336	0.255	-0.031	-0.163	0.130	0.114	0.328	-0.022	-0.062	1.000				
(20) Civil_Liberty	-0.054	-0.017	0.091	-0.025	0.119	-0.145	0.059	0.105	-0.064	-0.136	0.123	-0.019	0.030	0.002	-0.001	0.124	-0.014	0.036	0.405	1.000			
(21) Political_Rig-s	-0.033	-0.011	0.108	-0.020	0.157	-0.121	0.035	0.076	-0.047	-0.117	0.154	-0.035	0.046	0.036	0.003	0.105	-0.013	0.093	0.366	0.963	1.000		
(22) AvRainfallmm	0.150	-0.059	-0.285	-0.067	-0.273	-0.060	-0.223	-0.060	-0.142	0.028	0.195	0.376	-0.475	-0.512	-0.081	0.009	-0.255	-0.216	0.092	0.043	0.017	1.000	
(23) AvTemperaturec	0.016	0.289	0.378	0.121	0.398	-0.018	0.188	0.080	0.328	0.056	-0.285	-0.294	0.500	0.509	0.149	0.069	0.218	0.271	0.007	0.080	0.096	-0.822	1.000

Table 4: Variance Inflation Factor

	VIF	1/VIF
LnMobile	5.503	.182
Debt	3.888	.257
AvTemperaturec	5.056	.198
AvRainfallmm	3.861	.259
Government	3.356	.298
Education	3.062	.327
CO2Emissions	3.022	.331
Internet	2.954	.339
Law	2.203	.454
Inflation	2.088	.479
CPIA	1.496	.668
Mean VIF	3.317	.

5.3 Foreign Direct Investments and Cocoa Production in Africa

This section addresses the research question; *does FDI have a positive association with cocoa production in Africa?* Table 5 indicates the panel and cross-sectional regression results for the relationship between FDI and cocoa production for a sample of 4 countries with and without controls for the period 1997-2017. Equation 1 (Section 4) analyses the relationship between FDI and cocoa production in Africa. Columns 1 - 8 each uses a different FDI variable as the main explanatory variable. Equation 2 (section 4) analyses the association between interaction terms and the impact of FDI in comparison to the direct effect of the control variables on cocoa production. I analyzed fixed effects regression on panel data following the model used by (Gohou & Soumare' 2012), regional differences were not checked because all the countries apart from Cameroon are in the same region.

Table 5: Panel and cross-sectional regression results for the association between FDI and cocoa production for a sample of 4 countries with controls, 1997-2017 (including interaction terms)

(***1% significance level ** 5% significance level * 10% significance level)

(Fixed effect model-Standard errors in are indicated in the parentheses)

VARIABLES	1	2	3	4	5	6	7	8	9
FDIPOP	2,712***				1,836**	-48.32			
	(496.6)				(694.7)	(2,118)			
FDIGDP		28,011***					21,697**		
		(10,284)					(10,152)		
FDIGCF			-2,027					-1,634	
			(2,128)					(1,522)	
LAG FDIPOP 2				19.27***					13.03
				(5.184)					(14.64)
FDIPOP 2						14.97			
						(15.89)			
Openness				-1,954	207.6	-235.9	409.4	-39.09	-5,387**
				(1,553)	(1,501)	(1,575)	(1,545)	(1,628)	(2,295)
Debt				-1,278	-1,016	-910.2	-908.2	-613.3	929.9
				(975.5)	(997.3)	(1,005)	(1,022)	(1,066)	(1,612)
Government				3,107	-1,987	-2,202	252.0	-2,933	5,865
				(8,764)	(9,186)	(9,202)	(9,54)	(9,844)	(17,285)
Education				-6,36	-15,544	-17,046	-9,054	10,777	
				(17,672)	(19,571)	(19,665)	(19,699)	(17,603)	
Inflation				341.8	721.9	803.4	1,278	552.6	-3,499
				(1,23)	(1,322)	(1,326)	(1,406)	(1,415)	(2,886)
LnMobile				-37,277	-19,59	-14,851	-21,532	-21,747	-13,623
				(23,172)	(24,237)	(24,789)	(24,934)	(26,07)	(28,814)

VARIABLES	1	2	3	4	5	6	7	8	9
Internet				-5,781	554.2	252.3	6,584	8,114	-1,464
				-8,422	-8,725	-8,744	-8,472	-8,792	-15,62
Law				-23,496	45,23	40,16	53,311	85,88	15,87
				-57,996	-52,819	-53,171	-54,007	-56,435	-75,561
CPIA				54,295	33,614	41,67	9,397	-1,343	95,448
				-49,82	-52,584	-53,352	-52,946	-55,498	-81,265
AvRainfallmm				1,224	1,014	445.6	2,064	2,463	85.98
				-1,899	-1,998	-2,089	-1,973	-2,044	-2,104
AvTemperaturec				73,542	-66,573	-83,762	-61,84	-65,683	100,25
				-131,706	-135,365	-136,788	-139,134	-145,156	-137,815
CO2Emissions				825,458*	247,983	337,806	333,613	527,1	1.303e+06
				-487,219	-487,293	-497,246	-497,427	-514,576	-941,72
FDI_Openness									210.2*
									(106.2)
FDI_Debt									-147.6*
									(79.10)
<i>Country effect</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Year effect</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Constant	565,878*	583,259*	654,643**	-1.109e+6	2.490e+06	2.666e+06	1.773e+06	1.878e+06	-1.743e+6
	-324,71	-325,102	-324,663	(3.509e+06)	(3.617e+06)	(3.665e+06)	(3.710e+06)	(3.871e+06)	(3.678e+06)
Observations	84	84	84	68	72	72	72	72	68
R-squared	0.2720	0.0848	0.0112	0.771	0.750	0.756	0.736	0.713	0.830
Country Number	4	4	4	4	4	4	4	4	4

The results for both panel and cross-sectional regressions support the hypothesis of a significant positive association between FDI and cocoa production at the aggregate level. Table 5 outlines the panel regression results using FDI as the main independent variable for cocoa production. Columns 1, 2 and 3, each use different FDI variables as the explanatory variable without controls. The results confirm a strongly positive relationship between per capita FDI and FDIGDP and cocoa production at a significance level of 1%. When FDIGCF is used in the analysis, however, the regression coefficient becomes negative and is no longer significant. Similar results were found by previous researchers such as (Gohou & Soumare' 2012) pg.84. The positive and significant relationship holds even after various factors that influence the impact of FDI and cocoa production are controlled. We, therefore, cannot reject the hypothesis that per capita FDI has a positive association with cocoa production.

With reference to the study by (Gohou & Soumare' 2012), FDI per capita is retained as the main measure of FDI for consequent regressions. Column 4 confirms even stronger results at 1% when the lag of FDIPOP is analyzed. This is supported through column 5 where it is observed that the positive relationship between Per capita FDI and cocoa production remains significant at a 5% confidence level when control variables are introduced in the model. Since the relationship between cocoa production and the flow of FDI can be non-linear, the same regressions were conducted using FDIPOP and FDIPOP square (FDIPOP²).

The regression result in column 6 indicates that FDIPOP² has a positive association with cocoa production although the results are not significant at any level. *Debt*, *Inflation*, and *Government* have insignificant associations with cocoa production. *CO2Emissions* have a positive and

significant association with cocoa production when *LAG_FDIPOP_2* is analysed as the main independent variable. This is probably due to the lagged effects of use of fertilizers in cocoa production, however, *AvRainfallmm* and *AvTemperaturec* are found to have insignificant associations with cocoa production.

5.3.1 Effect of Interaction terms on the association of FDI on cocoa production

Equation 2 (Section 4) analyses the interaction terms presented in Table 5, column 9. The results maintain a positive relationship between *LAG_FDIPOP_2* and cocoa production. The direct association of *Openness* with cocoa production is found to be negative and significant at 5%. However, the interaction effect of openness, *FDI_Openness* has a positive and significant association with the impact of FDI on cocoa production at 10% (Column 9). This confirms my speculation that the higher the openness of a country, the higher the impact of FDI on cocoa production. The direct effect of *debt* on cocoa production is found to be insignificant. However, the interaction term for debt, *FDI_Debt* has a negative and significant association with cocoa production at 5%. This confirms my speculation that debt would put a strain on government resources thereby making it hard for the country to access financial resources for cocoa production (Gohou & Soumare' 2012, pg.84). This also implies that the higher the debt, the lower the impact of FDI on cocoa production.

Infrastructure variables, *Internet* and *lnMobile* are found to have insignificant associations with the impact of FDI on cocoa production. While Corruption (*CPI*) or rule of law (*LAW*) have positive associations with cocoa production although the results are not significant. It can also be noted that *Av.Rainfallmm* and *Av.Temperature* have non-significant associations with cocoa production. Contrary to my speculation, *CO2Emissions* have a positive association with cocoa

production; moreover, the results are significant at 10% level of significance when Lag_FDI_POP2 is used in the model. This could be as a result of the use of CO2 fertilizers to enhance cocoa production. However, it is expected that in the long run, climate change will reduce yield with climate change reducing the amount of land available for cocoa production (UNDP, 2012a).

Summarising the findings so far, the results for both panel and cross-sectional regressions support the hypothesis of a significant positive relationship between FDI and cocoa production. As speculated, *Openness* has a positive and significant interactive association with the impact of FDI on cocoa production, while *Debt* has a negative and significant interactive association with the impact of FDI on cocoa production. All factors being constant, it is observed that \$1.00 FDI per capita is associated with an increase of approximately 0.055% (0.000545) Tonnes of cocoa in production. This has been estimated from the coefficient of FDIPOP 1,836.

6. Conclusion and Policy Recommendations

This paper analyses the association between FDI and cocoa production among the top 4 cocoa-producing countries in Africa; *Ivory Coast (Côte d'Ivoire)*, *Ghana*, *Cameroon*, and *Nigeria* for the period 1997 – 2017. The Hausman test confirms that the panel data model with fixed effects is the best model for this study in comparison to the random-effects model. The main independent variable used in the research was per capita FDI; however additional robustness tests were performed using different FDI variables. This approach has been used by previous researchers and several factors that affect the association between FDI and cocoa production were controlled. Furthermore, interaction terms were introduced in the analysis to test the

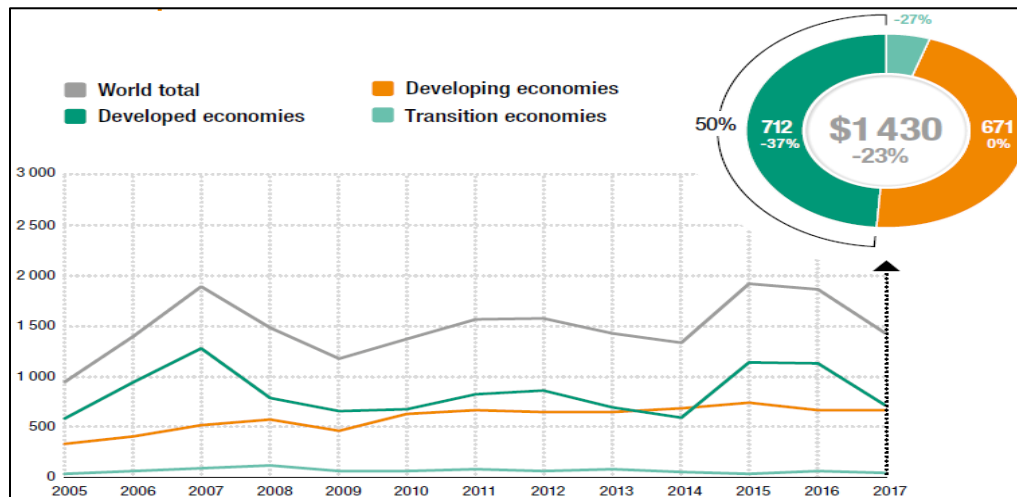
model for robustness and compare the direct effects of the control variables with the interactive effect on cocoa production. The results confirm a strongly positive association between FDI and cocoa production in Africa. *Openness* of a country is found to have a positive and significant interactive association with the impact of FDI on cocoa production, while *Debt* has a negative and significant interactive association. The research does not investigate the possibility of a causal relationship between FDI and cocoa production in Africa, I have left this interesting phenomenon for future studies on this topic. Additionally, due to missing data, the study does not control for child labor and cases of misreported cocoa production between the countries due to smuggling; This could make an thought-provoking area of research in future as the issues have received a lot of global attention in the last decade. Moreover, there has also been a lot of transport infrastructure development in Africa in recent years which has played a major role in connecting farmers to the markets. Unfortunately, the data is not sufficiently available but would yield interesting results in future research on cocoa production.

Furthermore, the research recommends a continuous evaluation of the impact of climate change on cocoa production to ensure the right policies and reformations are made to ensure the sustainability of the crop (UNDP, 2012a). There has been a lot of speculation on the impact of climate change on the environment and agriculture, however, cocoa farmers also contribute to greenhouse gas removal, through the preservation of grasslands, wetlands, and forestry. Additionally, the research offers recommendations to update foreign investment screening mechanisms especially with the growing awareness of the decline in natural resources; FDI should be directed to projects that ensure the sustainability of natural resources. Finally, this research re-emphasizes the use of disaggregated sectoral FDI inflows in future research in

implementation of policies relevant to the sectors. African countries should design policies aimed at attracting FDI in agriculture which is one of the major sectors supporting the economy in Africa. The investments will encourage infrastructure development, create jobs, advance local skills thus have a positive association with cocoa production and improving welfare by increasing the income of cocoa farmers.

Appendixes

Appendix A: FDI inflows (Global and by group of economies, 2005–2017).



Source: UNCTAD, FDI/MNE database (www.unctad.org/fdistatistics)

Billions of dollars and percent

Appendix B: Variance inflation factor

	VIF	1/VIF
Civil Liberty	15.535	.064
Political Rights	15.134	.066
LnMobile	5.568	.18
AvTemperaturec	5.252	.19
Debt	3.985	.251
AvRainfallmm	3.949	.253
Government	3.421	.292
Education	3.216	.311
CO2Emissions	3.155	.317
Internet	2.961	.338
Law	2.235	.447
Inflation	2.173	.46
CPIA	1.732	.578
Mean VIF	5.255	.

Appendix C: Hausman (1978) specification test

	Coefficient
Chi-square test value	235.09
P-value	0

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