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Persistent inequality in Guinea-Bissau: The role of France, the CFA Franc, and long-term currency imperialism

Mouhamadou Fallilou Ndiaye

Department of Agricultural and Resource Economics, University of Connecticut,
1376 Storrs Road, Unit 4021 Storrs, CT 06269, USA
Email: mouhamadou.ndiaye@uconn.edu

Abstract

Guinea-Bissau is among the world's most unequal countries. Its use of the CFA currency, pegged to the euro and controlled by France, raises continuing concern. This paper investigates the impact of joining the C.F.A zone (1997) on Guinea-Bissau per capita GDP, fisheries capture, and rice yields. In the absence of randomisation, we apply a synthetic control method SCM (Abadie and Gardeazabal, 2003) to build a counterfactual using a weighted combination of potential countries as control units and estimate the effects of entering the CFA zone on economic growth. The SCM results for Guinea-Bissau suggested that joining the CFA union contributed substantially to the decline of per capita GDP, fisheries capture, and rice yields. Other economic indicators such as cotton seed net per capita production and cashew nuts yields included in our study were inconclusive. Overall, Guinea-Bissau did not show evidence of economic growth after it entered the Franc zone. The country has been in long-term decline since then.

Keywords: CFA Currency; Guinea-Bissau; Synthetic Control Method (SCM).

1. Introduction

Economic inequalities are highly increasing in African nations. Most of the wealth of nations on the continent is concentrated in a few hands. According to the United Nations Development Program (UNDP), 10 of the world's 19 most unequal nations are in sub-Saharan Africa and Guinea-Bissau is among the top ten (UNDP, 2019).

Today, the former Portuguese colony and member of the CFA zone[1] continuous use of a currency pegged to the euro raises a big concern, especially when opposite viewpoints have emerged in recent years questioning the performance of the union and challenging its continued relevance (Obeng-Odoom, 2020, pp, 165-170). Walle, (1991) claimed the Franc zone is in the midst of twin economic and political crises, while other authors (e.g., Strong, 2018) argued that joining the CFA zone can generate potential economic gains for d seeking membership by fostering growth.

However, most scholars describe the union as unfit for trade growth and economic integration and is, therefore, inefficient. Recent contributions have filled a big gap in the CFA literature (e.g. Ghebreyesus, 2007; Zhao and Kim, 2009; Strong, 2018), nevertheless, research on important policy questions concerning former non-French colonies enquiring how the union membership would impact their economy is limited, even though, the results from those studies could be essential for future policy evaluation.

Consequently, our paper investigates the impact of joining the CFA union on Guinea-Bissau[2] per capita GDP for two main reasons:

(1) To establish whether or not Guinea-Bissau's brief civil war solely provoked the steep drop of its per capita GDP, as claimed especially by Barry *et al* [3] (2007). For Barry and his colleagues (2007), the civil war in the country from June 1998 to May 1999 caused 42% drop in the per capita GDP. But recent studies (Mueller, Tobias, 2016) proved that the effects of war on per-capita GDP usually contribute up to an 18% decline[4] over four years depending

[1] The Central African Economic and Monetary Community (CEMAC), and the West African Economic and Monetary Union (WAEMU) compose the CFA ZONE.

[2] Former Portuguese colony that experienced a steep drop of per capita GDP between 1997-1998; the same period it joined the CFA union in May 1997.

[3] The authors followed Lopez and Wodon (2005) model of Rwanda and used a technique to identify and correct the outliers in time series to build a counterfactual in order to assess the impact of Guinea-Bissau internal conflicts on per capita GDP.

[4] Other Authors like Stefano Costalli, Luigi Moretti, and Costantino Pischedda (2016) used the synthetic control method to assess the economic impact of civil war and found an average annual loss of local GDP per capita of 17.5% with variation across cases but significantly less than the 42% drop claimed in the paper.

on duration and intensity. Moreover, the civil war and instability in Guinea Bissau lasted eleven months unlike former Portuguese colonies Angola and Mozambique, which experienced longer and more destructive civil war (IMF, 2015). Even more striking, the per capita income of Guinea-Bissau dropped when it entered the CFA union in May 1997, a year before the civil war.

(2) To develop an important and updated model for currency union policy evaluation, a decision-making tool for former non-French colonies such as the Gambia or Sierra Leone considering entering or not the CFA zone.

Furthermore, our paper will analyse the impact of joining the CFA zone on Guinea-Bissau rice yields and fisheries capture considering the drop in yields and capture index that occurred the same year Guinea-Bissau joined the CFA union, and the vital role rice cereals and fishery sector play in most African countries. Moreover, Guinea Bissau produces a substantial quantity of rice domestically consumed by the population and makes up to 40% of calorific intake and almost 38% value of food consumption of the average household, according to the International Rice Research Institute (IRRI, 2015). Whereas foreign fishing access agreements represent 40% of the Guinea-Bissau government's revenue and provide 120,000 jobs to the local with 52% to women (Anon, 2010). Finally, fishery captures provide food stable and a great source of income for the population.

To conduct our study, we rigorously have selected prior 1997, various conflict and economic predictors to build a synthetic control model (SCM) (Abadie and Gardeazabal, 2003) using a weighted combination of countries (control units) that never joined the CFA union and considered socio-economically similar to Guinea-Bissau (treated unit) to create a counterfactual. To avoid spill over effect of the policy[5] within the same geographic region that can bias our results, we expanded the sample to a second (SCM) matched on a larger pool of countries that including those in our first model; Our goal is to evaluate any differences between the two models and conclude.

The results suggest that by joining the CFA union, Guinea-Bissau per capita GDP, fisheries capture, and rice yields partly declined. Other economic indicators such as cotton seed, net per capita production and cashew nuts yields included in our study were inconclusive. Overall, Guinea-Bissau did not show evidence of economic benefit in joining the Franc zone.

[5] One important assumption of our SCM model is that the policy effect or treatment effect (joining the CFA union in 1997) cannot affect the per capita GDP in the pool of donor regions, Guinea-Bissau (our treated unit) is the only country affected by the policy for all years in the pre-treatment period used to create the SCM and afterward.

2. Background

2.1. New financial institutions and CFA Zone Enlargement

Between 1945 and 1959, the Central Fund for Free France (CCFL) was exclusively in charge of issuing CFA banknotes to French Equatorial Africa, French Western Africa, French Overseas Departments, Saint Pierre-et-Miquelon, Cameroon and Madagascar. The CCFL mission was to re-establish French monetary authority in each territory that was isolated from the metropolitan area during world war II and who suffered from trade shortages. Nevertheless, all banking attributions in the CFA zone were transferred in the 1960s, after the creation of two separate African central banks, operating with a transaction account in the French treasury, which motivated multiple countries to join the union.

In April 1959, Ivory Coast , Burkina Faso, Mauritania, Senegal, Niger and Benin, newly independent West African countries and founding states of the Central Bank of West African States (BCEAO), joined the Franc union. The same year, Chad, Central African Republic, Congo, and Cameroon joined the Central Bank of Equatorial African States (BCEAC) to manage their common currency; the CFA (CFA Franc History and information BCEAO, 2019). In May 1962, the (BCEAO) states created the West African Monetary Union (WMU) to regulate monetary policies, centralized foreign exchange reserves, allow free currency circulation and transfers within the union. Consequently, Togo joined in 1963, while Mali's request for membership was granted in 1967. From 1972 to 1973, two important monetary cooperation agreements were signed to increase the scope of intervention of the African central banks within the Franc Zone.

The first agreement involved France and the Central African Economic and Monetary Community (CAEMC) and the second involves the WAMU and France as well. In 1994, a new treaty was ratified to establish the new West African Economic and Monetary Union (WAEMU) in place of the WAMU to develop a broader and more competitive shared marketplace, allowing a free flow of persons, capital, and services. The treaty also permitted the West African Development Bank (BOAD) and the BCEAO to develop as autonomous financial institutions. In 1997, Guinea Bissau, a former Portuguese colony joined the CFA zone to become the last African country to enter the Union.

Today, the CFA which stands for the financial community of Africa for the member countries of the WAEMU, and the franc for financial cooperation in Central Africa for the member countries of CAEMC (IMF, 2019) is the principal currency used in a union that counts over 150 million inhabitants from the

Atlantic ocean to the Nile, and from the Sahara desert to the Congo River basin. Its 14-member countries have heterogeneous economic activities, different organization patterns, and several strengths and weaknesses.

2.2. Evolution of the currency

The CFA franc was created on December 26, 1945, when France signed the Bretton Woods Agreement (IMF, 2019). At the time of its creation, the acronym stood for "Franc of the French Colonies of Africa," which subsequently became the "franc of the French community of Africa," then in 1958 turned into the "franc of the financial community of Africa," in West Africa[6] and the "franc of financial cooperation" in Central Africa.

Throughout the years, the acronym has evolved taking into account the 'sovereignty' of those countries in the union, nevertheless, the pegged exchange rate of the CFA kept changing as a result of multiple devaluations indented to offset the depreciation of the French currency. Prior to December 1945, the French colonies' currency had the same value as the French franc (1 French franc = 1 Colony franc). Then, the creation of the CFA led to the first devaluation of 1.70 CFA franc exchanged at 1 metropolitan French franc. In 1948, the second devaluation of 17.65% of the CFA compensates the depreciation of the French franc versus the US dollar leading to 2 CFA exchanged at 1 French Franc. In 1960, the creation of the new franc (100 old French francs = 1 new French franc) left the CFA exchanged rate to the French franc unchanged for over thirty years.

According to the International Monetary Fund (I.M.F, 2015) the artificially high exchange rates of the CFA currency when goods produced in the union was priced out of the world market during the 1980s led to the poor economic growth of the zone and a 50 % devaluation of their currency in 1994 to improve exports and raise their per capita GDP. In 1999, the European currency (Euro) was created and replaced the French franc and the CFA franc pegged to the Euro according to the same fixed parity and guarantee of convertibility of 1 Euro equal 655.95 F CFA.

2.3. Viewpoints on the CFA Zone

From the creation of the CFA zone, many scholars have expressed different viewpoints on the union capacity to promote socio-economic growth, develop

[6] Between January and December of 1960, 17 sub-Saharan African nations, including 14 former French colonies, gained independence from their former European colonists.

trade and integration among the country members. Boughton (1991) argued "from the perspective of a currency union among the African countries, it would appear that the zone would not constitute an optimum currency area", while Rose and Engel (2000), claimed that the CFA members are more integrated than countries with their own currencies but less integrated than regions within a country. Ghebreyesus (2007) added that monetary union in the case of the CFA franc zone did not promote economic integration between member countries, despite the use of common foreign exchange policy and free transferability of resources among these countries, thus actual trade remained small.

Those viewpoints will be reinforced by Zhao and Kim (2009) who argued that member countries of the CFA union are structurally distinct from each other, therefore highly subject to asymmetric shocks. Recently, Strong (2018) concluded that joining the CFA zone could generate potential economic gains for countries seeking membership by fostering growth. Subsequently, the studies referenced above, contradictory results, contributed and developed significantly the CFA literature.

3. Methodology

Guinea-Bissau, a former Portuguese colony at just over 36, 000 sq. km is located in West Africa, surrounded by the Atlantic Ocean, Senegal and Guinea. Guinea-Bissau economy depends essentially on farming with intricate shoreline on the Atlantic Ocean, and coastal valleys that flood regularly, which promote rice cultivation. Fisheries and cashew nuts exports that account for 60% of its national income (FAO, 2015) contribute as well to its economy. In 1997, Guinea-Bissau became the second non-French colony and the last country to join the CFA zone.

To study the effect of Guinea-Bissau on joining the CFA union in 1997, on per capita GDP, fisheries captures, and rice yield, one could identify a unit or a group of countries (control) identical to Guinea-Bissau, outside of the union then with few assumptions[7], compare the outcome of interest before and after 1997 (Bertrand, Duflo and Mullainathan, 2001). However, the absence of randomisation for the treatment, selecting identical controls as the treated, and separating the effects induced by joining the union to other non-policy factors will be nearly impossible. Policies spillover across the regions' border can also

[7] The parallel trends assumption requires that the trend in the outcome variable for both treatment and control group during the pre-treatment era are similar.

confound any comparisons. Surrounding countries could at times serve as a gage of similarity, however environmental, economic and political differences, especially in the West African region make our controls obsolete and can increase bias in our results.

An alternative and more suitable methodology for our study is the Synthetic control method (SCM), introduced by Abadie and Gardeazabal (2003) and later developed in Abadie, Diamond, and Hainmueller (2010). SCM allows building a counterfactual by using a weighted combination of potential countries as control units to estimate the outcome. The conceptual framework gives the researcher choices for multiple comparison units, leading to robust results.

For example, in our study we created a comparison unit composed of countries similar to Guinea-Bissau: Mozambique, Ghana, Mauritania (control group) among others, before we matched them to Guinea-Bissau (treated group) during 1985 to 1997, the year it joins the union. The matching is done based on characteristics (covariates) that are related to per capita GDP such as the export index or import index, and each country will be assigned a probability weight from 0 to 1 according to their similarity to Guinea-Bissau. Once the weights established, a synthetic control unit is created to show the path of what would have happened if Guinea-Bissau did not join the union in 1997(the counterfactual). Then, two distinct graphs are created to represent the counterfactual and the treated unit.

Lastly, we observe the fitness of the two graph lines prior to 1997 and draw conclusions. If we notice a close fit, we can assume that the separation between the graph lines after 1997 suggests that entering the CFA union had an impact on per capita GDP. According to Bouttell, Craig *et al* (2018) it is critical that the synthetic control unit is built from a pool of potential controls that are similar to the treated unit. Thus, the first group of potential African donor countries judged socio-economically very similar to Guinea-Bissau is the "Restricted Donor Pool".

However, Clelland and Gau (2017) stated that effective use of the method requires that three assumptions hold. First, the treated is the only state affected by the policy change for all years in the pre-treatment period used to create the synthetic control and afterward. Second, the policy change has no effect before it is enacted. Third, the treated state's counterfactual outcome can be approximated by a fixed combination of donor states but did not require similarity with the treated unit. Therefore, the full sample in the dataset is used as the "Full Sample Donor Pool" for a second synthetic control model to accommodate both theories.

3.1. Synthetic Control Model

First, we observe $N+1$ country for a T period. Our treated country (Guinea-Bissau) is denoted $n=1$ and the other countries selected as potential controls called donor pool are indexed $n=2, \ldots N+1$. Our panel data is strongly balanced, from period $t=1, \ldots T_0, \ldots T$ with $t < T_0$ as (pre-intervention), $t = T_0$ as (treatment implementation date) and $t > T_0$ as (post-intervention). To build up the missing counterfactuals in absence of treatment, our comparison units will be restricted to those countries which were not exposed to any structural shocks and that we believe, their "Per-capita GDP" is determined by the same structural process as Guinea-Bissau as noted in the methodology above. Our treated unit $n=1$ joined the union in ($t = T_0 = 1997$) and is exposed to the treatment for ($t > T_0$=1997) while our donor pool $n=2, \ldots N+1$ is not exposed for all t. One important assumption is that joining the CFA zone has no effect on Guinea-Bissau Per-Capita GDP before 1997. We will repeat the process with a larger sample and include conflict indicators for $n=1, \ldots N+1$ for Robustness check. Next, we will follow the general model design of Abadie *et al.* (2010) and define δ_{nt} as an indicator for treatment on unit n at time t. The observed outcome variable Y_{nt} (the effect of joining the CFA zone on Per-capita GDP) is the sum of a time-varying treatment effect $\lambda_{nt}\delta_{nt}$ and the counterfactual outcome built without treatment Y^0_{nt} specified using a factor model:

$$Y_{nt} = \lambda_{nt}\delta_{nt} + Y^0_{nt} \;\&\; Y^0_{nt} = \beta_t + \varphi_t \nabla_n + \mu_t \phi_t + \rho_{nt} \rightarrow$$
$$Y_{nt} = \lambda_{nt}\delta_{nt} + \left(\beta_t + \varphi_t \nabla_n + \mu_t \phi_t + \rho_{nt}\right) \quad (1)$$

∇_n is a (J x 1) vector of observed covariates not affected by the treatment, ϕ_t is a (1 x J) unknown parameter vector, μ_t is a (1 x R) vector of common unknown factors and φ_n is an (R x 1) vector of unknown factor loadings while ρ_{nt} represent the error term with mean zero and independent across time and countries. β_t is an unknown time common factor.

We construct the synthetic control as a weighted average of the units in the donor pool defining $W = (\omega_2, \ldots \omega_{N+1})'$ as a vector of weights for $n=2, \ldots N$ with $0 \leq \omega_n \leq 1$ and $\sum_{n=2}^{N+1} \omega_n = 1$. Choosing a particular value for W is the same as choosing a synthetic control. In fact, we select an optimal predicted weight $W^*(\omega^*2, \ldots \omega^*_{N+1})'$ estimate that will replicate the treated pre-treatment observations. Assuming $n=1$ is the 'treated', we estimate the treatment effect by evaluating an approximation of Y^0_{nt} with the vector of weight W^*:

$$\tilde{\lambda}_{1t} = Y_{1t} - \sum_{n=2}^{N+1} \omega^*_n Y_{nt} \quad (2)$$

3.2. Estimation

We subset the outcome Y_n between pre (B) and post (A) treatment vector. $Y_n = ({}^{B}_{n}Y | {}^{A}_{n}Y)$ then we define θ_l as an (m x 1) vector of all pre-interventions characteristics (the predictors) for the treated country Guinea-Bissau, including ∇_n the vector of covariates, unaffected by the treatment and Ω a linear combination of ${}^{B}_{n}Y$ to have $v = h + \Omega$. We define as well θ_0 as a (m x n) matrix regrouping all the donors' predictors. And define lastly Z as a (v x v) matrix of variable weight to take into account the magnitude of the predictors' covariates. An estimation of the synthetic control method is to find W and Z, given Y and θ. As indicated by Abadie *et al* (2010), we choose Z to minimize the prediction error term between the synthetic control and the pre-treatment outcome. We set up a measure of distance $||G||_A = \sqrt{G'AG}$ and obtain $||{}^{B}_{1}Y - {}^{B}_{0}Y||$ the root mean squared error before treatment.

We select an optimal W^* to minimize:

$$||\theta_1 - \theta_0 W_0||_Z = \sqrt{(\theta_1 - \theta_0 W)' Z (\theta_1 - \theta_0 W)}$$

$$st: \ \omega_n \geq 0 \ \forall \ n = 2, \dots N+1$$

$$\sum_{n=2}^{N+1} \omega_n = 1 \tag{3}$$

And construct a path that matches the synthetic control and Guinea-Bissau.

We can infer:

$$\tilde{\Lambda} = 0 \ or \ E\left[Y_{1t} - \sum_{n=2}^{N+1} \omega^*{}_n Y_{nt}\right] \to 0 \ as \ (t < T_0) \to \infty \ if \ \sum_{t=1}^{t=T_0} + \mu_t{}' \mu_t \tag{4}$$

is a regular matrix (non-singular) and ω^* exists.

3.3. Inferences

To conduct statistical significance, we proceed as suggested by Abadie *et al*., (2010) to a placebo test to simulate a random assignment of treatment, which consist of giving the treatment to all our control units ($n=2$, …$N+1$) the same year $t=T_0$ or to implement it to all units ($n=1$, …$N+1$) at a different period $t \neq 0$. The goal is to construct a distribution of placebo effects and compare it to the actual treated unit. If the test leads to large effects for the control units similar to the country of interest, then there is a high probability that the observed outcome was due to chance. We calculate the impact of the placebo effects on each year post intervention and define:

$$\tilde{\boldsymbol{\sigma}}^{C}_{nt} = \boldsymbol{Y}_{nt} - \tilde{\boldsymbol{Y}}^{0}_{nt} \ \& \ \tilde{\boldsymbol{Y}}^{0}_{nt} = \beta_t + \sum_{n=2}^{N+1} \boldsymbol{\omega}^*{}_n \boldsymbol{Y}^{0}_{nt} \to \tilde{\boldsymbol{\sigma}}^{C}_{nt} = \boldsymbol{Y}_{nt} - (\beta_t + \sum_{n=2}^{N+1} \boldsymbol{\omega}^*{}_n \boldsymbol{Y}^{0}_{nt}) \tag{5}$$

Our objective is to examine if the impacts $\widetilde{\sigma}_{1t}$ on the treated country are statistically different from the distribution of the placebo estimation $\widetilde{\sigma}_{nt}^{C}$ for all $t>T_0$, and build the corresponding one-sided p-values.

We define the two sided $p-values = Pr(|\tilde{\sigma}_{1t}^{C}| > |\tilde{\sigma}_{1t}|)$ and for positive effects, the one sided $p-values = \Pr(\tilde{\sigma}_{1t}^{C} > \tilde{\sigma}_{1t})$. The above non-parametric testing has the main advantage not to impose a particular error distribution.

4. Dataset and sources

A reliable dataset for developing countries can be a challenge at times. However, world institutions such as the United Nations and the World Bank have intensified and expanded their statistical capacities in most African regions to provide more recent datasets, and follow-ups to provide more accuracy in their data collection. For our study, we explored the United Nation Data website (UNDATA), a source that offers official and reliable statistics compiled by the united nation, and locally produced by the countries. The UNDATA includes various indicators and allowed us to select African countries' development indicators primarily from the World Bank and agricultural indicators from the Food and Agriculture Organization (FAO). We also explored the Integrated Network for Societal Conflict Research website (INSCR) who manages and compiles the data provided by the Center for Systemic Peace (CSP). The Center consistently follows political behavior in major states in the world and build a database on new and persistent issues related to political violence, civil war, and coup. Associate researchers from the Center for systemic peace CSP crosscheck all data sources to ensure that the information is reliable and accurate. Therefore, we were able to collect conflict indicators from the CSP as well.

Even though we collected 34 years of data (1982-2016), we constructed an annual country-level panel dataset of 39 potential countries as control and Guinea-Bissau as the treated, from a period 1985 to 2012. Guinea-Bissau is the last African country to join the CFA union in 1997 and offer to our analysis a pre-treatment period of 12 years, largely sufficient to realistically predict how joining the CFA zone would affect per capita GDP and the other economic indicator in our study. Table 1 is a summary of all variables, source and time period.

Table 1: Summary Statistics for Variables, Sources and Period

Variables	Sources	Period
Predictors/Covariates		
Adjusted net national income (current US$)	UNDTA/WORLD BANK	1982 -2016
Agricultural land (% of land area)	UNDTA/WORLD BANK	1982-2016
Agriculture, forestry, and fishing, value added (current US$)	UNDTA/WORLD BANK	1982-2016
Cereal production (metric tons)	UNDTA/WORLD BANK	1982-2016
Cereal yield (kg per hectare)	UNDTA/WORLD BANK	1982-2016
Crop production index (2004-2006 = 100)	UNDTA/WORLD BANK	1982-2016
Death rate, crude (per 1,000 people)	UNDTA/WORLD BANK	1982-2016
Export unit value index (2000 = 100)	UNDTA/WORLD BANK	1982-2016
Export value index (2000 = 100)	UNDTA/WORLD BANK	1982-2016
Export volume index (2000 = 100)	UNDTA/WORLD BANK	1982-2016
Exports of goods and services (current US$)	UNDTA/WORLD BANK	1982-2016
Food production index (2004-2006 = 100)	UNDTA/WORLD BANK	1982-2016
Import unit value index (2000 = 100)	UNDTA/WORLD BANK	1982-2016
Import value index (2000 = 100)	UNDTA/WORLD BANK	1982-2016
Import volume index (2000 = 100)	UNDTA/WORLD BANK	1982-2016
Imports of goods and services (current US$)	UNDTA/WORLD BANK	1982-2016
Life expectancy at birth, total (years)	UNDTA/WORLD BANK	1982-2016
Rural population	UNDTA/WORLD BANK	1982-2016
Service exports (BoP, current US$)	UNDTA/WORLD BANK	1982-2016
Service imports (BoP, current US$)	UNDTA/WORLD BANK	1982-2016
Services, value added (current US$)	UNDTA/WORLD BANK	1982-2016
Trade (% of GDP)	UNDTA/WORLD BANK	1982-2016
Number of neighboring states sharing a border with the identified state	CSP	1982-2016
Number of regional states with interstate MEPV	CSP	1982-2016
Number of regional states with societal (civil or ethnic) MEPV	CSP	1982-2016
Number of states in the designated geopolitical region	CSP	1982-2016
Sum of all societal (civil and ethnic) MEPV magnitude scores for all neighboring States	CSP	1982-2016
Net per capita production cereal	UNDAT/FAO	1982-2016
Gross per capita production cereal	UNDAT/FAO	1982-2016
Gross per capita Index cereal	UNDAT/FAO	1982-2016
Outcome variable		
Capture fisheries production (metric tons)	UNDTA/WORLD BANK	1982-2016
GDP per capita (constant 2010 US$)	UNDTA/WORLD BANK	1982-2016
Cotton Gross per Capita	UNDAT/FAO	1982-2016
Rice yield (kg/ha)	UNDAT/FAO	1982-2016

To investigate Guinea-Bissau joining the C.F.A zone at the eve of civil war and its impact on per capita GDP, we built a synthetic control unit restricted to 8 countries judged socioeconomically similar to Guinea-Bissau (Restricted Model). Then we built a second SCM using all countries in our sample and compare the two models. We used the full sample of donor pool countries (Table 2) for the rest of the outcome variables included in our research: capture fisheries and rice yield.

Table 2: List of Countries in the Donor Pool

Argentina	Guatemala	Mauritius
Bangladesh	Guyana	Mexico
Bolivia	Honduras	Morocco
Brazil	Indonesia	Mozambique*
Costa Rica	Jordan	Nicaragua
Dominican Republic	Kenya*	Nigeria
Ecuador	Madagascar*	Pakistan
El Salvador	Malawi*	Panama
Fiji	Malaysia	Paraguay
Ghana*	Mauritania*	Peru

Notes: * denotes countries that are part of the restricted donor pool.

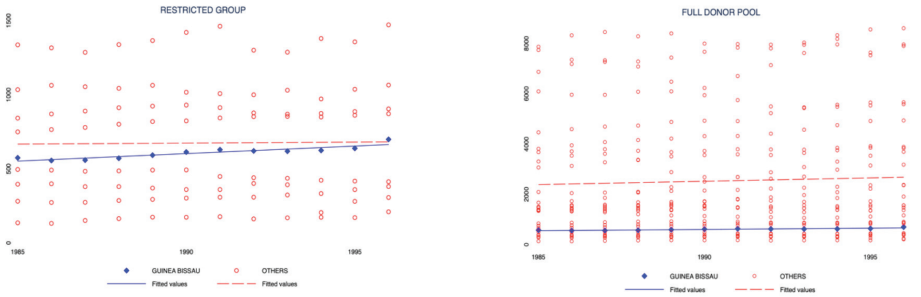
Source: UNDATA / World Bank.

5. Results and discussion

5.1. Per-capita GDP

The following graphs (Fig. 1) are scatterplots that compare Guinea-Bissau mean per capita GDP to the entire sample of donor pool countries before 1997 and also the restricted donor pool sample to the treated country Guinea-Bissau. The results suggest an appropriate matching between treated and control groups in both cases. However, we note that the restricted donor pool countries' level of per capita GDP is the closest in magnitude to Guinea-Bissau and maybe a more suitable comparison group to study the effects of joining the CFA zone in 1997.

FIGURE 1: PER-CAPITA GDP COMPARISON BETWEEN RESTRICTED AND FULL DONOR POOL (1985-1997)



Sources: UNDATA / World Bank.

Our first synthetic control model built from the restricted donor pool of nine countries judged socioeconomically similar to Guinea-Bissau (treated unit) consists of Uganda with the highest weight of (0.498), Ghana (0.317), Zimbabwe (0.133), Mozambique (0.053), whereas, the second SCM1 including the sample donor pool (40 countries) consists of Mozambique with the highest weight of (0.394), Malawi (0.319), Nigeria (0.107), Zimbabwe (0.094), Indonesia (0.086) (Table 3).

TABLE 3: SUMMARY OF COUNTRY WEIGHTS IN SYNTHETIC GUINEA-BISSAU

Restrcted model		**Full sample model**							
Country	SCM1 Weight	Country	SCM1	SCM2 Weight	SCM3	Country	SCM1	SCM2 Weight	SCM3
Ghana	0.317	Argentina	0	0	0	Mauritius	0	0	0
Kenya	0	Bangladesh	0	0	0	Mexico	0	0	0
Madagascar	0	Bolivia	0	0	0	Morocco	0	0.017	0
Malawi	0	Brazil	0	0	0	Mozambique	0.394	0.215	
Mauritania	0	Costa Rica	0	0	0	Nicaragua	0	0	0.141
Mozambique	0.053	Dominican Republic	0	0	0	Nigeria	0.107	0.35	0.433
Rwanda	0	Ecuador	0	0	0	Panama	0	0	0
Uganda	0.498	El Salvador	0	0	0	Pakistan	0	0	0
Zimbabwe	0.133	Fiji	0	0	0	Paraguay	0	0	0
		Ghana	0	0.086	0	Peru	0	0	0
		Guatemala	0	0.179	0.014	Philippines	0	0.038	0
		Guyana	0	0	0	Rwanda	0	0	0
		Honduras	0	0	0	South Africa	0	0	0

Indonesia	0.086	0	0	Sri Lanka	0	0	0
Jordan	0	0		Thailand	0	0	0
Kenya	0	0.055	0.198	Tunisia	0	0	0
Madagascar	0	0.009	0.214	Turkey	0	0	0
Malawi	0.319	0	0	Uganda	0	0.036	0
Malaysia	0	0	0	Uruguay	0	0	0
Mauritania	0	0	0	Zimbabwe	0.094	0.015	0

Notes: SCM1 : Synthetic Control Model for Per Capita GDP
SCM2 : Synthetic Control Model for Rice Yields
SCM3: Synthetic Control Model for Fisheries capture

During the pre-treatment period, our choice of predictors including conflict indicators and economic indicators successfully generated two synthetic controls model (Table 4) very similar to the treated unit (Guinea-Bissau).

Table 4: Treated Guinea-Bissau and the Synthetic Units Comparison

Predicators	**Treated**	**Synthetic Control Model (SCM)**		
Common Predicators		**(1)**	**(2)**	**(3)**
		Restricted donor pool	**Full sample donor pool**	
Adjusted net national income (current US$ BILLIONS)	0.19	4.55	13.30	11.40	12.50
Agricultural land (% of land area)	51.48	55.38	50.71	57.48	56.70
Agriculture, forestry, and fishing, value added (current US$ MILLIONS)	110.00	218.00	403.00	532.00	534.00
Death rate, crude (per 1,000 people)	16.97	17.40	12.20	11.30	14.45
Export value index (2000 = 100)	37.64	70.35	60.70	45.30	53.26
Food production index (20042006 = 100)	58.97	62.41	57.44	56.10	60.86
Import value index (2000 = 100)	169.27	57.30	78.81	90.99	87.50
Life expectancy at birth, total (years)	49.31	50.53	47.34	51.13	49.67
Number of regional states with civil or ethnic conflict	4.83	4.84	3.75	4.38	3.72
Sum of all civil and ethnic conflict magnitude scores for all neighboring states	0.42	6.15	3.34	3.40	2.67
Sum of all civil or ethnic conflict magnitude Scores for all regional states	11.75	17.53	15.65	14.56	11.67
Total summed magnitudes of all conflict societal and interstate	0.32	1.48	2.28	1.80	0.12
Trade%	50.40	40.39	50.16	39.80	41.17

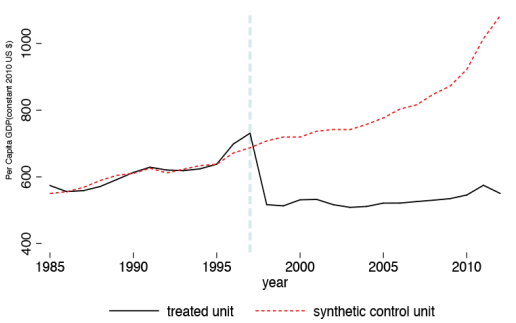
Only GDP Per Capita					
GDP per capita (constant 2010 US$) (1985)	574.20	562.45	567.51		
GDP per capita (constant 2010 US$) (1988)	571.08	583.03	579.83		
GDP per capita (constant 2010 US$) (1996)	698.72	682.93	692.72		
Only Rice Yields					
Rice Yields 1992	19011.00			18138.11	
Rice Yields 1994	20067.00			19494.99	
Rice Yields 1995	19070.00			19443.63	
Rural population (MILLIONS)	0.71			3.12	
Gross per capita production of cereal	79.69			79.95	
Only Capture Fisheries					
Capture fisheries production index (1982=100)(1986)	98.85				106.50
Capture fisheries production index (1982=100)(1989)	144.27				125.03
Capture fisheries production index (1982=100)(1996)	187.02				181.65

Notes: (1) Per capita GDP (2) Rice yields (3) Fisheries capture

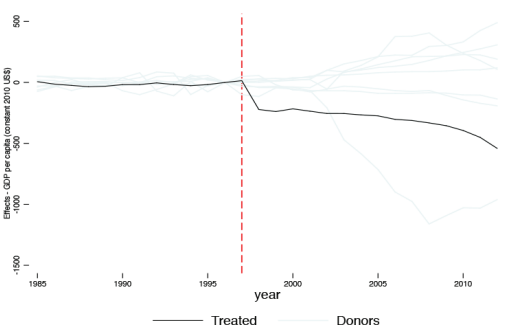
As indicated by Figure 2A and Figure 3A, the analysis in both cases shows that the synthetic control model per capita GDP increased after 1997. Also, we note a lower per capita increased for the restricted model as well. Overall, the results suggest that joining the CFA union (1997) contributed substantially to a drop of Guinea-Bissau per capita GDP.

FIGURE 2: PER-CAPITA GDP ANALYSIS FOR RESTRICTED MODEL (1985-2012)

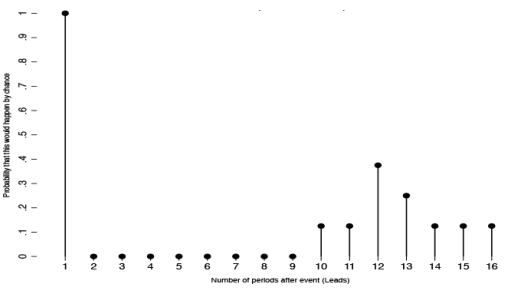
2A: SYNTHETIC CONTROL



2B: PLACEBO TEST



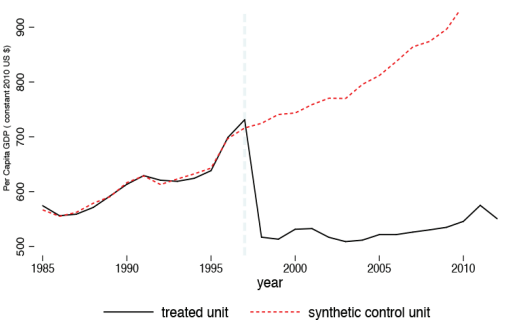
2C: P-VALUES



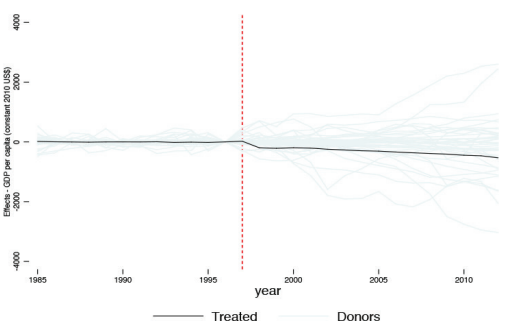
Sources: UNDATA / World Bank

FIGURE 3: PER-CAPITA GDP ANALYSIS FOR FULL DONOR POOL (1985-2012)

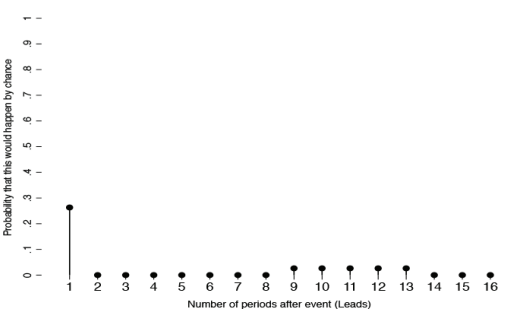
3A: SYNTHETIC CONTROL



3B: PLACEBO TEST



3C: P-VALUES



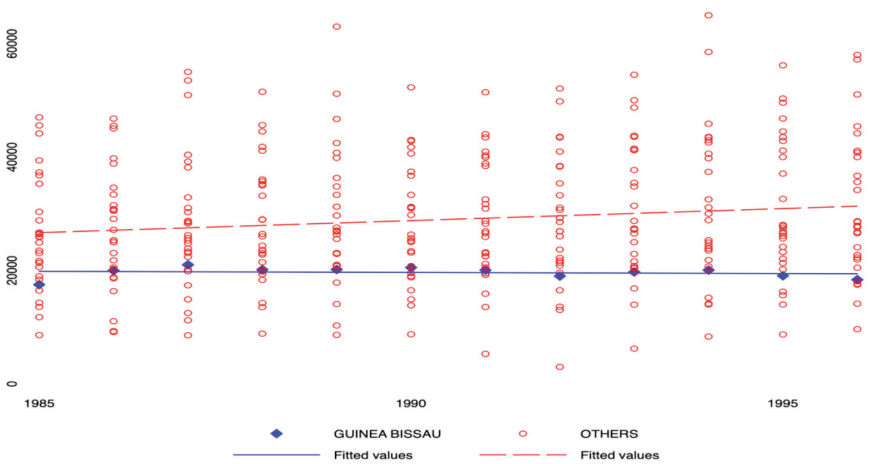
Sources: UNDATA / World Bank.

We ran a placebo test (Fig. 2B and Fig. 3B), as suggested by Abadie *et al*. (2010) to simulate a random assignment of treatment, then calculated our p-values. Our tests establish statistical significance in the results, with p-values <. 1(Fig. 2C and Fig. 3C) and comforting our findings; Guinea-Bissau entrance in the CFA union in 1997 participated in its per capita GDP drop.

5.2. Rice yield

The two scatterplots below (Fig. 4) compare the mean rice yields of Guinea-Bissau (treated) and the donor pool (control) during the pre-treatment period (1985-1997) and show similar trends for both groups. Even though, a higher level of rice yields (kg/ha) in the control group is noticeable, we can observe a suitable comparison base for our synthetic control model.

FIGURE 4: RICE YIELD COMPARISON (1985-1997)

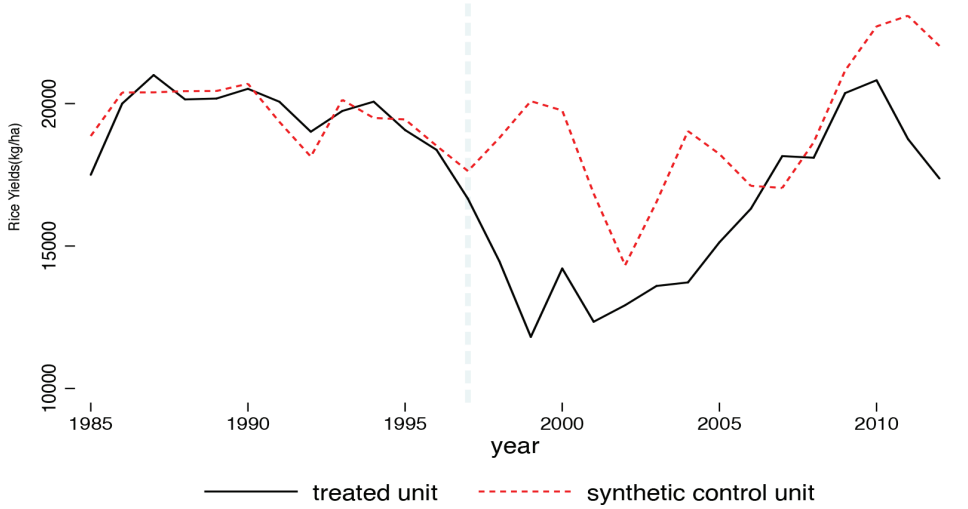


Sources: UNDATA / FAO.

We create a new synthetic control model (SCM3) from the full sample of 40 countries to avoid possible spillover effects within the same geographical region (Table 3). First, we noticed that 7 of the 9 units in our donor pool are African countries and consist of Nigeria with the highest weight of (0.35), Mozambique a former Portuguese colony with (0.215), Guatemala (0.179), Uganda (0.036), Kenya (0.055), Ghana (0.086), Morocco (0.017), Zimbabwe (0.015) and Philippines (0.038).

Our predictor variables rigorously picked consist of conflict and agriculture indicators that will be matched with our donor pool countries based on the appropriate weight to build our SCM. Table 4 shows that most of the treated indicators have been closely reproduced in our synthetic control unit, allowing a fitted counterfactual model similar to Guinea Bissau before 1997.

FIGURE 5: RICE YIELD SYNTHETIC CONTROL (1985-2012)



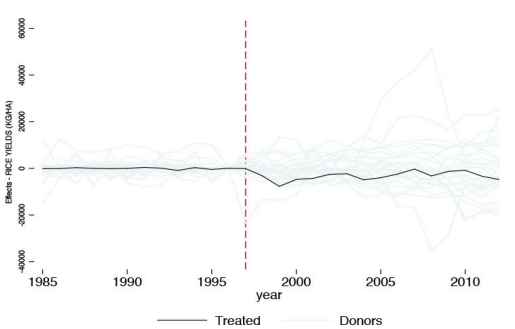
Sources: UNDATA / FAO.

In order to evaluate the effect of joining the CFA Union on rice yield, we inspect visually our SCM graph (Fig. 5) for any differences between our synthetic control model and the actual Guinea- Bissau the treated unit post-1997. We noticed a significant divergence between the SCM line and Guinea-Bissau around 1997, which suggests that joining the CFA zone contributed to the drop of rice yields in Guinea-Bissau.

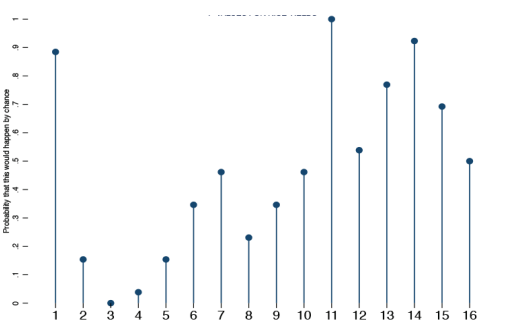
For statistical significance, we ran a placebo test (Fig. 6A), by permuting the treatment to those countries in our donor pool (controls) and watch for any effects. We finally, calculated p-values for each period post-1997 (Fig. 6B) and draw conclusions. Overall, the results support our previous conclusion, with some significance for the 3rd period.

FIGURE 6: RICE YIELD TEST (1985-2012)

6A: PLACEBO TEST



6B: P-VALUES

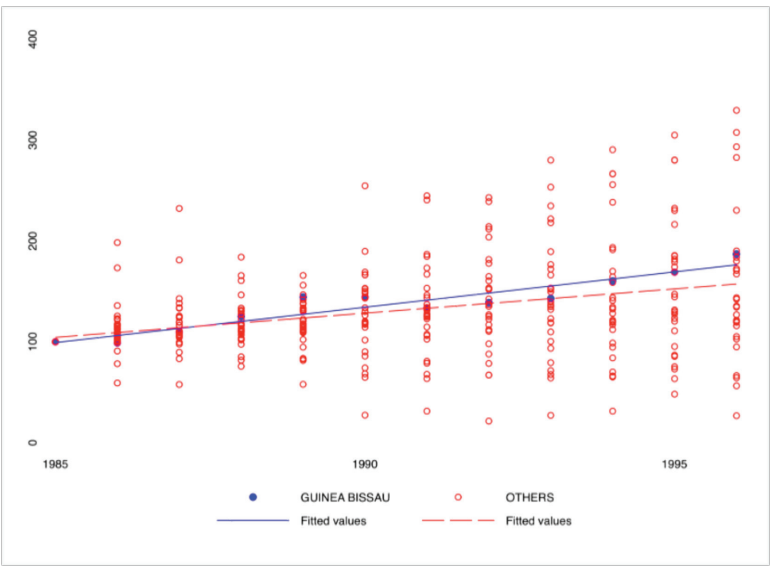


Sources: UNDATA / FAO.

5.3. Fisheries captures

We compared the mean fisheries captures index between Guinea-Bissau and the other countries in our full sample donor pool (Fig. 7). Visually, we notice that during the pre-treatment period, the treated unit and the control countries shared similar trends and barely diverged. The graph suggests that the donor pool is a potential match group for Guinea-Bissau.

FIGURE 7: FISHERIES CAPTURES INDEX COMPARISON (1985-1997)



Sources: UNDATA / World Bank.

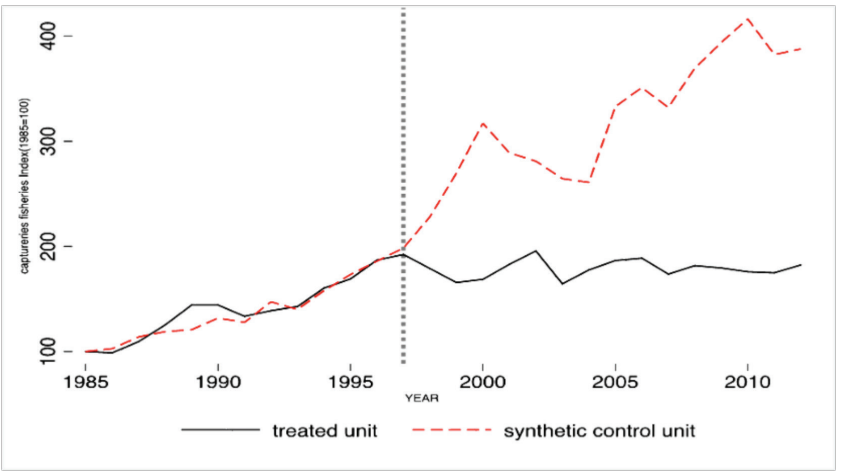
We used our full sample as control (Table 3), similar in our previous model to build our synthetic control unit (SCM3). The following table shows that SCM selected for the donor pool 5 countries which 3 are largely African nations with a cumulative weight of (0.84). Nigeria has the highest weight (0.433), Madagascar (0.214), Kenya (0.198), then Nicaragua (0.141) and Guatemala (0.014).

After cautiously choosing the conflict and economic variables that best predict Guinea-Bissau fisheries capture, we matched our predictors with the donor pool countries based on appropriate weight, and create a synthetic control that resembles the real Guinea-Bissau (Table 4).

The following Figure 8 shows the synthetic control unit and Guinea-Bissau plot line merging the entire pretreatment period, before they separate around 1997, which implies a quantity increase of the fisheries capture in our counterfactual and the opposite effect for the real Guinea-Bissau. Overall, Guinea-Bissau's

entrance in the CFA zone in 1997 is a partial cause of the decrease of fisheries capture.

FIGURE 8: FISHERIES CAPTURES INDEX SYNTHETIC CONTROL (1985-2012)

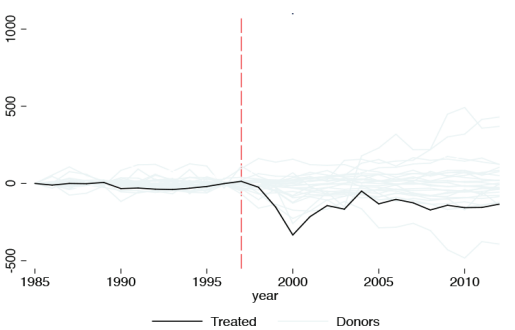


Sources: UNDATA / World Bank.

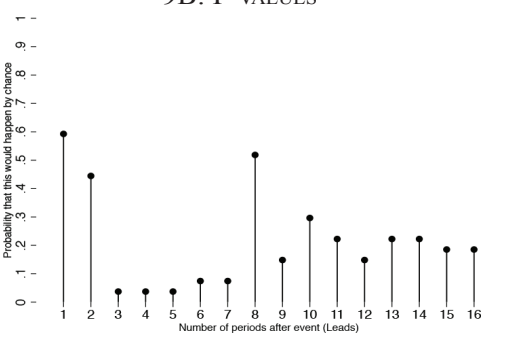
As performed in our earlier model, we run the placebo test by permutating our treatment and the control countries (Fig. 9A) in the donor pool for any impacts. We also calculated our p-values (Fig. 9B) and a look of the graph shows a large impact on our treated unit after 1997. We found significance in our calculated p-values (<.1) for the post period (3 to 7).

FIGURE 9: FISHERIES CAPTURE TEST (1985-2012)

9A: PLACEBO TEST



9B: P-VALUES



Sources: UNDATA / World Bank.

5.4. Discussion

In the past, authors have focused on the consequences of currency integration and its effects on trade among member countries. Recently, the CFA zone has

been in turmoil and attracted many scholars who narrowed their studies on the effect of currency integration on economic development in the CFA region.

In our study, we used Synthetic Control Method (SCM) and included a restricted group we compared to a full sample as a robust check to establish whether Guinea-Bissau's 1997 civil war caused a 42% steep drop of its per-capita (Barry *et al,* 2007).

==> Our first results proved that Guinea-Bissau civil war contributed to the decline of its per-capita GDP, but joining the CFA region caused a substantial drop in its per-capita GDP. Also, our findings aligned with Mueller, and Tobias, 2016, who proved that the effects of war on per-capita GDP usually contribute up to an 18% decline over four years depending on duration and intensity. In light of our results, the decision-makers should bear in mind, when engaging policy choices, such as joining the CFA zone for Guinea-Bissau, for long term economic effects, which could be far more devasted than a brief civil war.

Research findings in the CFA literature are divided and can be categorized into two distinct groups:

(1) Those who argued "from the perspective of a currency union among the African countries, it would appear that the zone would not constitute an optimum currency area" (Boughton, 1991, p.1).

(2) Those who claimed, "The CFA union can generate potential economic gains for countries seeking membership by fostering growth" (Strong, 2018, p.1).

Our paper could serve as a policy evaluation for countries or international agencies exploring currency union materialization, thus, a benchmark for former non-French colonies in West Africa (the Gambia and Sierra Leone) to evaluate if joining the CFA union would be economically beneficial, especially when Strong (2018) argued that a former French colony, Mali, gained economically from joining the CFA region.

Consequently, we looked at Guinea-Bissau rice yields, cottonseed production, cashew nuts production, and fisheries capture, despite the per-capita GDP drop, to establish, if other economic sectors gained from the CFA membership.

==> Our second results indicated that Guinea-Bissau did not show economic growth when it entered the CFA zone, which supports Boughton, (1991) views on the CFA region not constituting an optimum currency area. Hence,

new countries, especially former non-French colonies should not expect economic growth if they join the CFA union.

It is worth noting that we were not able to apply the double robustness test on rice yields and fishery captures indicators due to the lack of data availability in the restricted model yet, the implications of these findings for the persistent economic inequality in Guinea-Bissau are quite clear. When Guinea-Bissau joined the CFA union, it adopted simultaneously a trade openness policy essentially to improve economic inequality, foster sustainable development and boost trade. However, previous studies (Xu, 2003) established how trade liberalization or openness provoked rising economic inequality in developing countries and Cramer, (2003) linked economic inequality to civil conflict.

==> Overall, our findings indicate that joining the CFA union could have contributed to the expansion of economic inequality in Guinea-Bissau. Also, the rise of economic disparity in the country may have prompted the 1998 civil war.

6. Conclusion

The suitability of the Franc zone as a means of economic integration and an efficient tool for development among France's former colonies has been questioned ever since the CFA currency was created in 1945. Throughout the years, numerous studies supported the claim that the zone was not an optimum currency area, however, multiple authors have proved that the union can provide economic gains and price stability.

Despite opposite viewpoints in the CFA literature, today a new conscious African youth blames the CFA currency which is pegged to the Euro for the high unemployment rate, high income inequalities, increasing migration to Europe, and over the reach commodity prices. Overall, most analysts perceive the CFA currency as unfit for development. The CFA currency has imposed on their respective country leaders onerous contract terms with France. Yet, countries that abrogate these terms could risk internal instability.

In this context, this paper is a contribution that brings facts in the case study of Guinea-Bissau, the last African country and the second non-French colony to join the CFA union in 1997. We ran a synthetic control model to estimate the impact on various economic indicators including per capita GDP, fisheries capture, and rice yields of Guinea-Bissau joining the CFA union. Our results suggested that joining the union contributed substantially to the decline of

all its economic indicators. Overall Guinea-Bissau did not show evidence of economic growth when it entered the CFA zone in our study. Instead, doing so has weakened the economic fundamentals of the country, which has become one of the most unequal in the world.

Biographical Notes

Mouhamadou Fallilou Ndiaye is a Researcher and an Academic Advisor at the University of Connecticut, Storrs, USA. He holds a PhD degree in Agricultural Economics (University of Connecticut, Storrs, USA), a master's degree in Applied Economics (University of Connecticut, Storrs, USA) and a master's degree in Economics from (Roosevelt University, Chicago, USA). His research interests are focused on international development, trade, and the economics of education.

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Appendices

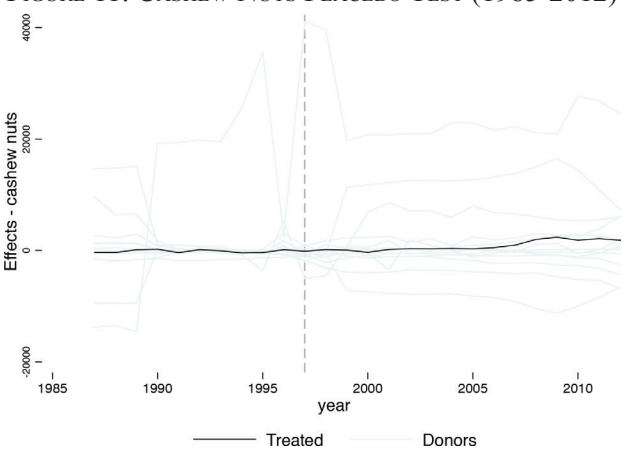
TABLE 5: SUMMARY STATISTICS

	Before 1997			After 1997		
Variables	**Guinea-Bissau mean**	**(9 countries) Donor pool mean**	**(40 countries) Donor pool mean**	**Guinea-Bissau mean**	**(9 countries) Donor pool mean**	**(40 countries) Donor pool mean**
Adjusted net national income (current US$)	1.90E+08	3.72E+09	3.84E+10	5.16E+08	8.40E+09	.92E+10
Agricultural land (% of land area)	51.48471	53.69701	45.87288	57.23092	58.01769	47.85617
Agriculture, forestry, and fishing	1.10E+08	1.40E+09	4.92E+09	2.72E+08	2.61E+09	9.58E+09
Capture fisheries production index	5159.25	121081	547679	6681.8	168322.2	614453.1
Cereal production (metric tons)	169364.3	1480898	6998016	191974.9	1998061	9836922
Cereal yield (kg per hectare)	1468.45	1238.482	1960.5	1335.173	1375.357	2522.688
Crop production index (2004-2006 = 100)	59.42833	71.91198	71.14408	104.1007	103.0859	100.9574
Death rate, crude (per 1,000 people)	16.97092	15.58748	9.556382	13.0516	11.34297	7.831566
Export unit value index (2000 = 100)	124.4167	127.4583	103.0334	118.743	150.349	134.487
Export value index (2000 = 100)	37.64453	84.04708	61.70197	151.9399	266.9744	214.8245
Export volume index (2000 = 100)	33.77033	78.70171	62.43925	122.9178	162.2297	153.6347
Exports of goods and services (current US$)	2.16E+07	9.01E+08	8.49E+09	1.14E+08	2.70E+09	3.24E+10
Food production index (2004-2006 = 100)	58.97	66.75448	66.7619	104.056	100.3807	100.8841
GDP per capita (constant 2010 US$)	607.9163	674.2239	2761.393	529.0788	739.6771	3671.824
Import unit value index (2000 = 100)	86.66667	116.8542	98.45728	144.6327	134.1919	127.3538
Import value index (2000 = 100)	169.265	76.03555	58.652	218.1538	235.1757	203.2283
Import volume index (2000 = 100)	211.6608	66.21616	60.02555	143.5016	162.8801	151.4625
Imports of goods and services (current US$)	8.41E+07	1.23E+09	8.86E+09	1.84E+08	4.17E+09	3.29E+10
Life expectancy at birth, total (years)	49.31042	50.77841	62.4284	53.56907	55.6045	66.71788
Rural population	711485.3	9890776	1.48E+07	860212.6	1.37E+07	1.76E+07
Service exports (BoP, current US$)	8046667	2.98E+08	1.81E+09	2.12E+07	1.08E+09	5.44E+09
Services, value added (current US$)	6.56E+07	1.83E+09	2.44E+10	2.39E+08	4.90E+09	6.78E+10
Trade (% of GDP)	50.40246	51.22876	63.15855	49.38027	66.40824	

FIGURE 10: CASHEW NUTS INDEX SYNTHETIC CONTROL (1985-2012)

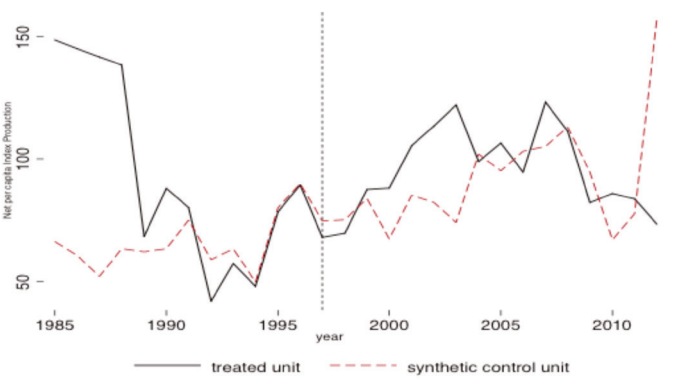
Sources: UNDATA / World Bank.

FIGURE 11: CASHEW NUTS PLACEBO TEST (1985-2012)



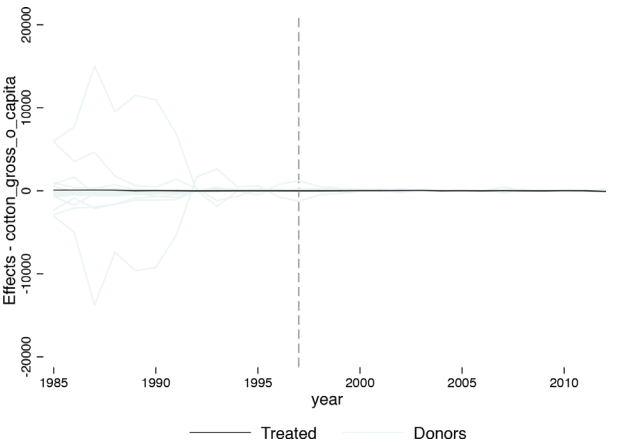
Sources: UNDATA / World Bank.

FIGURE 12: COTTON PRODUCTION SYNTHETIC CONTROL (1985-2012)



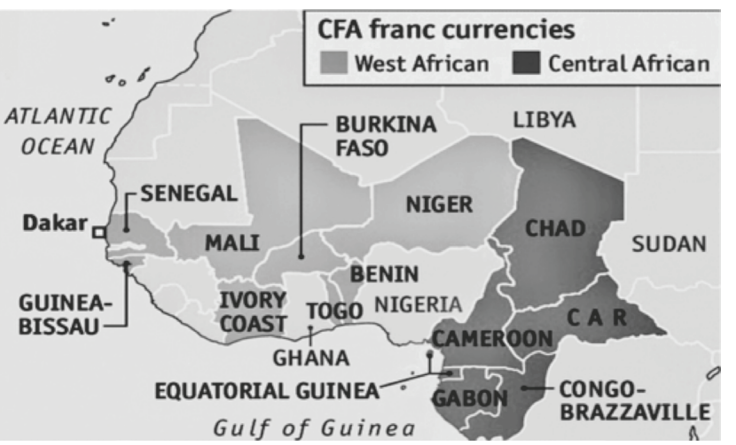
Sources: UNDATA / World Bank.

FIGURE 13: COTTON SYNTHETIC CONTROL (1985-2012)



Sources: UNDATA / World Bank.

FIGURE 14: MAP OF CFA COUNTRIES



Source: The Economist Magazine.