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Abstract*: Several attempts to establish common currency by regional trade blocs have been carried out in Africa and the continent is home to two existing common currency unions using the CFA francs, respectively. This paper focuses on the effects of common currency on economic growth in the CEMAC custom union. The study applies the sharp regression discontinuity design model to analyse the causal effects of the common currency on economic growth. The causal effects are identified by exploiting the discontinuity of the individual currency in favour of a regional one. This is a done by evaluating the value of GDP per capita as a proxy for economic growth before and after the implementation of the common currency in 1994. Our findings show that the monetary policy change instituted in the CEMAC region in 1994 has not played any significant role in promoting economic growth in the CEMAC region. Instead, the CEMAC customs union has performed on average poorly compare to its predecessor UDEAC and its regional counterpart such as UEMOA that uses a similar currency with similar exchange rate.*

Keywords: CEMAC, common currency, economic growth, franc CFA, regression discontinuity design

Regional trade agreements (RTAs) have been used to enhance geo-socioeconomic integration between countries whilst still maintaining national borders. This is based on the idea that such agreements address the constraints of low and limited production created by small and fragmented markets (Andriamananjara, 2003). Therefore, it is widely argued that RTAs are valuable tools for countries in the concerned regional bloc to carry out joint projects.

There are two main RTAs in Africa that have adopted a common currency. These are the Central African Monetary

Community, also known as "Communauté Économique des États d'Afrique Centrale" (CEMAC) and the West African Economic and Monetary Union commonly also known as "Union Économique et Monétaire Ouest Africaine" (UEMOA). Studies that analysed the effects of common currency on these RTAs showed that UEMOA achieved a higher growth rate than the CEMAC region. Given the advantages of the adoption of a common currency, it is, however, still unclear if the common currency has given the CEMAC region any competitive edge over other RTAs in Africa. Analysis by Bénassy-Quér and Coupet (2005) found that neither CEMAC nor UEMOA fulfils the criteria of an optimum currency area; rather the union of both into CFA franc common currency unions is considered more of a colonial influence or characteristic, rather than an economic one.

The CEMAC custom union is no stranger to RTA, and countries in that region have reaped some discreet benefits through collaborative trade agreements. Economic integration was initiated in the CEMAC region before independence under the former administrative grouping or federation entitled French Equatorial Africa (FEA).

This paper assesses links between common currency adoption and economic growth in the CEMAC region. The question remains to what extent the growth experiences in CEMAC, pre-and-post adoption of the common currency, could be attributed to the franc CFA. This is more of a counterfactual analysis that examines pattern of economic growth before and after the formation of the common currency union.

It is important to highlight gaps in earlier empirical literature on common currency and economic growth that the current study tries to fill. Most of the earlier studies on the CEMAC trade bloc are devoted to examining individual country's trade performances and national output (Carrere, 2013; Zhao & Kim, 2009). Given different growth rates, it is also important to address the impact of the common currency (franc CFA) on growth rates in the CEMAC trade bloc. Evaluating the efficiency and effectiveness of initiating a common currency and the causal inferences between a common currency and economic growth is yet to be carried out. This study aims to fill these gaps. The method used in this study considers both the pre-treatment and post-treatment effects at the same time. Also, it is a quasi-experiment that normally produces an unbiased estimate in the treatment, when executed correctly (Rubin, 1977).

The remainder of this paper is organised as follows. We next present the literature review, followed by the theoretical and

methodological framework. We then present our data sources and the main empirical results. Finally, we conclude with policy recommendations.

Literature Review

Literature on international trade supports the view that trade liberalization leads to economic growth. However, the impact on growth is still debatable, as economists have identified different outcomes. Previous studies in the CEMAC region have paid more attention to trade openness, and very little work has been done on the relationship between a common currency and economic growth. Past studies focused mainly on the EU. For example Sokolowska (2008), Guellec & von Hagen (2000), and Conti (2014) investigate the effects of the Euro on economic growth for countries in the European Union. These authors observe that the Euro has had a positive influence on EU economic growth.

Fetahi-Vehapi, Sadiku, and Petkovski (2015) estimate the effects of trade openness on economic growth in southeast European countries using the system of Generalised Methods of Moment (GMM). They note that countries that reduce barriers to trade enjoy higher economic growth. When convergence is measured in line with correlation of innovation in the gross domestic product, Fielding and Shields (2005) find no evidence in business cycle convergence. The authors conclude that a common currency can lead to higher economic integration among member states than countries that do not share a common currency or even peg their currency to another major one, such as the US dollar.

Nawaz, Aziz, and Zaman (2014) estimate the impact of trade factors on economic growth using the seemingly unrelated regression (SUR) for the South Asian Association for Regional Cooperation countries. They observe a strong correlation between economic growth and net exports, terms of trade, and foreign direct investment. While Felbermayr (2005) applies Blundell and Bond's system GMM estimator to estimate the relationship between the levels of a country's openness and per capita income, he affirms the existence of a strong relationship between trade and per capita income. Applying the SUR model and using data from 1960 to 1997, Kónya (2006) shows that causality between GDP and exports and between exports and economic growth differs from one Organisation for Economic Co-operation and Development (OECD) country to another. There is a consensus that higher economic integration will likely increase regional growth, though the benefit to individual member states is still uncertain.

The growth rate is also affected by the rate of inflation (Boschi & Girardi, 2007, Boujelbene & Boujelbene, 2010, Jalil et al., 2014). Previous studies have analysed different aspects of economic growth, including monetary policy, inflation, financial institutions, and the state of financial development. For instance, He (2011) studied the relationship between international trade, economic growth, and inflation. His result shows a positive relationship between international trade, GDP growth, and inflation.

For countries to benefit from steady economic growth, low inflation, and increased intraregional trade flow, there has to be some level of macroeconomic convergence among member states. If the macroeconomic convergence is weak, then the benefits of regional integration will not be felt completely.

Theoretical and Methodological Framework

Previous models of economic growth did not clearly suggest a systematic relationship between economic integration and economic growth. Consequently, it is possible to find a situation where increasing economic integration can have both positive and negative effects on growth rates.

The economic rationale of a common currency in relation to its impact on economic growth and trade has been the subject of numerous theories and studies, with no real consensus reached. The debate started in the early 1960s when Mundell (1961) proposed the optimum currency areas theory. This theory laid the foundation to explain the effects of a common currency within a geographical area.

Assuming that by means of an appropriate regional macroeconomic policy, a regional central bank is established and member states' local currencies are replaced with the regional one, what would the effect of this replacement have on the overall growth pattern of the region? To answer this question, certain conditions are put in place. These conditions are necessary to facilitate the recruitment of members into the monetary union and for the benefits to be felt. According to De Grauwe (2006), these conditions include firstly, macroeconomic shock symmetry across the region. Secondly, the labour markets must be flexible enough to withstand the shocks, and, thirdly, the level of trade flow between member states should be high. These conditions are in line with the criteria put forward by the classical theory of optimum currency areas when countries in a particular region want to form a monetary union. These criteria include, but are not limited to, a high level of openness, mobility of the labor force, symmetry of the level of

macroeconomic shocks among member states, and the possibility of fiscal transfers convergence (Criste, 2013).

Model specification

The estimation technique used in this paper is the sharp regression discontinuity design (RDD)(Imbens and Lemieus, 2008). The RDD is used to analyse the causal effects of the common currency on economic growth, exploiting the discontinuity of the individual currency in favour of a regional one. The RDD technique was introduced in 1960 by Thistlethwaithe and Campbell. The model is a pre-test/post-test program-comparison group strategy where subjects are assigned to the program based on a cut-off point.

Our attention is around the threshold value, where the average treatment effect of the covariate is identified. We apply the sharp RDD as it deals with the deterministic function which occurs when a single variable is solely responsible for the treatment effects. The description of the model is closely related to that used by Pellegrini et al. (2013). The basic framework was developed by Imbens and Lemieux (2008).

Let $Y_i(1)$ and $Y_i(0)$ denote the potential of region i, where $Y_i(0)$ is the outcome of economic growth before the implementation of the common currency in 1994. $Y_i(1)$ is the outcome of growth after implementation of the common currency. The main interest here is comparing $Y_i(1)$ and $Y_i(0)$. For this to happen, we calculate the difference ($Y_i(1) - Y_i(0)$). For each unit i, the outcome is observed corresponding to the average treatment effects of $Y_i(0)$ and $Y_i(1)$. Given a simple regression equation to represent the evaluation problem,

$$Y_i = \alpha + \beta_0 W_i + \beta_1 r_i + \beta_2 r_i W_i + \varepsilon_i \qquad (1)$$

$$W_i = \gamma_1 * Z + \mu \qquad (2)$$

α is the average outcome value for those in the treatment group, Y_i is outcome measure for observation i, r_i is a rating variable for observation i at the cut-off point, while ε_i is stochastic random

term, which is independent and identically distributed. β_0 is the marginal impact coefficient at the cut-off point.

Let W_i denote the treatment variable, with $W_i = 1$ if member state adopted the common currency in 1994, otherwise $W_i = 0$. The outcome, which is the per capita GDP growth for the CEMAC region, can be written as:

$$Y_1 = (1 - W_i)Y_i(0) + W_i(1) = \begin{cases} Y_i(0) \text{ if } & W_i = 0 \\ Y_i(1) & W_i = 1 \end{cases} \qquad (3)$$

As mentioned earlier, the sharp discontinuity design with assignment W_i is a deterministic function of one of the covariates X_i, which is greater than the cut-off point. That is:

$$P\{Treatment(W_i)\} = 1 \text{ if } X_i \geq c = Z$$
where c =1994 (the eligibility threshold)
$$= 0 \text{ if } X_i < c$$

Following Lee and Lemieux's (2010) approach, the regression equation on the left hand can be rewritten given the cut-off point as follows:

$$Y = \alpha_l + f_l(X - c) + \varepsilon, \qquad (4)$$

And that on the right hand side as:

$$Y = \alpha_r + f_r((X - c) + \varepsilon \qquad (5)$$

Using a pool regression technique as a direct way of expressing the treatment effects of both sides of the threshold from equations (4) and (5):

$$Y = \alpha_l + \tau D + f(X - c) + \varepsilon, \qquad (6)$$

Given that

$$\tau = \alpha_r - \alpha_l \text{ and}$$
$$f(X-c) = f_l(X-c) + D[f_r(X-c) - f_l(X-c)], \quad (7)$$

the standard errors of the treatment can be derived from equation (7). To allow the regression function to differ from both sides of the cut-off point, Lee and Lemieux (2010) recommend the addition of interaction terms D and X in the equation.
From equation (7), we have:

$$f_l(X-c) = \beta_l(X-c), \text{ and } f_r(X-c) = \beta_r(X-c).$$

We can now rewrite equation (6) as:

$$Y = \alpha_l + \tau D + \beta_l(X-c) + (\beta_r - \beta_l)D(X-c) + \varepsilon \quad (8)$$

All the countries with a covariate of at least C are assigned to the treatment. In our case, the treatment is the institution of the common currency (Franc CFA). Given $\alpha_l = \lim_{x \uparrow c} E[Y_i / X_i = x]$ and $\alpha_r = \lim_{x \downarrow c} E[Y_i / X = x]$. To find the average casual effect or outcome of the treatment at the point of discontinuity;

$$\lim_{x \downarrow c} E[Y_i / X_i = x] - \lim_{x \uparrow c} E[Y_i / X_i = x] \quad (9)$$

Equation (9) reduces the problems of nonlinearity being mistaken for discontinuity. This occurs in a situation where we might assume a jump at the threshold, whereas it is unaccounted for nonlinearity in the counterfactual conditional mean function (Angrist & Pischke, 2009). At the discontinuity point, the average causal effect of the treatment is given as:

$$\tau_{SRD} = E[Y_i(0) - Y_i(0) / X_i = c] \quad (10)$$

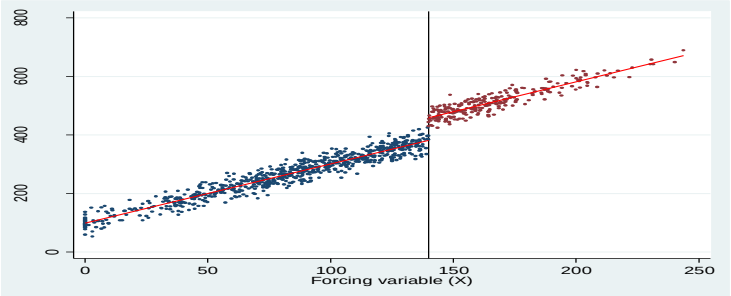
The estimated average treatment effect can be estimated by comparing the average treatment value of regional growth moving

very close in either direction before and after the implementation of the common currency at $X = c$.
The average effect is therefore given as:

$$\tau_{SRD} = \lim_{x \uparrow c} E[Y / X = x] - \lim_{x \downarrow c} E[Y / X = x] \qquad (11)$$

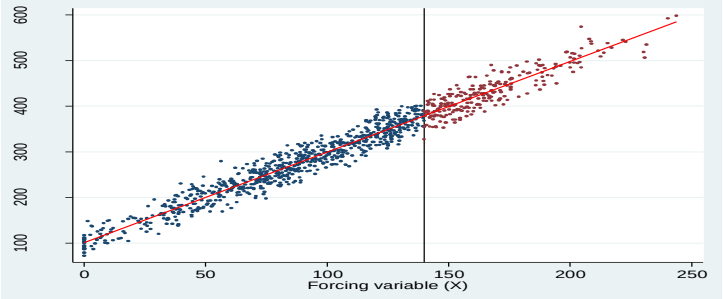
In RDD, graphical analysis is of utmost importance, as it acts as a way to visualize the identification problem (Imbens & Lemieux, 2008). When the raw data are presented in the form of a diagram, the research design becomes more transparent. Figure 1 below shows an example of a linear graph with treatment effect. We can see clearly the jump at the discontinuity point around the threshold of 140. On the other hand, Figure 2 shows the case where there is no discontinuity at the cut-off point.

Figure 1: Linear Graph with Treatment Effects



Source: Author's computation using a scatter plot

Figure 2: Linear Graph with No Treatment Effect



Source: Author's computation using a scatter plot

Given the above, the bandwidth can now be constructed to estimate the regression function around the boundary. This will enable us to analyse the impact of the treatment effects from the cut-off point. Once the bandwidth is identified, τ_{SDR} can then be estimated using local linear regression approaching c from right and approaching c from left. τ_{SDR} is an example of a nonparametric regression, since we are interested in the regression function at the single point, called the boundary point. Local linear regression reduces bias in the estimation and allows the intercept and slope coefficient to differ from either side of the threshold. It also helps resolve some of the problems encountered using the polynomial functions and kernel regression in the RDD. This problem stemmed from estimating the regression at a particular point and the bias found in kernel regression of the treatment effect (Lee & Lemieux, 2010). Local linear regression also enables the functional form to be correctly specified (Jacob et al., 2012).

Data Analysis and Results

Description and Data Sources

The data used for the analyses are a balanced panel of the six countries (Cameroon, Chad, Central African Republic, Republic of Congo, Equatorial Guinea and Gabon) that span the 44-year period from 1970 to 2013. The dataset is derived from a UNCTAD statistics database. Fewer variables than would ordinarily have been expected were used in the empirical model because of its counterfactual nature. The controlled variables used in our growth and trade analysis are gross domestic product (GDP) and a dummy variable. The level of GDP per capital is used as a proxy to determine the level of economic growth. A dummy variable (CEM_{ij}) for the common currency is included. It takes the value of 1 from 1994, when member states adopted the franc CFA, and zero, otherwise.

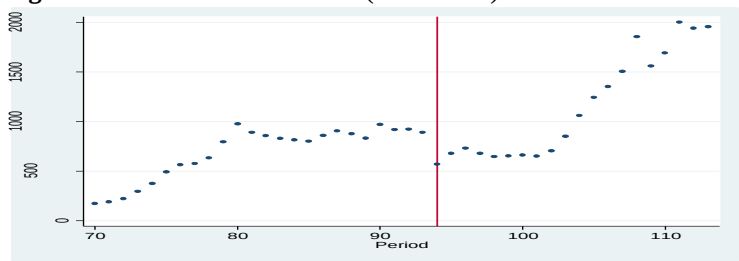
In order to isolate the possibility of other variables causing the change in economic growth, other control variables are added in the regression. These variables include foreign direct investment (FDI). FDI is the net inflow of the transfer of skilled personnel, marketing skills, financial and intangible assets, such as technologies, and the net inflow of fixed assets. The data are derived from the World Bank development indicators. Another variable of interest is inflation rate ($RELP$). This is the inflation rate of

member states considered in the study. The inflation rate is the annual change of the cost of a basket of goods and services acquired by the average consumers measured by the consumer price index (CPI). The data are derived from the World Bank Development Indicators Statistics database.

Graphical analysis

To further explore the data, we use the *rdplot* and *cmogram* to construct the sharp RD design. The result of a scatter plot of our data is presented in Figure 3, where the treated and the non-treated groups are clearly visible. As mentioned earlier, the treated group is the average level of per capita growth (cempc) from 1994, and the non-treated group is the average per capita before 1994. The evaluation of the treatment effect aims at providing evidence of the presence of a jump in terms of average CEMAC GDP per capita. This happens beginning in 1994, with the cut-off line sharply separating treated and non-treated regions. Relaxing the linearity assumption and applying the polynomial function of the forcing variable in the regression gives more weight to points far from the cut-off points.

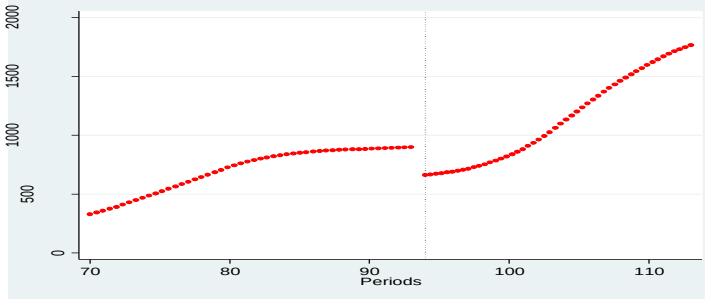
Figure 3: CEMAC GDP Growth (1970-2013)



Source: From author's computation using scatter plot

We use local regression as a smoothing method in a kernel weighed local polynomial to minimize bias in the model. Adding smooth regression lines, which are based on polynomial fit, makes the jump more visible (Imbens & Lemieux, 2008). This is shown in Figure 4.

Figure 4: Kernel-weighted Local Polynomial



Source: Author's computation

Figure 4 clearly shows a situation where, on average, the imposition of the franc CFA did not positively affect CEMAC economic growth. There is a fall in the average gross domestic product per capita around the threshold point.

4.3 Parametric approach

In estimating a parametric approach, the right functional form is of great importance for the outcome and forcing variable relationships. To do this, different polynomial fits are introduced in the forcing variable. Since low-order polynomial and a data point that is close to the cut-off point produces bias, it is advisable to present both parametric and non-parametric results. One acts as a complement to the other (Lee & Lemieux, 2010). In the first instance, all the observations are used to model the outcome in order to increase precision of the model. In doing so, the results of the outcome around the boundary point derive their strengths from observations far from the cut-off points. The result is presented in Table 1.

Table 1 present the results of all observations from the dataset for the CEMAC region as a whole and the individual countries that make up the region. The OLS estimates show the result with different forms of polynomial. The variable of interest is CEMdummy, which represents the effect of the common currency on CEMAC economic growth. The effects of the imposition of a common currency in the CEMAC region in 1994 are negative, and statistically significant for the CEMAC region (cempc) as a whole. For the individual countries, the effect is negative. The effect is significant at 0.01 for Cameroon (cmrpc) and at 0.10 percent for the Republic of Congo (cogpc). It is statistically insignificant for Central African Republic (cafpc), Chad (tcdpc), Equatorial Guinea (gnqpc), and Gabon (gabpc).

From Table 1, the negative impact is greater for the Republic of Congo (cogpc) than for Cameroon (cmrpc), while that of CEMAC (cempc) is less. All observations were used in the regressions. The findings suggest that all of the policies that were carried out in the mid-1990s, that is, from the change of name from UDEAC to CEMAC, devaluation of the CFA franc, and the institution of the common currency, on average did not provide favourable conditions for economic growth. The CFA franc has not created a situation where member states in the CEMAC region can benefit from accelerated economic growth. These conditions can be translated to the transmission mechanism to which common currency contribute to economic growth.

Table 1 Parametric Estimates of CEMAC Economic Growth Using Different Polynomial Fit

VARIABLES	cempc	cmrpc	cafpc	tcdpc	cogpc	gnqpc	gabpc
1.CEMdummy	-273.9*	-397.0***	24.35	59.68	-536.9*	-527.2	-1,013
	(155.9)	(128.5)	(64.11)	(71.25)	(315.1)	-3,229	-1,404
x_c	-92.36	-8.781	-182.3***	-147.2***	115.2	-20.76	-1,02
	(104.5)	(86.11)	(42.97)	(47.76)	(211.2)	-2,165	(940.8)
x2_c	-30.62	-4.530	-45.83***	-39.91***	24.98	-9.400	-391.7*
	(24.62)	(20.29)	(10.12)	(11.25)	(49.76)	(510.0)	(221.7)
x3_c	-3.776	-0.933	-4.397***	-4.113***	2.046	-1.018	-50.21**
	(2.439)	(2.010)	(1.003)	(1.115)	(4.930)	(50.53)	(21.96)
1.CEMdummy#c.x_c	311.6**	184.0	209.6***	263.3***	5.993	1,726	2,706**
	(132.0)	(108.8)	(54.30)	(60.35)	(266.9)	-2,735	-1,189
1.CEMdummy#c.x2_c	-62.68	-65.63**	33.82**	-14.65	-67.18	-751.8	-350.0
	(37.36)	(30.79)	(15.37)	(17.08)	(75.53)	(774.1)	(336.4)
Constant	833.8***	920.8***	274.8***	100.9	1,232***	373.6	5,344***
	(139.5)	(115.0)	(57.38)	(63.77)	(282.0)	-2,891	-1,256
Observations	44	44	44	44	44	44	44
R-squared	0.980	0.966	0.945	0.981	0.975	0.973	0.935

Dependent variable: per capita GDP. Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dropping-off some of the polynomials to adjust first and second-degree polynomials and also to restrict the windows around the cut-off point to estimate the treatment effects, the sample observations dropped from 1970-2013 to 1985-1999. The result is shown in Table 2. The treatment effect is still negative and highly significant for the CEMAC region, as a whole, and for most of the individual countries, except for Chad and Equatorial Guinea.

From Table 2, the effect of the CFA franc for Gabon is negative and highly statistically significant at 5%. This implies that when the sample observation is dropped and attention is paid around

the cut-off point, the effect of the policy change is stronger in Gabon as explained above. This is also true for Central African Republic (cafpc), as the coefficient is negative and statistically significant at 5%. There is a decline in economic growth between 1985 and 1995. Despite the changes that took place in the CEMAC customs union with regard to the CFA franc, low commodity prices accentuated this decline in GDP, coupled with government mismanagement and corruption around this same period.

Table 2 Parametric Estimates with Restricted Sample using Different Polynomial Fits

	Eq (1)	Eq(2)	Eq(3)	Eq(4)	Eq(5)	Eq(6)	Eq(7)
VARIABLES	cempc	cmrpc	cafpc	tcdpc	cogpc	gnqpc	gabpc
1.CEMdummy	-324.0***	-388.1***	-116.1**	-30.51	-361.9***	-199.2	-1,968**
	(66.90)	(77.81)	(45.16)	(24.48)	(95.47)	(197.9)	(738.2)
x_c	-10.22	7.170	-36.73*	-27.02**	-69.23	18.33	115.9
	(28.27)	(32.89)	(19.09)	(10.35)	(40.35)	(83.64)	(312.0)
x2_c	-1.877	1.889	-4.291*	-3.507**	-10.84**	0.954	-9.370
	(3.067)	(3.567)	(2.071)	(1.122)	(4.377)	(9.072)	(33.84)
1.CEMdummy#c.x_c	136.8**	85.21	71.13*	53.85**	284.9***	272.0	1,103*
	(52.57)	(61.15)	(35.49)	(19.23)	(75.02)	(155.5)	(580.1)
1.CEMdummy#c.x2_c	-25.97*	-19.21	-5.499	-0.562	-43.40**	-23.74	-298.8**
	(11.06)	(12.86)	(7.465)	(4.046)	(15.78)	(32.71)	(122.0)
Constant	899.1***	927.7***	411.1***	209.2***	1,019***	411.0**	6,337***
	(55.46)	(64.51)	(37.44)	(20.29)	(79.15)	(164.0)	(612.0)
Observations	13	13	13	13	13	13	13
R-squared	0.944	0.957	0.944	0.839	0.940	0.877	0.758

Dependable variable: per capita GDP. Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Nonparametric Approach

To avoid using an incorrect functional form, the analysis and findings are also presented using a nonparametric approach. In this approach, the local kernel regression function is applied, as it uses data around the cut-off point, reducing the level of bias in the model (Jacob et al., 2012). According to Lee and Lemieux (2010), the regression of the kernel estimates of the outcome on the forcing variable is a local mean of the outcome for values of the forcing variable at the cut-off point. Different kernel functions are applicable in the RDD. The triangular kernel is used, as it is considered optimal when estimating the local linear regressions at the cut-off point in order to estimate the average treatment effect (Fan & Gijbels, 1996). The rectangular kernel is employed in this analysis for comparability purposes. Following Lee and Lemieux's (2010) framework, more weight is put on observations close to the cut-off point by estimating the values of the regression function to

the right and to the left of the cut-off point and, then, considering the difference. The results are shown in Table 3, where a bandwidth of 10 and triangular kernel are used. When different bandwidths are used, there is very little change in the results. From Table 3, the difference is negative and significant where R2 is the regression estimate to the right and L2 is the regression estimate to the left of the cut-off point.

Table 3 Treatment Effect at X = 1994

R2	L2	dif
683.37281	886.59917	-203.2264

Source: Author's computation

The difference between the above two limits, R2 and L2, as in equation (11) is given as:

$$\tau_{SRD} = \lim_{x \uparrow c} E[Y / X = x] - \lim_{x \downarrow c} E[Y / X = x].$$

It equals the average treatment effect around the cut-off point. All the subjects that were assigned to the treatment received the treatment. Since there is normally a trade-off between bias and precision, the level of bias is reduced by using a linear regression imputing bin on both sides of the cut-off point. According to Lee and Lemieux (2010), imputing bin in the linear regression gives a better prediction at the cut-off point, which reduces bias present in the regression to a greater magnitude. Table 3 shows that the average effects of the imposition of common currency in CEMAC trade bloc is negative. There is a fall in the level of per capita GDP.

To further illustrate the assertion made, three different bandwidths of Local Wald Estimation are reported, which can be considered as an informal test of sensitivity, as shown in Table 4. Using the triangular and rectangular kernels, the effects of the franc CFA on economic growth is negative and statistically significant. Applying a bandwidth of 5 provides an estimate of -262, which is statistically significant at one percent level. Doubling the size of the bandwidth to 10, the negative effects are more pronounced, making the discontinuity even stronger.

Table 4 Nonparametric Estimation using Different Bandwidths and Kernel Types

	Eq(1)	Eq(2)
Variables	Cempc (tri)	Cempc (rec)
Bandwidth	Triangular kernel	Rectangular kernel
10	-292.9***	-323.8***
	(46.46)	(46.48)
5	-261.9***	-296.3***
	(43.95)	(71.09)
20	-509.7***	-673.8***
	(75.75)	(95.41)
Observations	44	44

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

According to Pellegrini et al. (2013), wider bandwidths lead to a higher smoothness around the cut-off point and are useful in reducing the unevenness of observations that can be found around the jump. When we apply the rectangular kernel, allowing the bandwidth to stay the same, the results are slightly higher and statistically significant at one percent.

Robustness Check

To check the robustness of the regression results, Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and the F-test are carried out. The AIC indicates whether the data used in the analysis fit the model better than another. The problem with AIC is, if all the subjects do not fit the model neatly, the AIC cannot indicate the problem. Jacob et al. (2012) suggest the use of the F-test to determine the appropriate model to use. Once this is done, it is necessary to increase the precision by adding a predetermined baseline characteristic and dropping outer data points in sequence from the lowest and highest rating distribution values (Jacob et al., 2012). Other covariates are controlled to ensure they are not responsible for the jump and thus affect the treatment around the point of discontinuity. The results are shown in Table 5.

In Table 5, Eq. 3 in column 4 shows that the control variables, such as CEMAC foreign direct investment (cemfdi) and CEMAC total population (cempop), are not statistically significant. CEMAC inflation (ceminf) and CEMAC labour force (cemLF) are statistically significant at 5 and 10 percent. This shows a positive relationship between CEMAC economic growth and its labour force and inflation, as stipulated in the literature. The jump as a result of the common currency is still negative and statistically significant at one percent. The P-value of the F-test indicates that we can

comfortably reject the null hypothesis and conclude that the institution of the common currency in CEMAC in 1994 had a negative effect on the region's economic growth, and that the model used does provide a better fit.

Table 5 Proof of Robustness using the AIC and BIC Tests with Controlled Covariates

Column 1	Column 2	Column 3	Column 4
Variable	Before 1994	From 1994	Before & after 1994
	Eq 1	Eq 2	Eq 3
CEMdummy	(omitted)	(omitted)	-924***
Cemfdi	-0.0489	-0.0358	0.00866
cemLF	0.282	-3.83	1.04*
Ceminf	-1.97	9.29	11.1**
cempop	-0.103	1.69	-0.344
_cons	730**	-4738*	-579
r2	0.403	0.917	0.894
r2_a	0.104	0.894	0.873
Aic	140	252	415
Bic	143	257	423
N	13	19	32

Standard errors in parentheses ***p<0.01, **p<0.05, *p<0.1

Source: Author's computation

Conclusions

In this paper, we used the RDD model to analyze the effects of a common currency on CEMAC economic growth. The GDP per capita was used as a proxy for economic growth, and the data sample covers the period from 1970 to 2013. The focus of attention is on the treatment effects around the threshold. The difference between above and below the cut-off point produces the outcome. In the case of CEMAC, all member states adopted the common currency, and all qualified since they are all active members of the CEMAC trade bloc. Both graphical and non-graphical analysis (equations) are deployed in the estimation technique. The graphs show clearly a negative jump around the cut-off point. Applying the Kernel-weighted local polynomial makes the jump clearer, showing a drop in GDP per capita. In the non-graphical analysis, both parametric and nonparametric approaches are used to make sure the results are robust. The results reveal that the imposition of the common currency has had an inverse relationship with the region's economic growth.

In the parametric approach, when the degree of polynomial is increased, the variable for CEMAC common currency is still significant and negative, but the results are less significant for the majority of the individual countries in the region, except for Cameroon where it is significant and negative at one percent. For

the Republic of Congo, the effect is also negative and significant at 10 percent. Reducing the degree of polynomial makes the results even more significant for most of the member states, except for Chad and Equatorial Guinea. The nonparametric method also confirms the results from the parametric approach, as the difference between the pre-post-period is also negative and significant. When different bandwidths are used in the analysis, applying both the triangular and rectangular kernel, the results are still significant at one percent. Lastly, when other variables are controlled before and after the implementation of the common currency, the common currency coefficient is still negative, and only the variable for labour force is positive and significant at 10 percent.

Policy Implications

One of the criteria for an OCA is the homogeneity condition to ensure that any external shocks should have equal proportional effects on member states of a trade bloc. This is not the case with member states of the CEMAC customs union, where the effect of external shocks is felt differently by member states. Even though the CFA franc has fulfilled some requirements of the OCA, it is still far from being an OCA. For example, some CEMAC states have benefited from lower inflation that has contributed to macroeconomic stability. Also, the convertibility of the CFA franc is guaranteed by the French Treasury. The fact that it is pegged at a fixed exchange rate to the euro has created some certainty in terms of financial discipline. However, the downside of the fixed exchange rate is that it has contributed to increased economic costs of adjustment, as it has increased unemployment as a result of lack of competitiveness of CEMAC economies due to the inability of member state to alter the value of the currency to compete competitively in the international market.

Tariff and non-tariff barriers have contributed to the low level of intra-regional trade. Political instability in the CEMAC region has weakened a regional central bank's ability to provide checks-and-balances in political systems in the CEMAC region. Close attention should be paid to the fixed exchange rate of the CFA franc against the euro. Decades ago, it made some economic sense to peg the CFA franc to the euro, as the EU was the CEMAC's main trading partner. Since the pattern of trade has changed, China and India are now the main trading partners. A common currency pegged to the euro at the fixed exchange rate will disadvantage the CEMAC customs union. Currently, these countries trade much less with Europe, so that a fixed exchange rate to the euro would have

affected member states trade balance negatively. Conversely, CEMAC countries trade a lot with Asia, so a switch to an alternative exchange rate would subsequently raise income levels of member states and improve member states' trade balance.

Recently, debates of the valuation of the CFA franc have intensified, and there has been speculation of possible devaluation of the CFA franc during the CEMAC Heads of State Summit held in Ndjamena, October, 25, 2018, due to poor macroeconomic fundamentals in the region's balance of payments. Slow progress of reforms, the deterioration of budget balances, and the increase in public debt drew wide speculations of the CFA franc devaluation. However, devaluation did not take place, as the BEAC central bank governor brought to the attention of the public that there was no reason for CEMAC to risk devaluation, as the current economic situation in the CEMAC zone is not anywhere near that of 1994, the year of the last currency devaluation[6].

It is no longer news that political constraints have contributed to the CEMAC region's poor economic performance. Most of the countries in the region have witnessed or are going through some tough political crises. The security threat posed by Boko Haram in the northwestern CEMAC region, piracy along the Gulf of Guinea, and instability in the Central African Republic between the anti-Balaka and Séléka militias continue to threaten the region's security. There were failed coup attempts in Equatorial Guinea in 2004 and 2017, and an internal political crisis in Cameroon. Industries will not be able to work to full capacity and economic growth is hindered. Political instability has a strong negative effect on a country's economic performance. Having politically unstable neighbor's influences a country's pattern of trade and investment and the mobility of factors of production, including labor, thus leading to lower economic development. Policies geared at enhancing trade and economic growth at the individual and regional level will be hampered if the security issues are not addressed. One step is for member states to initiate inclusive dialogs with the different stake holders that are contributing to the crises in the countries concerned.

It is clear from the analysis that the common currency adopted in 1994 by the CEMAC member states has, on average, not contributed to the region's growth rate. Other factors must have contributed to the region's economic growth. Policy makers should be careful when adopting policy changes like common currency. The creation of a common currency, such as the Euro, was

[6] Business Cameroon (2018)

successful and benefited the Euro zone in general, though some member states still face numerous challenges. In the case of the recently witnessed 2016 Brexit referendum, various analyses and conclusions are on the table about the future of the Euro. But, it is clear that not all regional trade blocs are planning to establish monetary unions anytime soon.

The main conclusions drawn from this study have a number of important implications for policy. The results presented suggest that networks formed by kinship constitute an important strategy

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